



**Biodiversity and  
Conservation Science**

**Dirk Hartog Island National Park Ecological Restoration  
Project: Vegetation Restoration - Remote Sensing  
Monitoring Program Report 2019/20**

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August 2020



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## Acknowledgments

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## Summary

Changes in vegetation cover across Dirk Hartog Island (DHI) were assessed using imagery from the Landsat satellite series, captured between 1988 and 2020 and photo point observations. From the analysis of these data the influence of the feral goat removal program is evident. A map identifying areas of significant vegetation cover change since destocking (2008) was also created. This suggests that to 2020, 39% of DHI has experienced a significant increase in vegetation cover, this is up from 38% in 2019. The area of sand dunes on the Island also continues to decrease.

Beyond the vegetation cover statistics mentioned above the monitoring program focused on publishing two scientific papers. A paper detailing the DHI vegetation monitoring program titled “Monitoring vegetation recovery in the early stages of the Dirk Hartog Island Restoration Programme using high temporal frequency Landsat imagery” was published in the Environmental Monitoring and Restoration journal. Another scientific paper titled “Feasibility of using remotely piloted aircraft imagery to estimate Dirk Hartog Island plant species” is in draft form. The paper has been co-written with Curtin University Masters student Ms Lucy Wilson and Dr Todd Robinson. The aim is to submit this paper for publication in late 2020.

To comply with covid-19 field work planned for April 2020 could not be undertaken.

Objectives for 2020/21:

- Analyse vegetation cover changes over DHI from Landsat imagery (1990 to 2021).
- Provide a report with summary statistics of vegetation change from analysis of Landsat imagery.
- Report on vegetation change related to destocking and goat removal.
- Finalise and submit a paper for publication titled “Feasibility of using remotely piloted aircraft imagery to estimate Dirk Hartog Island plant species” in a scientific journal.
- Investigate the integration of the DHI monitoring plots into the TERN network.



# 1 Introduction

Remote sensing is being used to report on vegetation recovery for the Dirk Hartog Island National Park Ecological Restoration Project (the Project). Objectives for 2019/20 were:

- Analyse vegetation cover changes over DHI from Landsat imagery (1990 to 2019).
- Provide a report with summary statistics of vegetation change from analysis of Landsat imagery.
- Report on vegetation change related to destocking and goat removal.
- Finalise a paper for publication in the scientific journal Ecological Management and Restoration.
- Analyse and report on RPA imagery of exclusion plots.

Additional work:

- RPA imagery captured by Dr Saul Cowen of exclusion plots captured in 2019 was processed.

Achieving the 2019/20 objectives will help achieve the wider objective to:

- Evaluate vegetation recovery in terms of species diversity and cover and correlate to environmental and grazing factors.
- Promote scientific research associated with the project and publish reports on the project as well as scientific findings: through publication of an article on the project in the Environmental Monitoring and Restoration journal.

## 2 Progress

The following section outlines progress towards achieving the 2019/2020 objectives.

### 2.1 Vegetation Cover Change

The analysis of vegetation cover change has continued using the same methodologies as outlined in “DHI remote sensing report - 2016-17” (DBCA) delivered August 2017.

### 2.2 Scientific Journal Submission

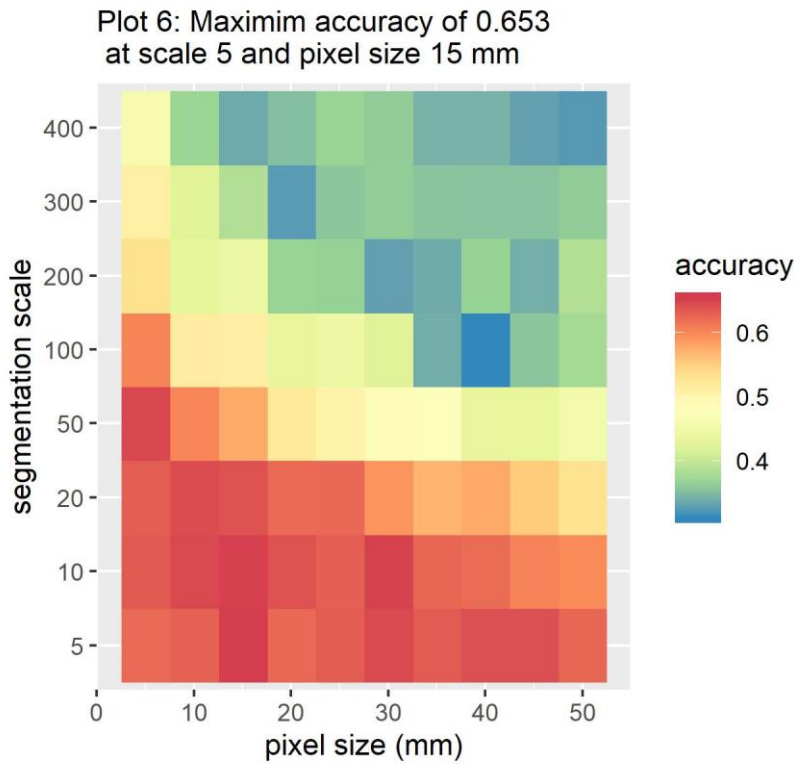
A scientific paper detailing the vegetation monitoring work being carried out on DHI was published by Ecological Management & Restoration in August 2019. The paper is titled “Monitoring vegetation recovery in the early stages of the Dirk Hartog Island Restoration Programme using high temporal frequency Landsat imagery”.

### 2.3 Exclusion plot monitoring - update

An analysis of the exclusion plots with Curtin University student Lucy Wilson is near completion, statistics are being finalised and a scientific paper is in draft form. The aim of the project is determine the degree to which plant species within the exclusion plots can be identified with RPA imagery. If a suitably robust method can be identified, it could be repeated on a regular basis to assess the impact of reintroduced fauna.

A key part of the exclusion plot rpa study was to identify the optimal input parameters in the classification model. Two key parameters are the segmentation scale and pixel size. By carrying out a large number of iterations we can see that the optimal combination of these parameters for site 6 is a segmentation scale of 5 and a pixel size of 15 mm (Figure 1).





\*Accuracy assessed using 10000 samples and 100 rf reps

Figure 1: Accuracy grid to identify optimal segmentation scale and pixel size to identify plant species at site 6.

Once the optimal parameters were identified a plant species classification can be created (Figure 2).

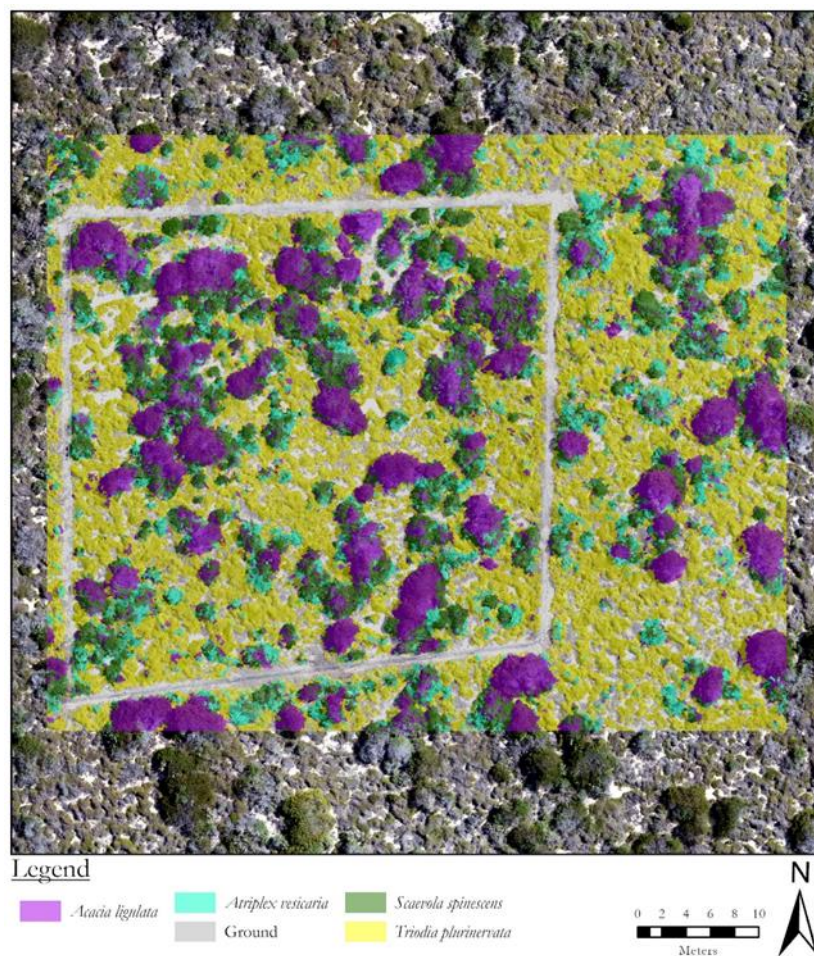
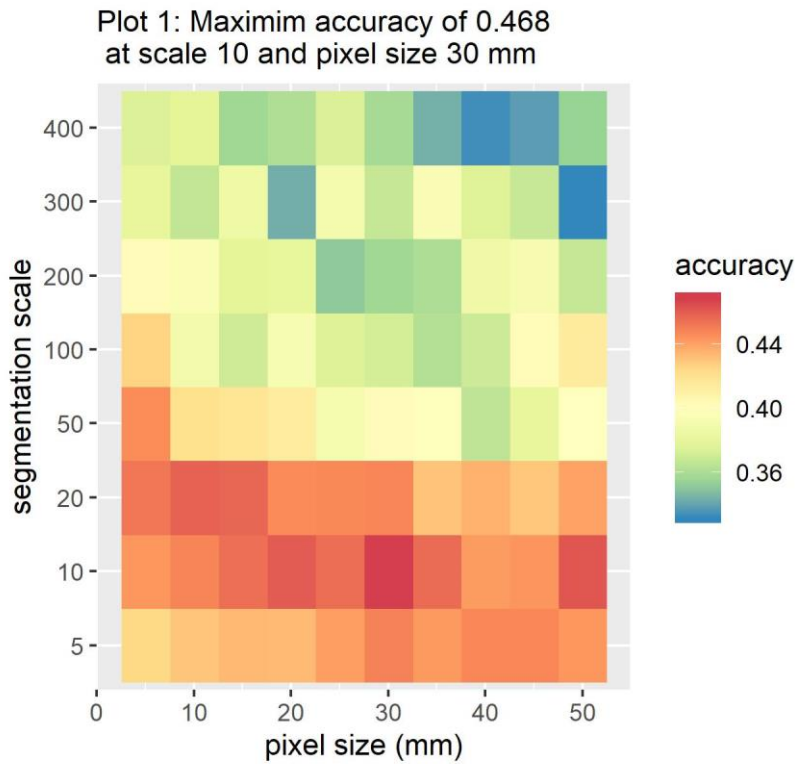


Figure 2: Study site 6 map with predicted segments and remotely piloted aircraft imagery. Kappa value and overall accuracy as 50.5% and 65.3% respectively.

The accuracy grid and classification for site 1 are shown in Figure 3 and Figure 4. The maximum accuracy achieved for this site was 46.8%. The lower accuracy at this site is due to the increased complexity, nine species compared to four at site 6.



\*Accuracy assessed using 10000 samples and 100 rf reps

Figure 3: Accuracy grid to identify optimal segmentation scale and pixel size to identify plant species at site 1.

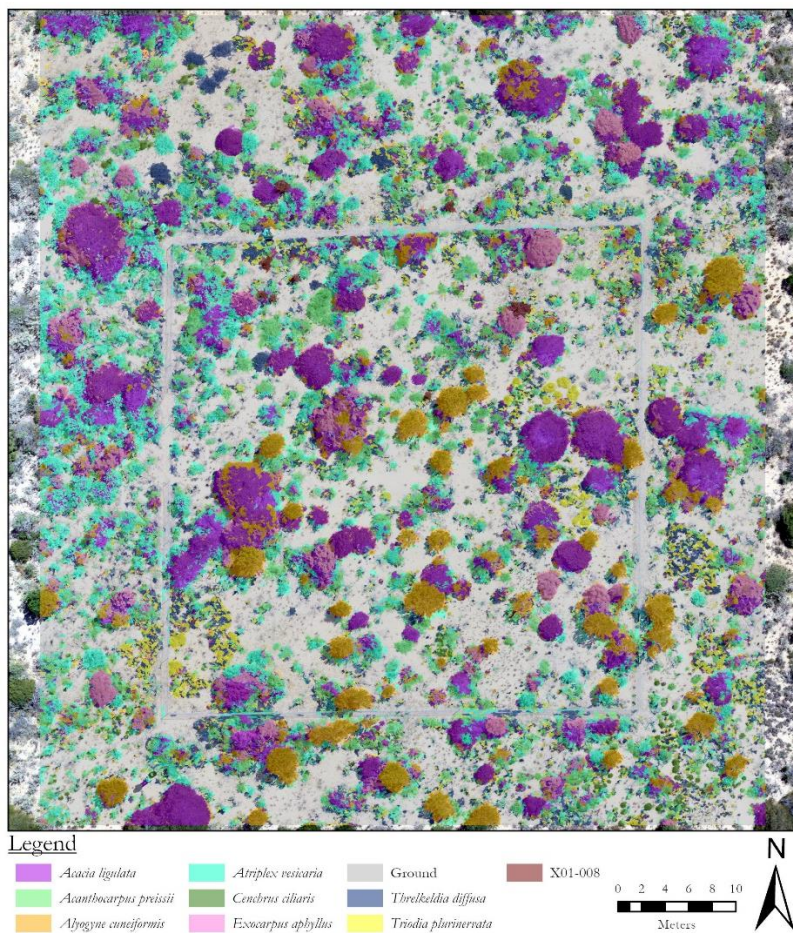


Figure 4: Study site 1 maps with predicted segments and remotely piloted aircraft imagery. Kappa value and overall accuracy as 46.8% and 74% respectively.

## 3 Results

### 3.1 Spatial extent of change

A map showing areas of significant vegetation change to 2012, 2016 and 2020 based on a 1988 to 2008 baseline are shown in Figure 5. Green areas indicate areas of significant vegetation cover increase, whereas orange and red indicate a reduction. Increases in vegetation cover are predominantly located in the southern third of the Island.

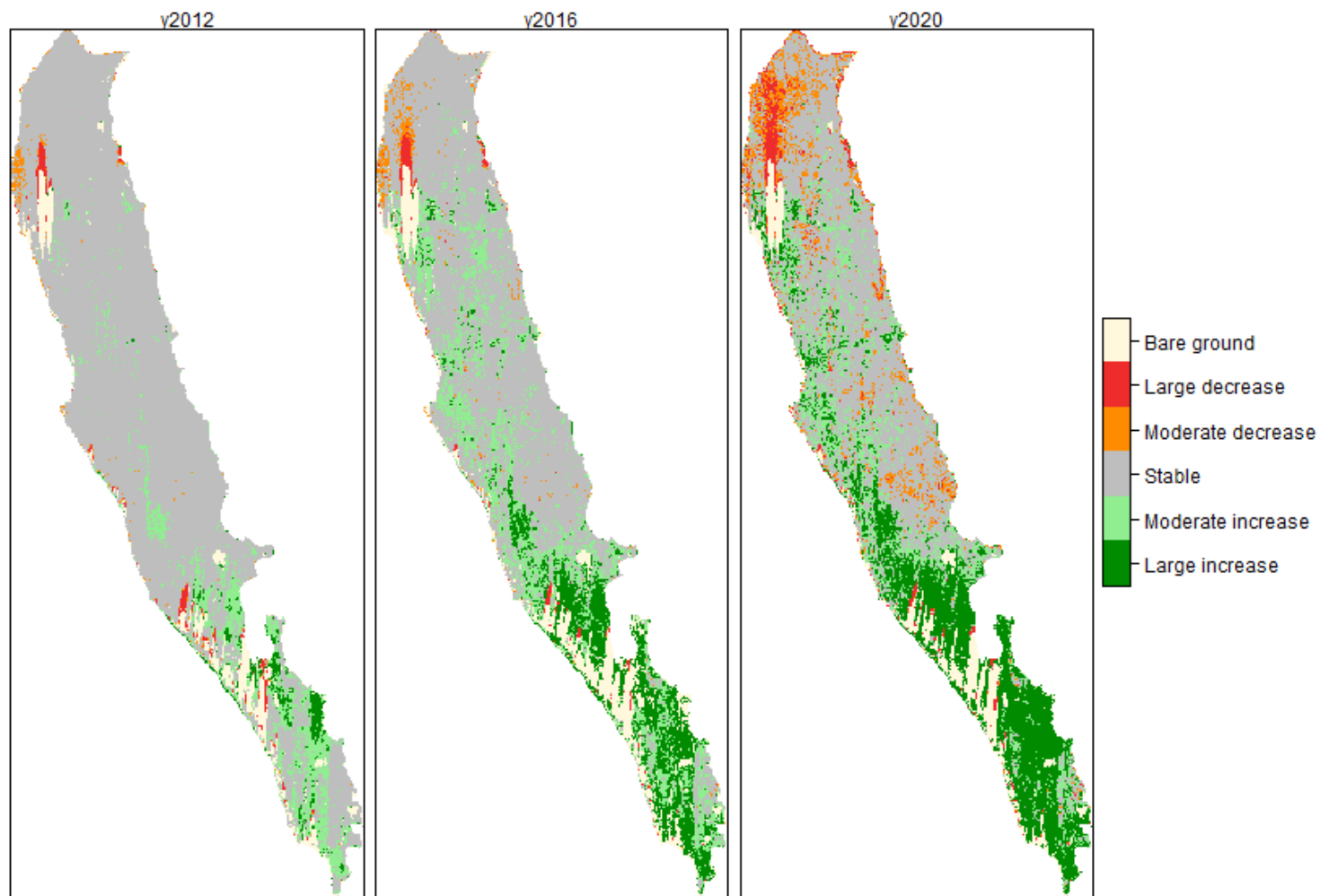


Figure 5: Significant vegetation cover change for years 2012, 2016 and 2020 based on the 1988 to 2008 baseline.

Area calculations for the classes in Figure 5 are shown in Table 1. The majority of DHI (43%) recorded no significant increase in vegetation cover since destocking, while 39% recorded either a moderate or significant increase. A decrease was recorded over 11% up from 9% in 2019. The area with decreasing cover is predominantly north of the north-western dune and is assumed to be due to the movement of sand.

Table 1: Percentage of area per change class for 2015 to 2020 on Dirk Hartog Island.

Class	2015	2016	2017	2018	2019	2020
Large increase	10	14	18	19	22	24
Moderate increase	17	19	18	16	16	15
Stable	61	54	51	50	46	43
Moderate decrease	2	2	3	5	6	7
Large decrease	2	1	2	3	3	4
Bare ground	8	10	8	7	7	8

### 3.2 Sand dune extent changes

The area of sand dune extent on DHI over the period 1957 to 2020 is shown in Figure 6. The numbers used in Figure 6 are included in the Appendices 2.

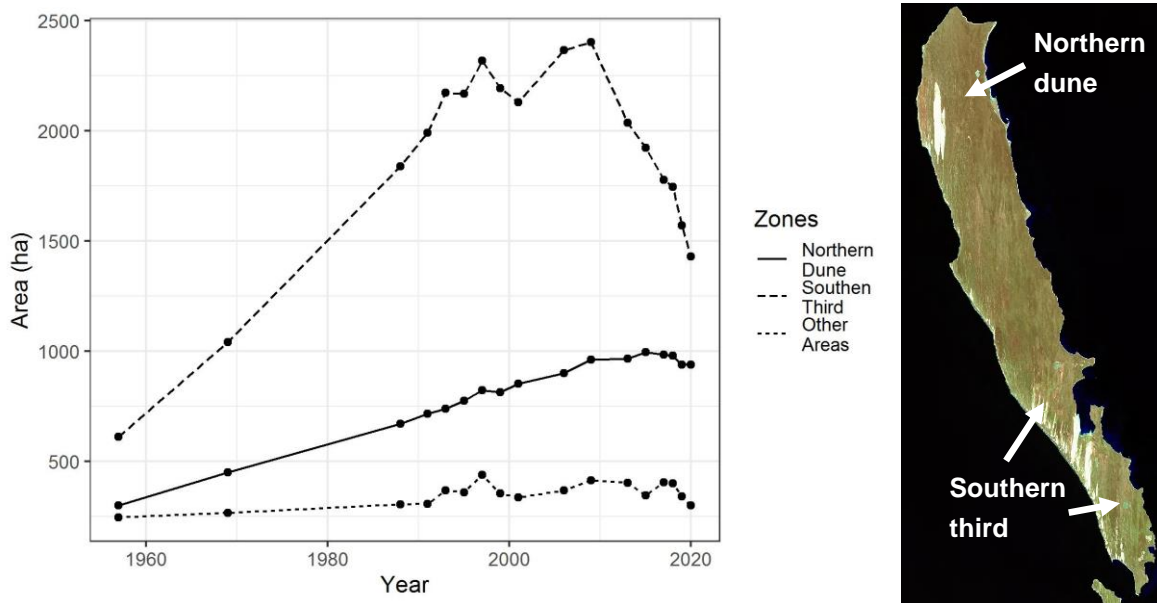


Figure 6: Sand dune extent changes across Dirk Hartog Island from 1957 to 2020.

The area of sand dune on the southern third reached a maximum of 2402 ha in 2009, was 1569 ha in 2019 and is now 1429 ha (Figure 6). The northern dune has also consistently reduced in area since 2015. These reductions contrast the constant increases recorded previously.

### **3.3 Monitoring site observations and analysis**

Site data for all photo point monitoring sites and sites added in 2014 are shown in the Appendix. Site descriptions were recorded by Greg Keighery (Senior Principal Research Scientist, DBCA) in 2014, 2016 and 2018.

Photo point photos are shown. Time series graphs of canopy cover from 1988 to 2020 are shown as are cusum charts. The aim of cusum charts are to determine if significant changes to vegetation cover have occurred since destocking (2008). The 1988 to 2008 time period is used as a baseline to assess significant change.



# Appendices 1

## Site 1

### Description:

Low Very Open Shrubland (2% cover); 0.5-1 metres *Acacia ligulata* with rarely recorded *Acacia tetragonophylla*.








Low shrubland (30-70% cover) 0.3- 0.5 metres of *Thryptomene baeckeacea* and *Melaleuca cardiophylla*, with rarely recorded shrubs of *Stenanthemum* sp., *Persoonia* sp., *Halgania cynaea* and *Olearia axillaris*.

Over low hummock grassland (10-30 % cover) of *Triodia plurinervata*.

Over scattered herbs and low shrubs (<2% cover) of *Halgania cyanea*, *Cassytha* sp., *Logania* sp. and *Dianella revoluta*.



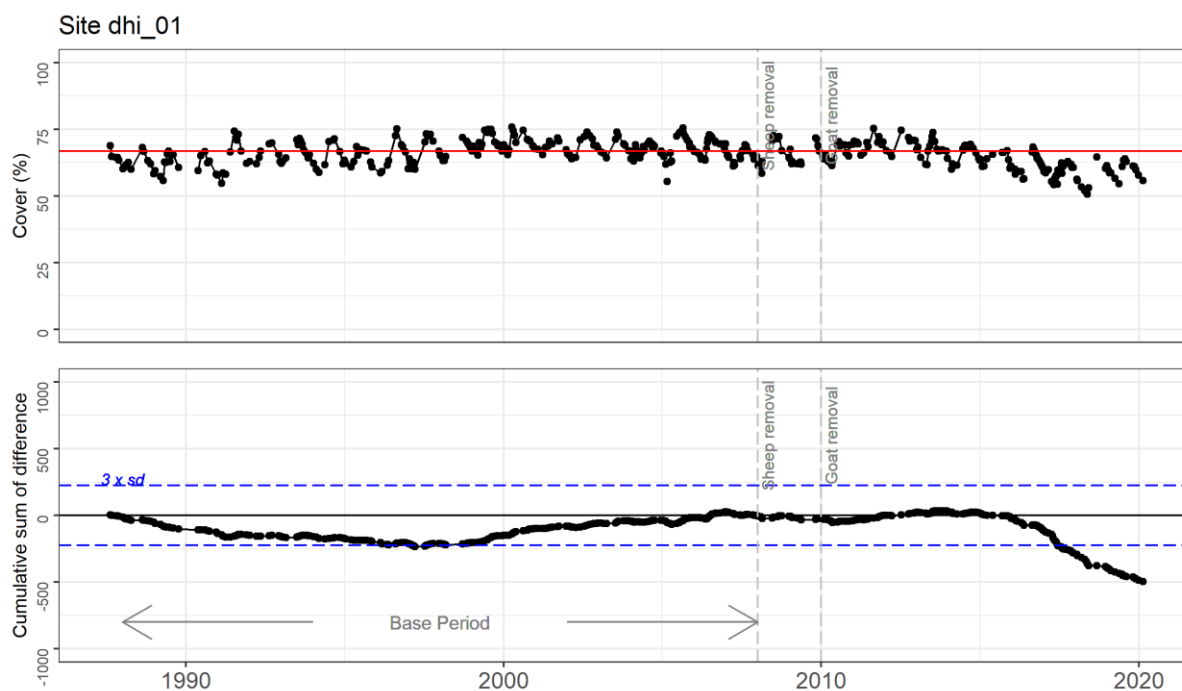
### Photo point photographs of site 1.

		
May 2006	May 2007	September 2008
		
October 2009	January 2012	April 2014
		
May 2016		

### Vegetation cover time series analysis:

No significant change in vegetation cover is evident in the time series.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



### Recommendations:

Recapture photograph points and reassess site condition either in 2021 or if a significant deviation from baseline vegetation cover are observed (3 standard deviation lines on cusum chart are breached).

**Site 2**

**Description:**

Low heath of *Melaleuca cardiophylla*/*Pileanthus limacis* (30-70% cover avg 60%) 0.2 metres

Low very open grassland of *Trioda plurinervata* (10% cover) 0.2 metres

Rare shrubs of *Mirbelia ramulosa*/ *Thryptomene baeckeacea*/  
*Leptosema macrocarpum*

Rare herbs of *Conostylis stylidioides*



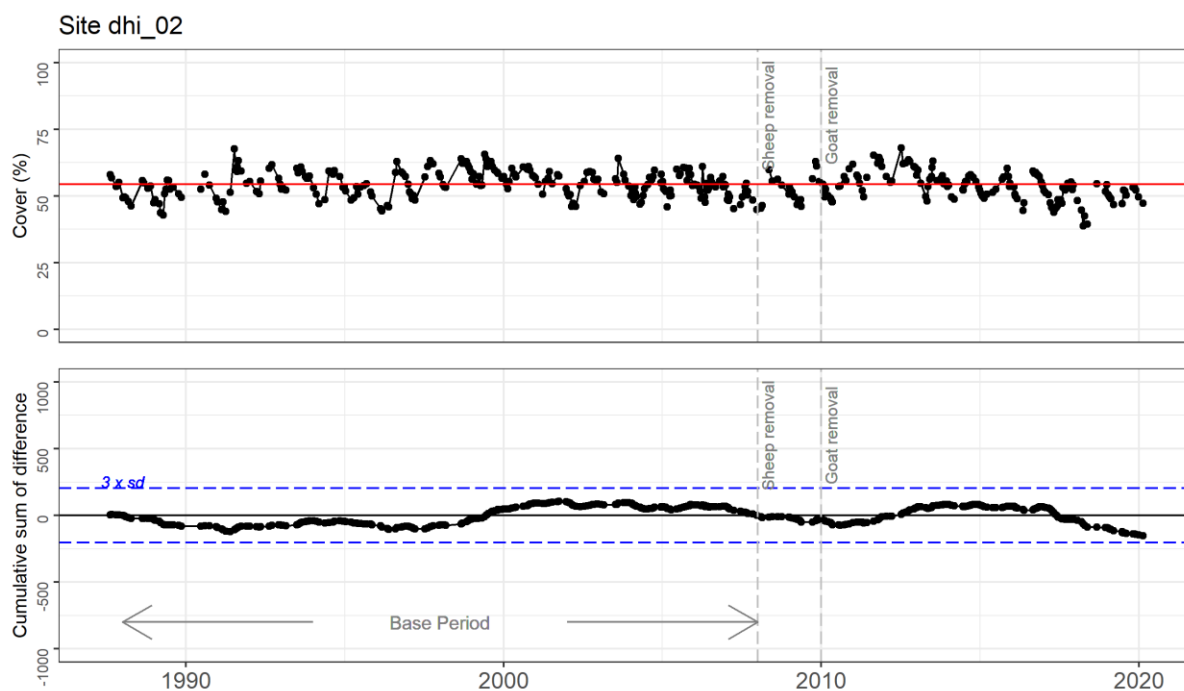
*Photo point photographs of site 2.*

<p>May 2006</p>	<p>May 2007</p>	<p>September 2008</p>
<p>October 2009</p>	<p>January 2011</p>	<p>January 2012</p>
<p>May 2016</p>		

## Vegetation cover time series analysis:

No significant change in vegetation cover is evident in the time series.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



## Recommendations:

Recapture photograph points and reassess site condition either in 2021 or if a significant deviation from baseline vegetation cover are observed (3 standard deviation lines on cusum chart are breached).

**Site 3**

**Description:**

Low Open Shrubland (2-10% cover) 0.5-1 metres *Acacia ligulata* and *Atriplex vesicaria*

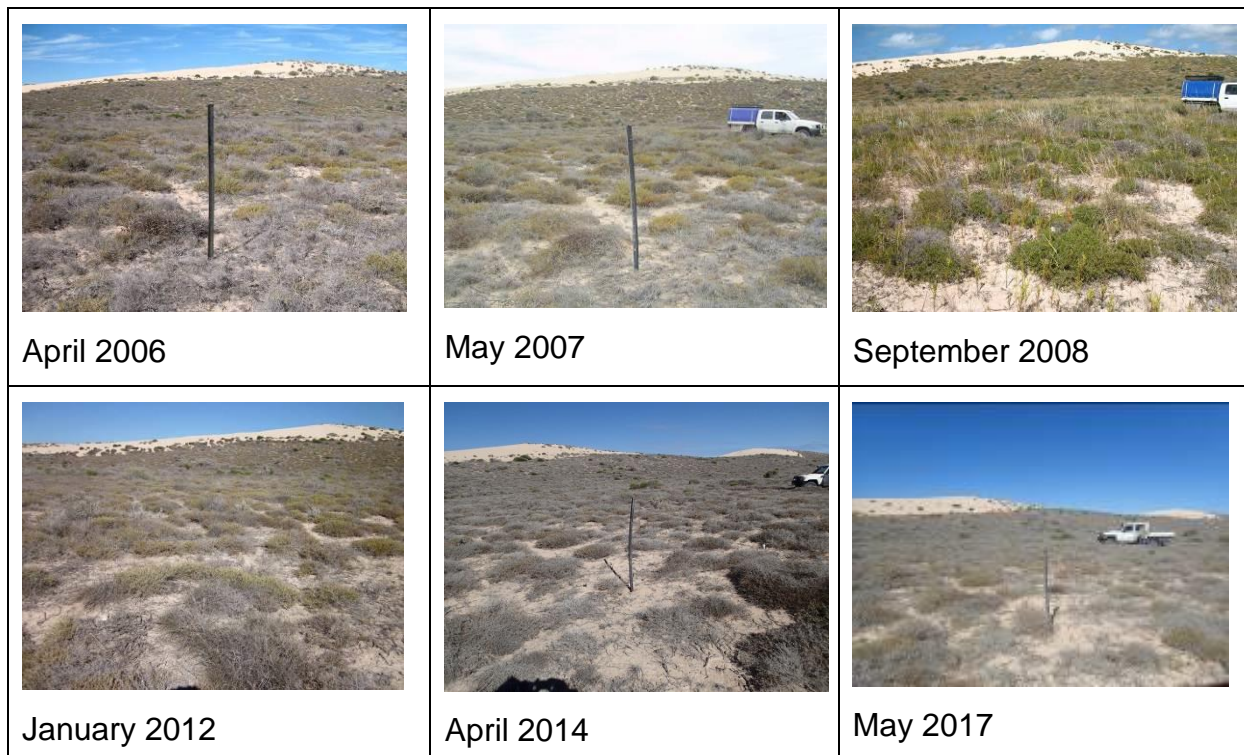
Low shrubland (10-30% cover) 0.3- 0.5 metres of *Thryptomene baeckeacea* and *Melaleuca cardiophylla*, with rarely recorded shrubs of *Ptilotus obovatus*, *Maireana* sp., *Atriplex* sp. and *Threlkeldia diffusa*

Over low hummock grassland (2- 10 % cover) of *Triodia plurinervata*

Over scattered herbs, grasses and low shrubs (<2% cover) of *Acanthocarpus robustus*, *Cymbypogon obtectus*, *Carpobrotus candidus*, *Senecio pinnatifolius* and *Dianella revoluta*.



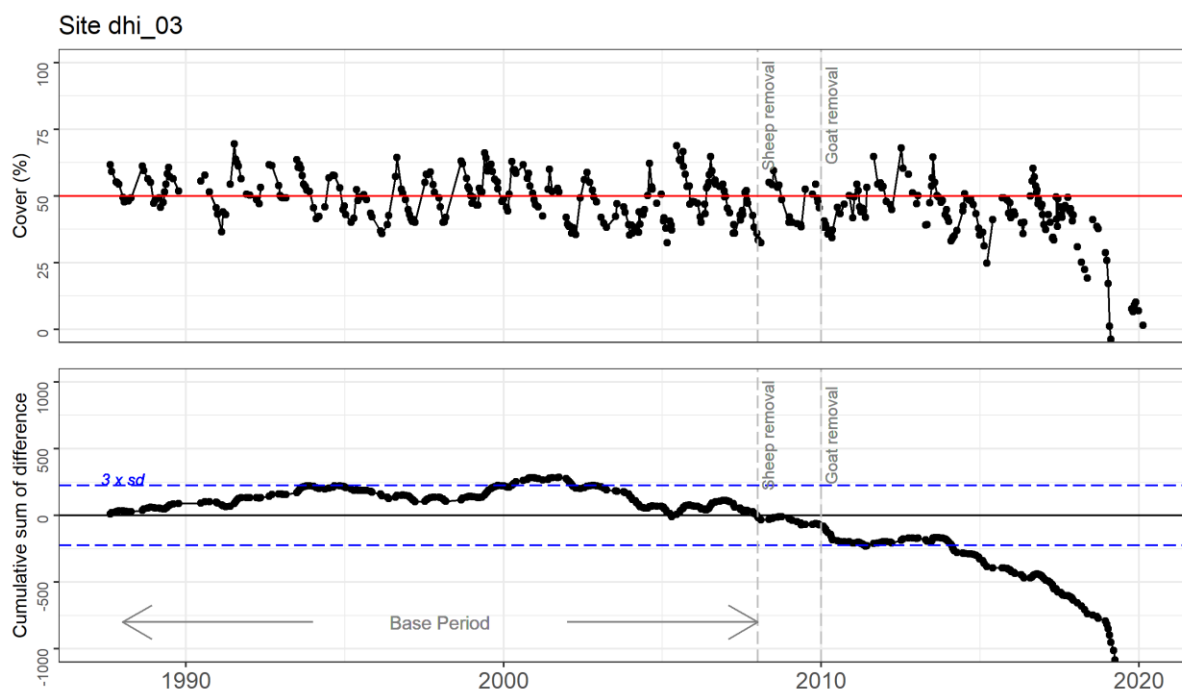
*Photo point photographs of plot 3.*



### Vegetation cover time series analysis:

Lower control line in the cusum chart has been breached in 2014 indicating a loss in cover. This site is now being encroached by a mobile dune.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



*Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).*

### Recommendations:

The declining cover at this site is difficult to discern from the site photographs. This is due to changes in location of the central marker in 2014. However, analysis of Landsat imagery shows that the sand dune movement may be a factor. In 1988 the closest sand dune was approximately 250 m to the west, this dune is now encroaching on the site.

**Site 4**

**Description:**

Tall Open Shrubland (2-10% cover) 2-2.5 metres of *Diplolaena grandiflora* with *Acacia* (estimated species) *sclerosperma*(dead), *Alectryon oleifolium* and *Rhagoda –Preissii* subsp. *Obovata*, *Scaevola tomentosa*

Low shrubland (30% cover) 0.3- 0.5 metres of *Thryptomene baeckeacea*

Prostrate to decumbent shrubland (10-30%) of *Threlkeldia diffusa*, mostly dead 10% alive in 2018

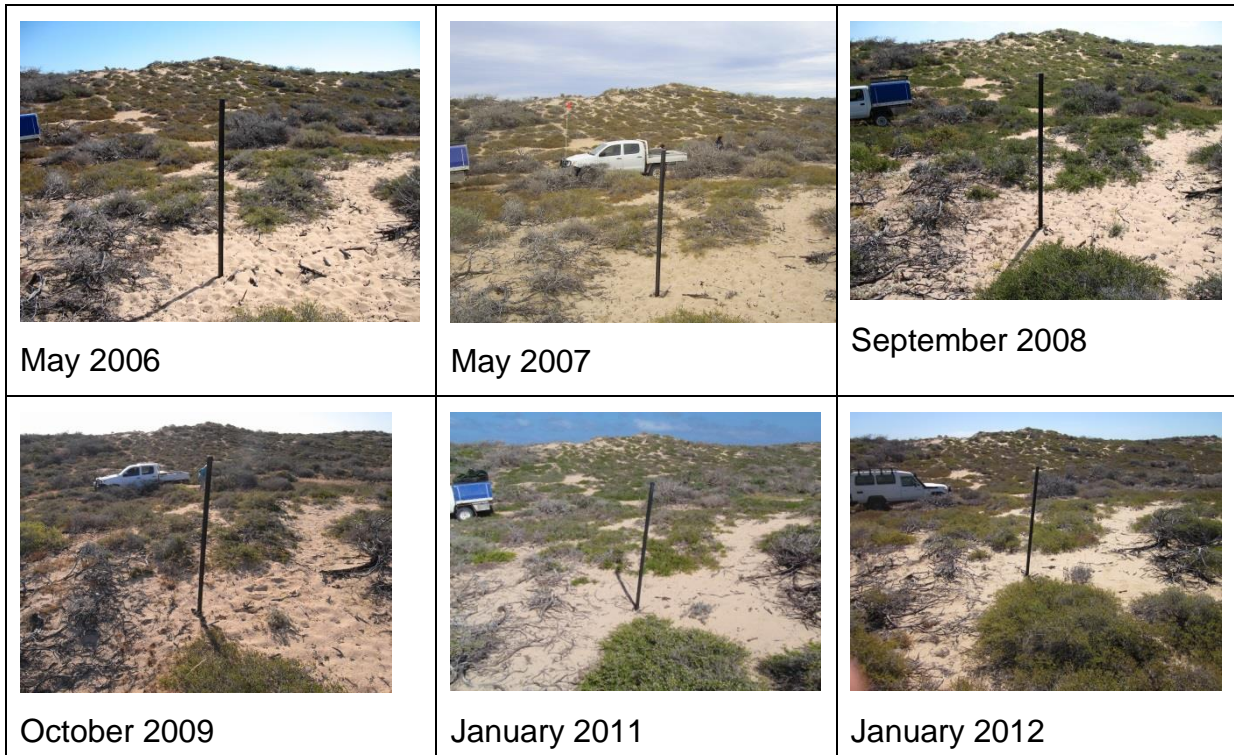
Over low grassland (2-10 % cover) of *\*Cenchrus ciliaris* and *Austrostipa nitida*

Over scattered herbs and low shrubs (<2% cover) of *Angianthus tomentosus*, *Podotheca gnaphaloides*, *\*Urospermum picroides* and *\*Brassica tournefortii*. *Euphorbia boophthona*/ *Euphorbia australis*/ *Commicarpus australis*/ *\*Sonchus oleraceus*, *Ptilotus obovatus*, *Atriplex vesicaria*, *Zygophyllum eremaum*

1 seedling of *Acacia sclerosperma*, 3 seedlings of *Acacia ligulata*



*Photo point photographs of plot 4*



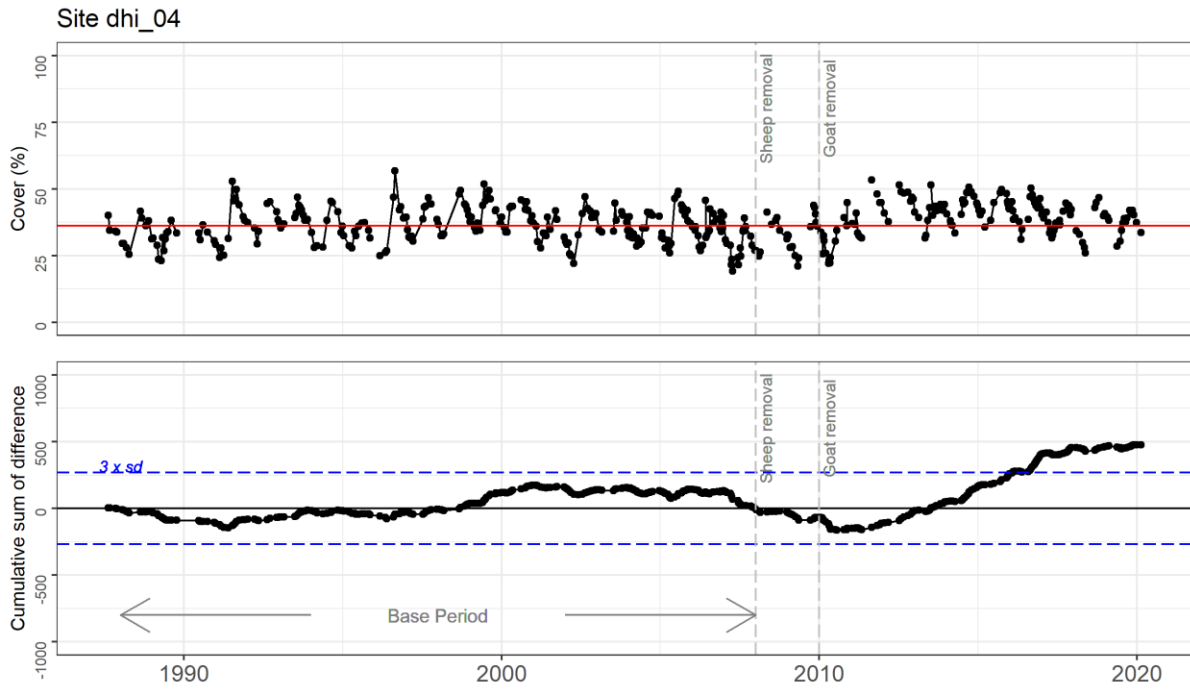


**Vegetation cover time series analysis:**

No significant change in vegetation cover is evident in the time series.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).





**Recommendations:**

The significant increase in vegetation cover at this site appears directly related to the removal of feral goats. The change in cover and degree of trampling is evident when comparing the 2007 (above) and 2017 (below) site photographs.



**Site 5**

**Description:**

Open shrubland *Diplolaena grandiflora* (20% cover) to 1 metre, over *Scaevola crassifolia*










Low shrubland *Capparis spinosa*/ *Frankenia pauciflora*/ *Pimlea gigliana*/ *Atriplex vesicaria*/ *Threlkeldia diffusa*/ *Ragodia preissii* (20-30% cover) 0.2 metres over prostrate herbs of *Carpobrotus* sp. Thevenard Island (10-20%)

Scattered herbs of \**Centaurea melitensis*/ *Euphorbia australis*/ *Euphorbia boophthona*/ \**Brassica tournefortii*/ \**Sonchus oleraceus* (<1% cover)

Scattered grasses *Cenchrus ciliaris* (<2% cover), *Eragrostis dielsii* (<1% cover)



*Photo point photographs of plot 5.*

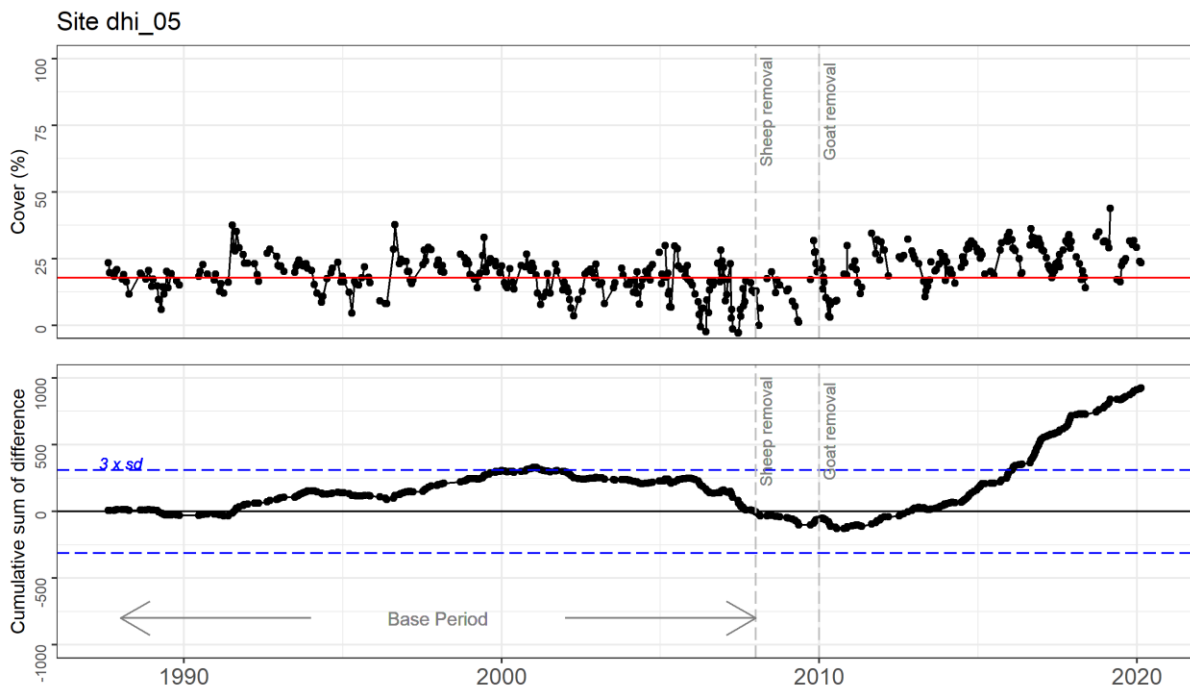
		
May 2006	May 2007 (peg was reinstalled)	September 2008
		
October 2009	January 2011	January 2012
		
May 2015	May 2015	May 2017



**Vegetation cover time series analysis:**

A significant increase in vegetation cover is evident in the time series graph and site photos. The increase appears to occur following 2010, this coincides with the removal of large numbers of goats from the area.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



**Recommendations:**

The significant increase in vegetation cover at this site appears directly related to the removal of feral goats. The change in cover and degree of trampling is evident when comparing the 2007 (above) and 2017 (below) site photographs.



**Site 6**

**Description:**

Acacia coriacea/ Acacia tetragonophylla (10% cover) 1 metre over  
 Sparse low Thryptomene baeckeacea (10% cover) shrubland 0.2 metres

Scattered Trioda plurinervata grassland (<5% cover) 0.2 metres over

Herbs of Euphorbia boophthona/ Ptilotus gaudichaudii/ Gnephosis arachnoidea/ \*Sisymbrium orientale/ \*Brassica tournefortii/ Salsola australis/ Carpobrotus sp. Thevenard Island



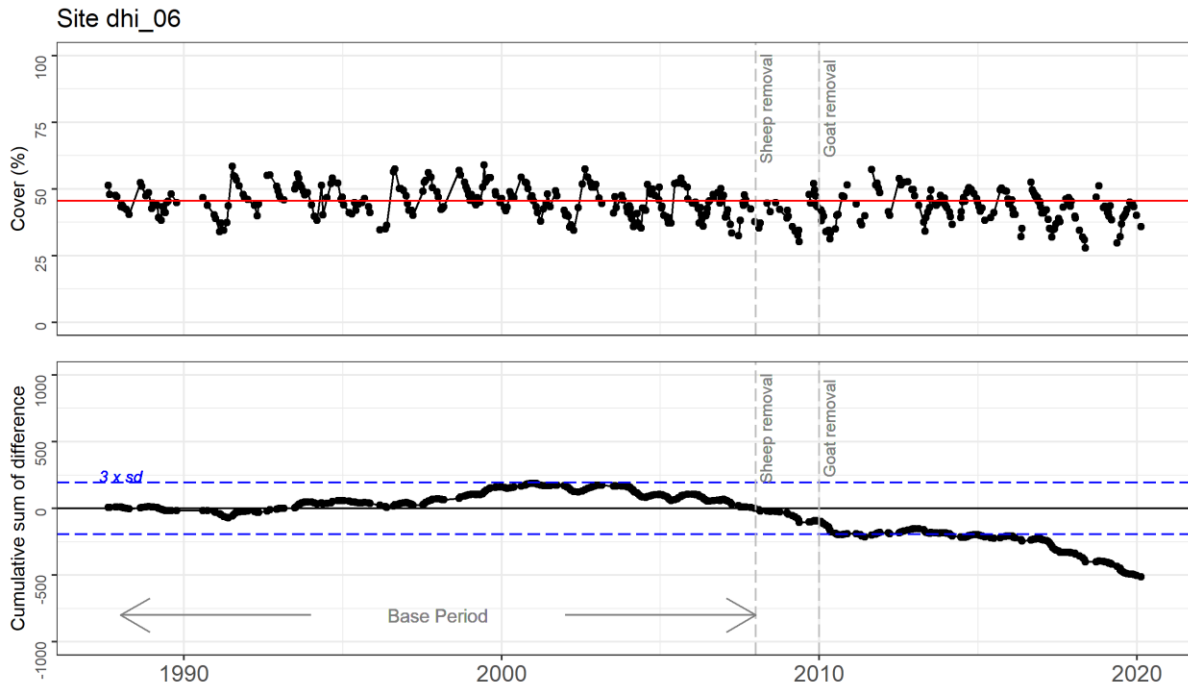
*Photo point photographs of plot 6.*

		
May 2006	May 2007	September 2008
		
October 2009	January 2011	January 2012
		
May 2015	May 2016	

### Vegetation cover time series analysis:

No significant change in vegetation cover is evident in the time series.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



### Recommendations:

Recapture photograph points and reassess site condition in 2021 as a significant deviation from baseline vegetation cover has now occurred (3 standard deviation lines on cusum chart are breached).

## Site 7

### Description:








Low Shrubland (10-30% cover) 1-2 metres of *Acacia ligulata* with scattered *Diplolaena dampieri*, *Alogyne hakeifolia*, *Alectryon oleifolia* and *Exocarpus aphyllus*

Low shrubland (30% cover) 0.3- 0.5 metres of *Thryptomene baeckeacea* (90%), with rarely recorded shrubs of *Santalum spicatum*, *Atriplex vesicaria*, *Rhagodia* (estimated species) *crassifolia* and *Threlkeldia diffusa*

Over succulent low shrubs (2-10% cover) of *Carpobrotus candidus*.



### Photo point photographs of plot 7.

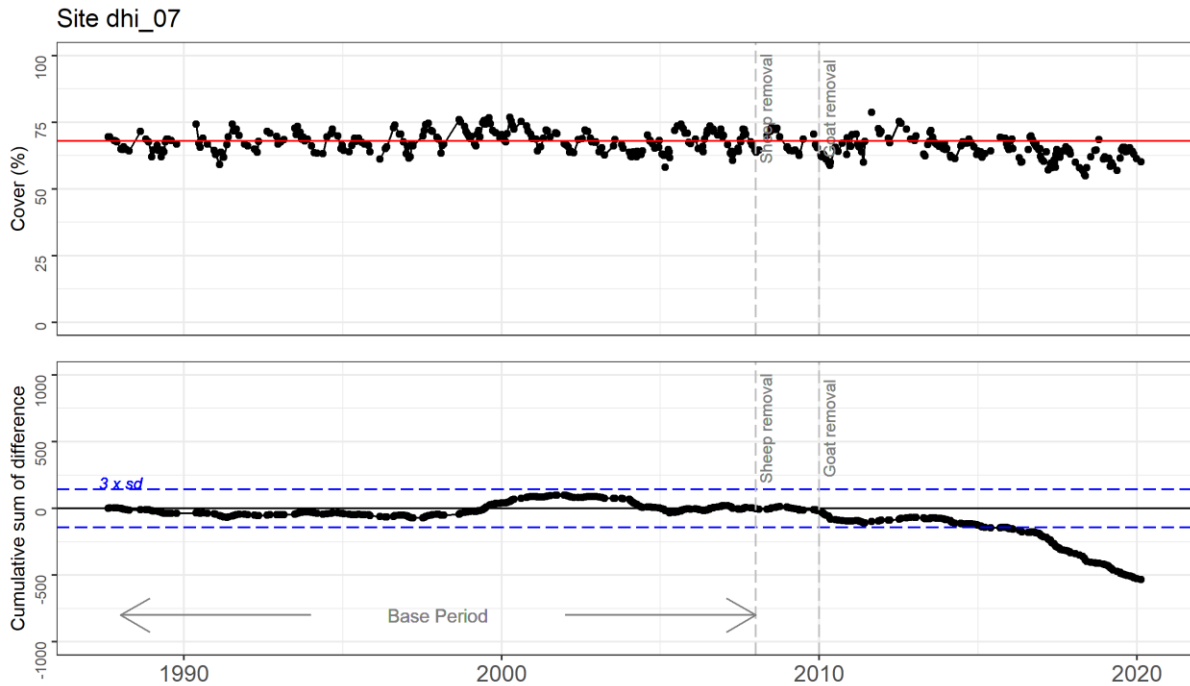
		
May 2006	May 2007	September 2008
		
October 2009	January 2011	January 2012
		
April 2014		



**Vegetation cover time series analysis:**

A slight decline in vegetation cover is now evident at the site.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



**Recommendations:**

Recapture photograph points and reassess site condition in 2021.

## Site 8

### Description:

Very scattered *Acacia ligulata* (<1% cover) 0.5 metres






Low heath of *Melaleuca cardiophylla*/ *Thryptomene baeckeacea* (30-70% cover avg 60%) 0.2 metres over

Grassland of *Trioda plurinervata* (5% cover) 0.2 metres

Scattered herbs (<5% cover) of *Salsola australis*/ *Ptilotus gaudichaudii*



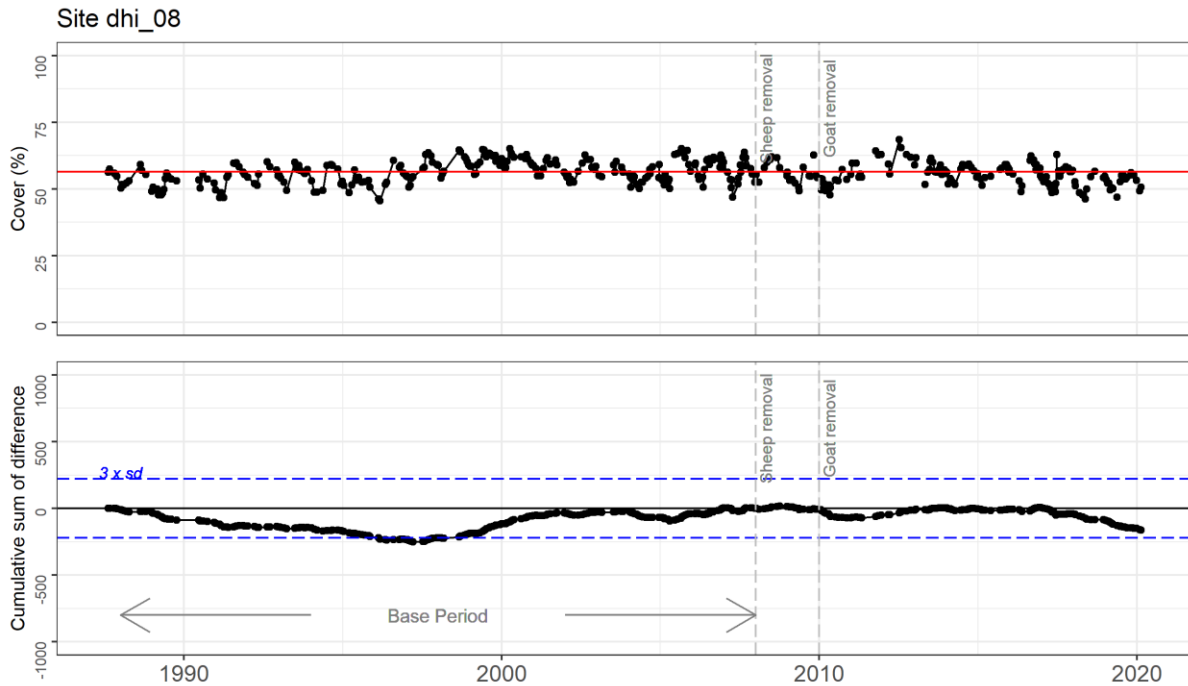
### Photo point photographs of plot 8.

		
May 2006	May 2007	September 2008
		
October 2009	January 2011	January 2012
		
May 2015	May 2016	

### Vegetation cover time series analysis:

No significant change in vegetation cover is evident in the time series.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



### Recommendations:

Recapture photograph points and reassess site condition either in 2021 or if a significant deviation from baseline vegetation cover are observed (3 standard deviation lines on cusum chart are breached).

## Site 9

### Description:

Low Open Shrubland (10-30% cover) 1-1.5 metres *Acacia ligulata* dominated (90%) with scattered shrubs of *Stylobasium spathulatum* and *Stennathemum* sp.

Low shrubland (30% cover) 0.3-0.5 metre of *Thryptomene baeckeacea*, with rarely recorded shrubs of *Melaleuca cardiophylla* and *Pileanthus limacis*

Over low hummock grassland (10-30 % cover) of *Triodia plurinervata*

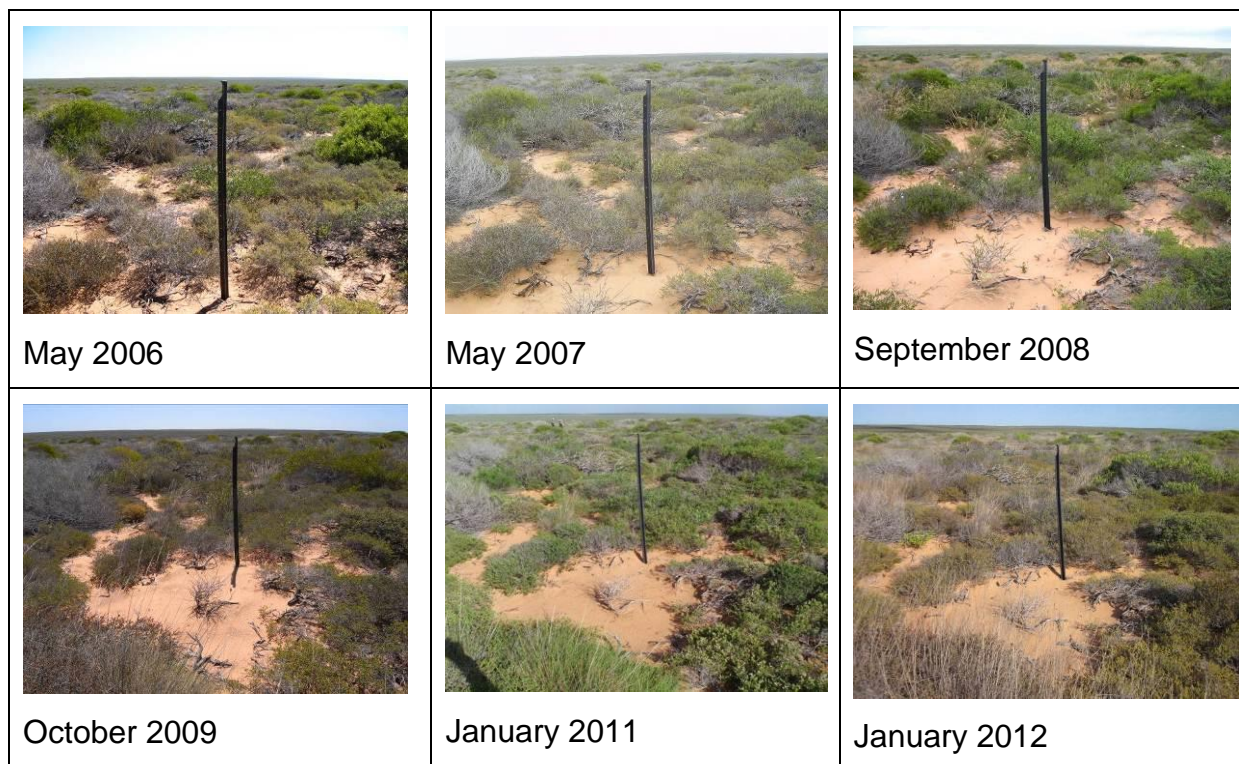
Over scattered herbs of *Dianella revoluta* and *Acanthocarpus preissii*

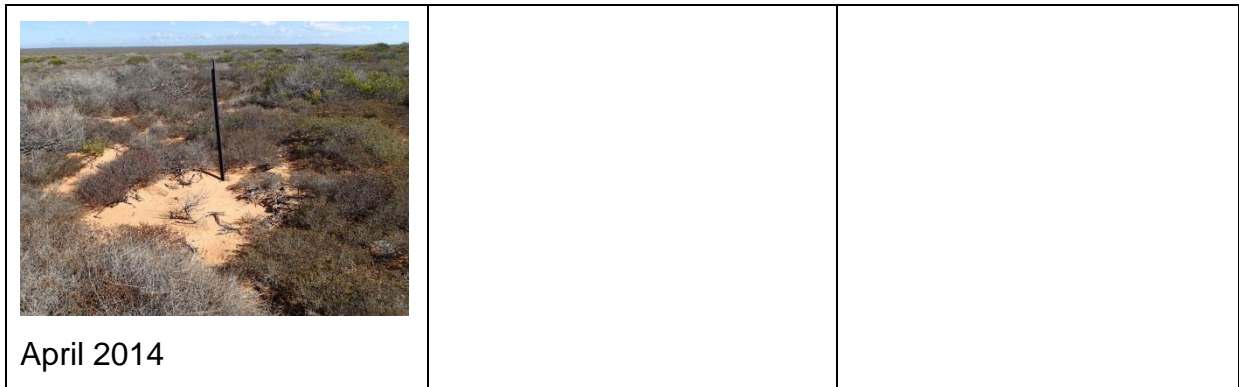
(Note at this site there was a tall layer of *Acacia coriacea* and *Acacia tetragonophylla*, now mostly dead, little evidence or regeneration, possible fire)

Note: Site of interest for long term monitoring as the upper stratum of *Acacia* has been lost with little sign of regeneration.



### Photo point photographs of plot 9.

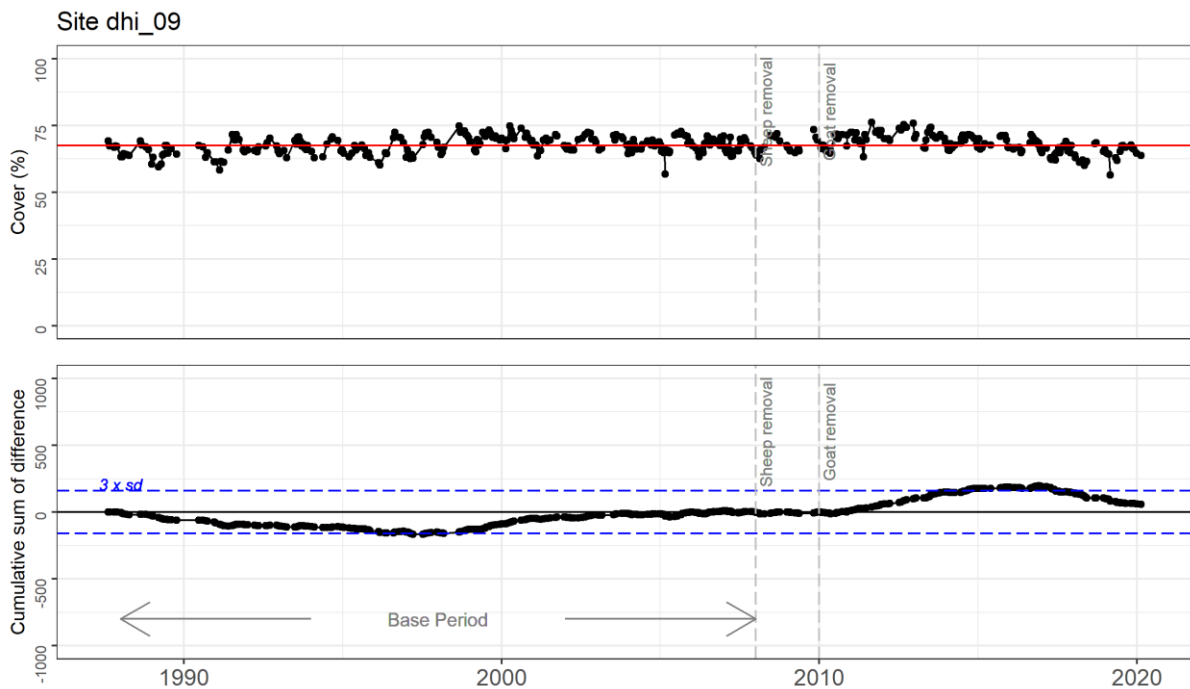




**Vegetation cover time series analysis:**

No significant change in vegetation cover is evident in the time series.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



**Recommendations:**

Recapture photograph points and reassess site condition either in 2021 or if a significant deviation from baseline vegetation cover are observed (3 standard deviation lines on cusum chart are breached).

## Site 10

### Description:

Low Open Shrubland (10-30% cover) 1-1.5 metres *Acacia ligulata* dominated (90%) with scattered shrubs of *Stylobasium spathulatum*

Low shrubland (30% cover) 0.5-1 metre of *Thryptomene baeckeacea*, with rarely recorded shrubs of *Melaleuca cardiophylla*, *Stenanthemum* sp. and *Pileanthus limacis* / *Acanthocarpus robustus*

Over low shrubland (2-10% cover) < 20cm *Halgania andromedifolia*/  
*Zygophyllum billardierei*/ *Beyeria calycina*/ *Ptilotus obovatus*

Over low hummock grassland (10-30 % cover) of *Triodia plurinervata* with many young *Triodia* scattered though.

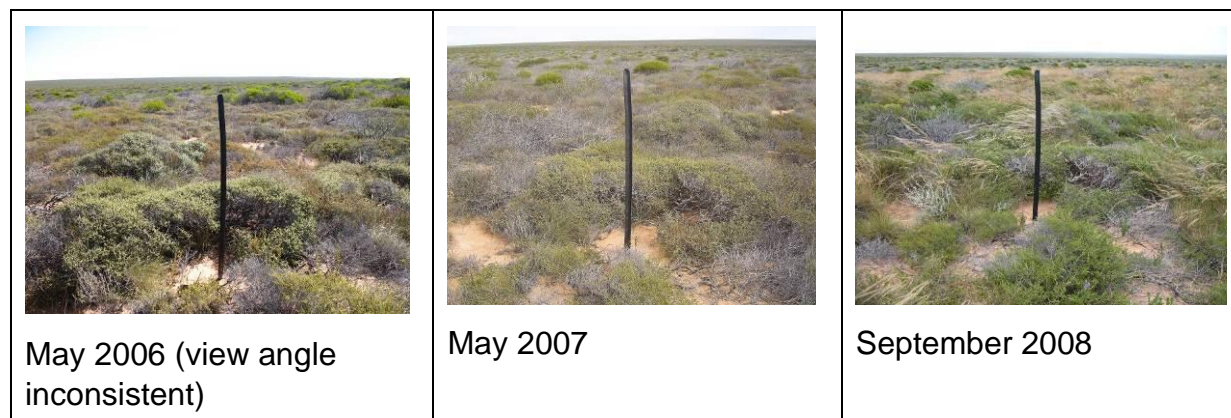
Herbs of *Dianella revolta*.

(Note at this site there was a tall layer of *Acacia coriacea* and *Acacia tetragonophylla*, now mostly dead, little evidence or regeneration, ?fire)

Note: Site of interest for long term monitoring as the upper stratum of *Acacia* has been lost with little sign of regeneration.

Undergoing successional change

*Photo point photographs of plot 10.*

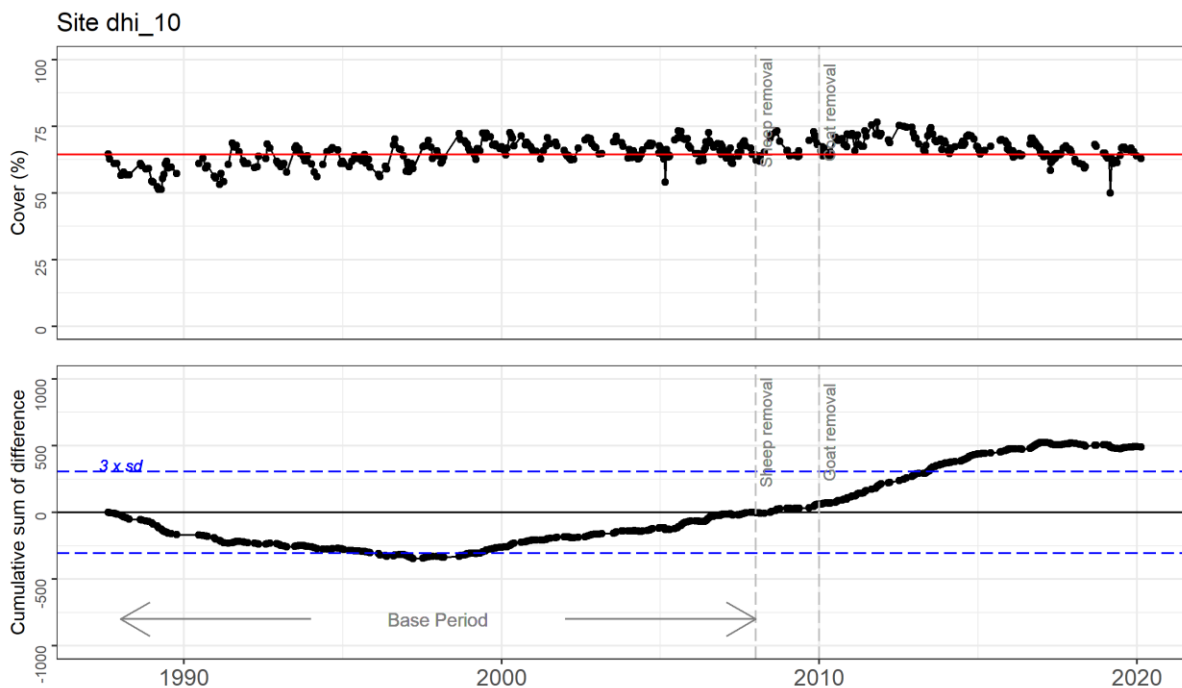




### Vegetation cover time series analysis:

The upward trend in vegetation cover has continued since the last report. The increase in cover may be due to long term recovery from fire or reduced grazing pressure. Grazing in the north of DHI is known to have decreased from the 1960s.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



**Recommendations:**

Reassess baseline period due to vegetation cover appearing to increase during the baseline period.



**Site 11**

**Description:**

Very Open Shrubland (2-10%) 1-2 metres of *Acacia sclerosperma* and *Acacia tetragonophylla* (largely dead)

Low Open Shrubland (2-10% cover) 1 metres *Acacia ligulata*

Low shrubland (30% cover) of 0.3- 0.5 metres of *Thryptomene baeckeacea* and *Melaleuca cardiophylla*, with rarely recorded shrubs of *Stylobasium spathulatum*, *Stenanthemum sp.* and *Pileanthus limacis*








Over low hummock grassland (30 % cover) of *Triodia plurinervata*

Over scattered herbs (<2%) of *Conostylis stylidioides* and *Dianella revoluta*.

Note: Site of interest for long term monitoring as the upper stratum of *Acacia* has been lost with little sign of regeneration.



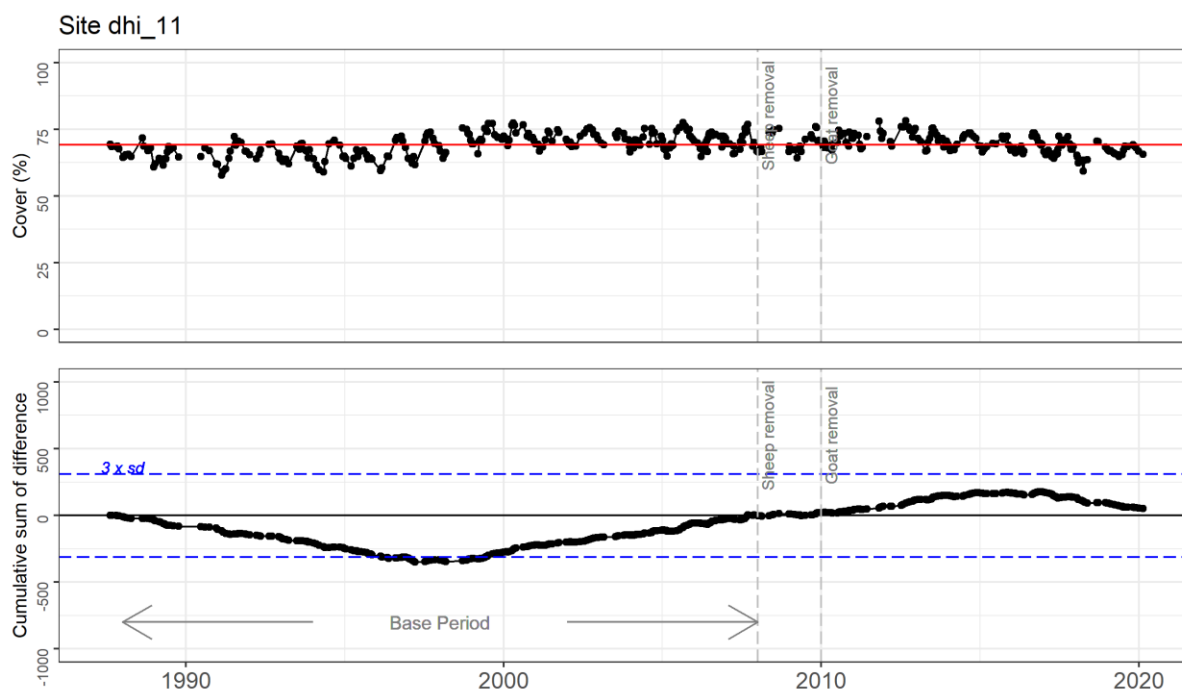
*Photo point photographs of plot 11.*

		
May 2006	May 2007	September 2008
		
October 2009	January 2011	April 2014
		
May 2018		

### Vegetation cover time series analysis:

No significant change in vegetation cover is evident in the time series.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



### Recommendations:

Recapture photograph points and reassess site condition either in 2021 or if a significant deviation from baseline vegetation cover are observed (3 standard deviation lines on cusum chart are breached).

**Site 12**

**Description:**

Open Mallee shrubland, 1-1.5 metres of *Eucalyptus fruticosa* and *Eucalyptus oraria*









Low Open Shrubland (2-10% cover); 1 metre of *Acacia ligulata*

Low dense shrubland (30-70% cover) of 0.3- 0.5 metres of *Thryptomene baeckeacea* and *Melaleuca cardiophylla*, with rarely recorded shrubs of *Stylobasium spathulatum*, *Stenanthemum sp.*, *Olearia dampieri* and *Pileanthus limacis*. With vines of *Cassytha racemosa*

Over low hummock grassland (10-30 % cover) of *Triodia plurinervata*



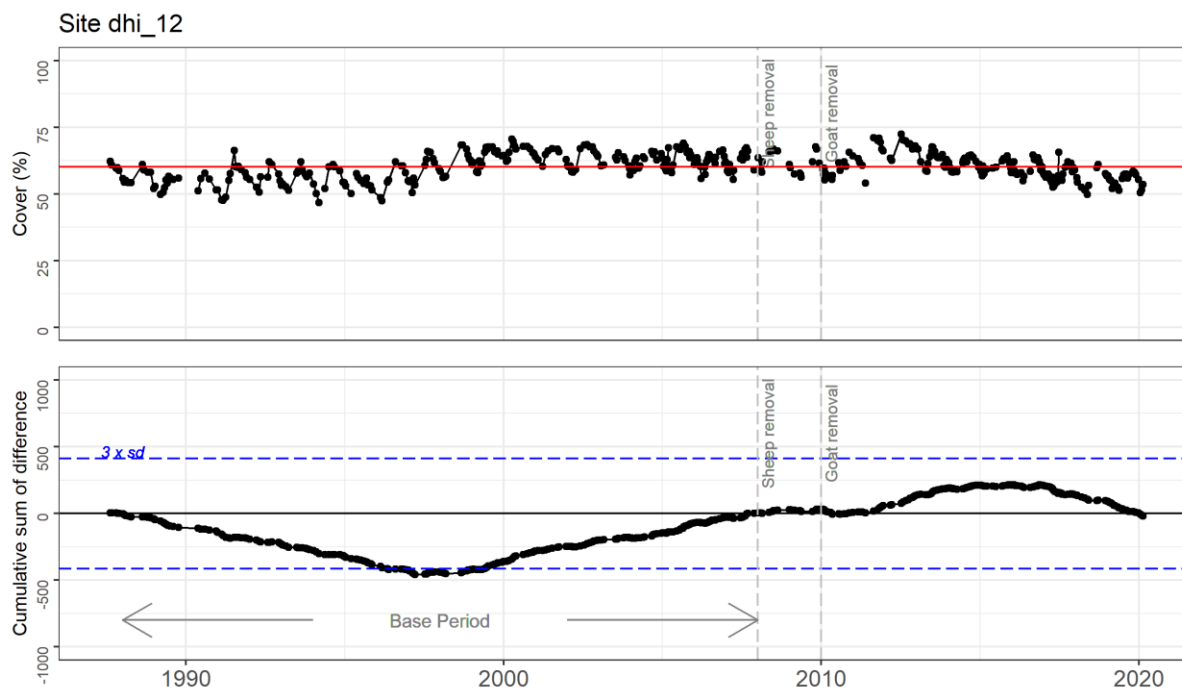
*Photo point photographs of plot 12.*

		
May 2006	May 2007	September 2008
		
October 2009	January 2011	January 2012
		
April 2014	May 2018	

### Vegetation cover time series analysis:

No significant change in vegetation cover is evident in the time series.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



### Recommendations:

Recapture photograph points and reassess site condition either in 2021 or if a significant deviation from baseline vegetation cover are observed (3 standard deviation lines on cusum chart are breached).

**Site 13**

**Description:**

Low Open Shrubland (2-10% cover) 1 metres *Acacia ligulata*









Low shrubland (30% cover) 0.3- 0.5 metres of *Thryptomene baeckeacea* and *Melaleuca cardiophylla*, with rarely recorded shrubs of *Stenanthemum* sp., *Mirbelia ramulosa* and *Pileanthus limacis*

Over low hummock grassland (10-30 % cover) of *Triodia plurinervata*

Over scattered herbs and low shrubs (<2% cover) of *Halgania cynea*, *Cassytha* sp., *Logania* sp. and *Dianella revoluta*.



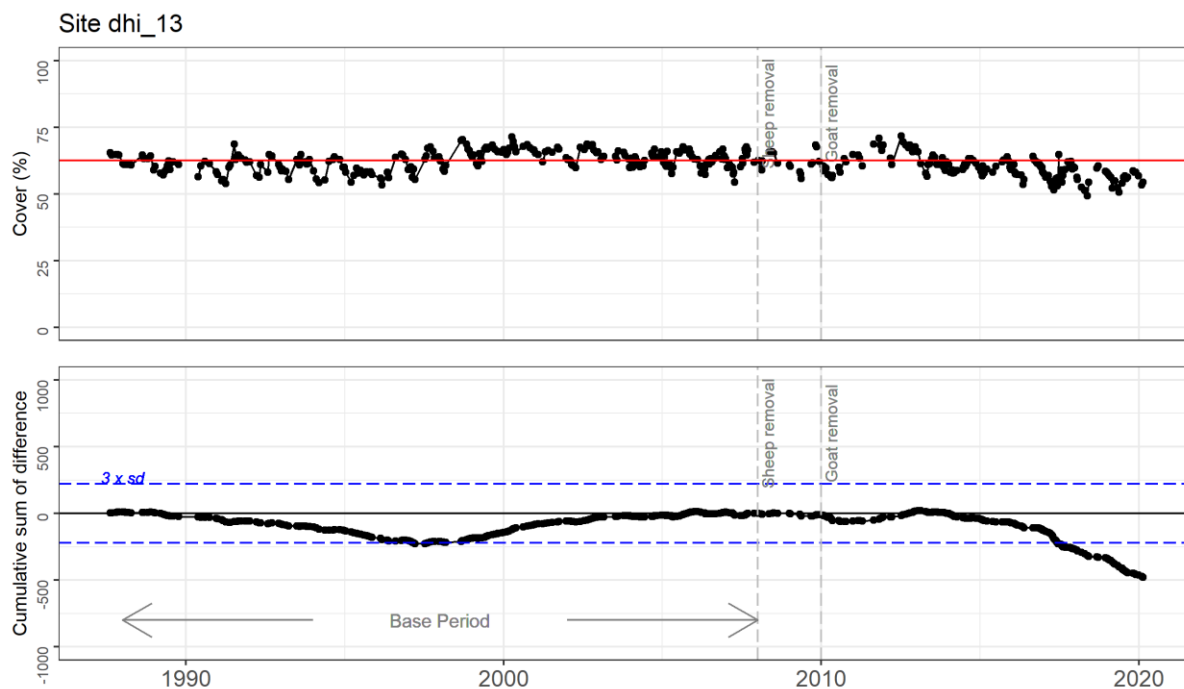
*Photo point photographs of plot 13.*

		
May 2006	May 2007 ( peg reinstalled)	September 2008
		
October 2009	January 2011	January 2012
		
April 2014	May 2018	

### Vegetation cover time series analysis:

No significant change in vegetation cover is evident in the time series.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



### Recommendations:

Recapture photograph points and reassess site condition either in 2021 or if a significant deviation from baseline vegetation cover are observed (3 standard deviation lines on cusum chart are breached).

**Site 14**

**Description:**

Low Open Shrubland (2-10% cover) 1-2 metres *Acacia ligulata* dominated (70%) with *Exocarpus aphyllus*

Dense low shrubland (30-70% cover) 0.5-1 metre of *Melaleuca cardiophylla*, *Thryptomene baeckeacea*, *Westringia rigida* and scattered *Stylobasium spathulatum* and *Pileanthus limacis*









Over low open shrubs (2% cover) of *Halgania cyanea*

Over low hummock grassland (10 % cover) of *Triodia plurinervata*

Over scattered herbs of *Salsola australis* and *Angianthus tomentosus*



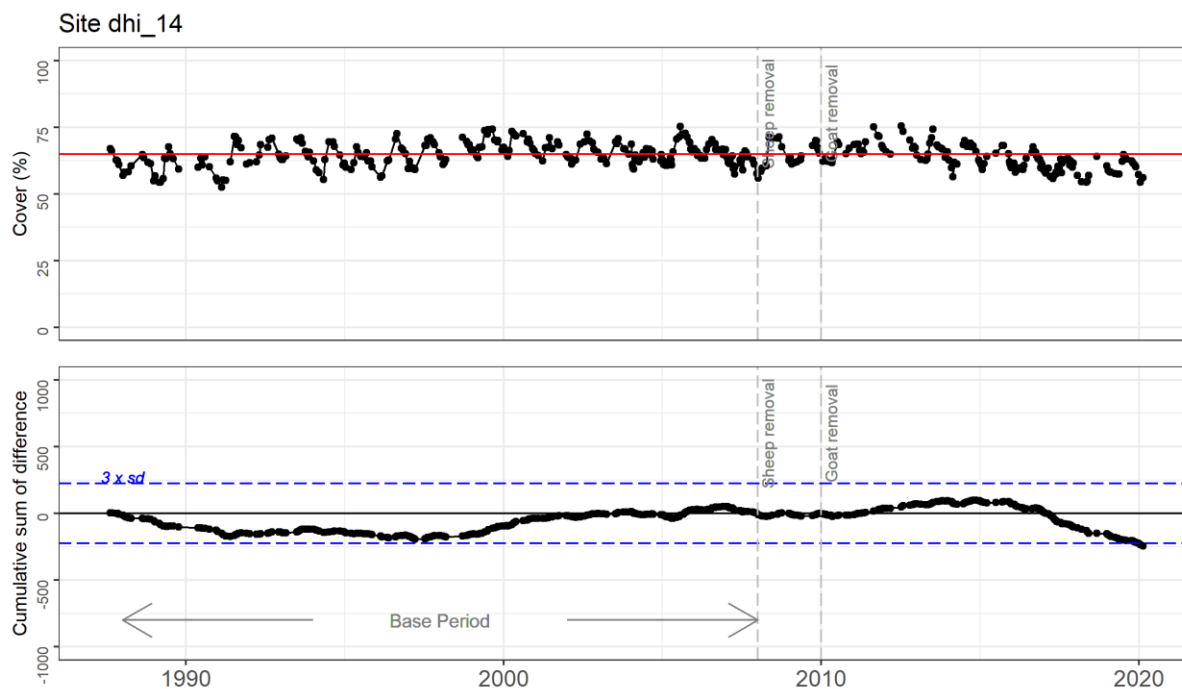
*Photo point photographs of plot 14.*

		
May 2006	May 2007	September 2008
		
October 2009	January 2011	January 2012
		
April 2014	May 2016	

### Vegetation cover time series analysis:

No significant change in vegetation cover is evident in the time series.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



### Recommendations:

Recapture photograph points and reassess site condition either in 2021 or if a significant deviation from baseline vegetation cover are observed (3 standard deviation lines on cusum chart are breached).



**Site 15**

**Description:**

Low Open Shrubland (2-10% cover) 0.5-1.5 metres Acacia ligulata dominated (70%) with Exocarpus aphyllus and Alectryon oleifolius

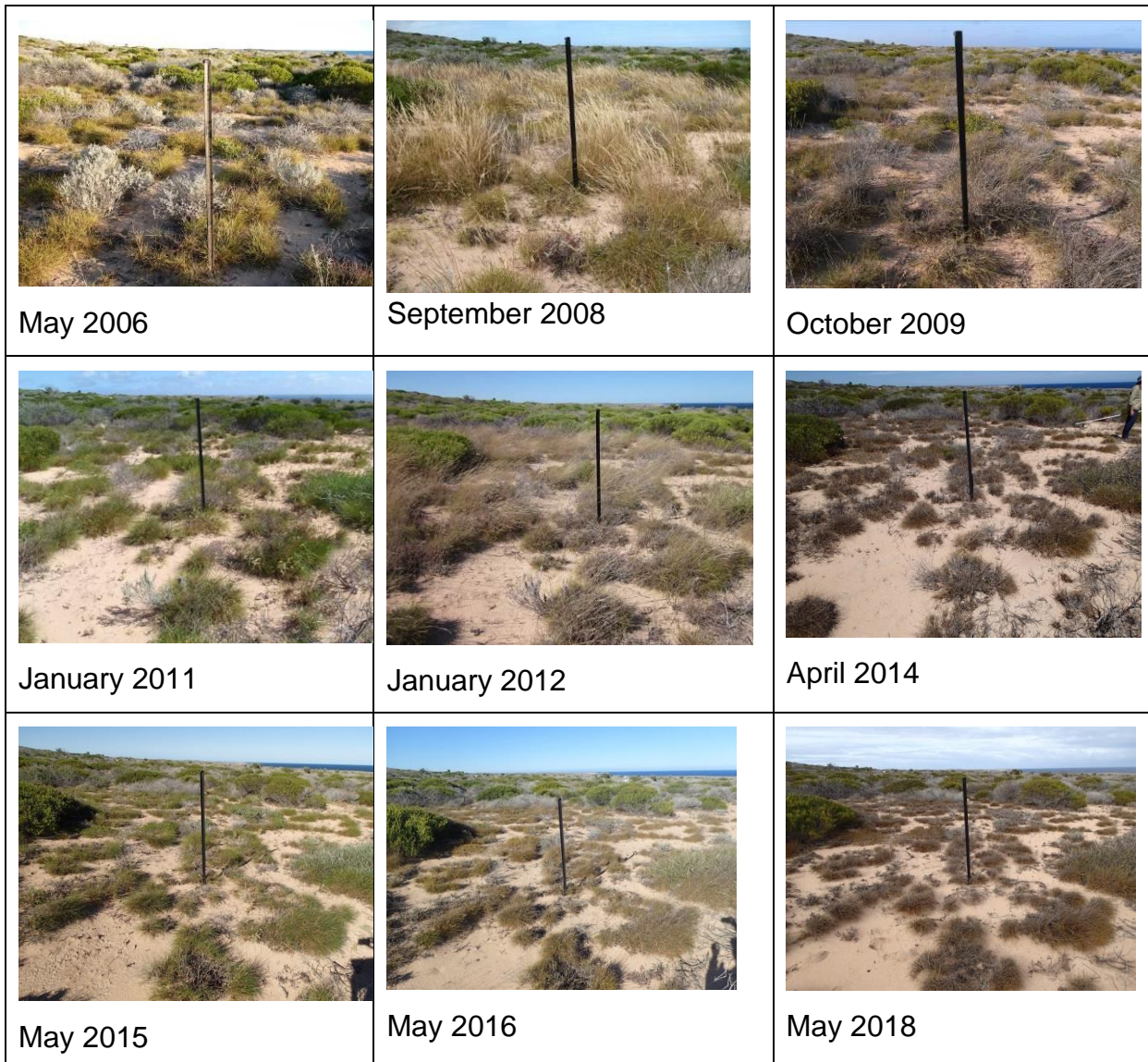
Over low shrubland (2-10% cover) 0.5 metre of Olearia axillaris(70%) and Mirbelia viminea, Diplolaena grandiflora, Rhagodia baccata , Enchylaena tomentosa, Acacia tetragonophylla and Thryptomene baeckeacea/ Scaevola spinescens/ Scaevola crassifolia. Rare Atriplex vesicoica, Solanum orbiculatum, corpobrotus candidus, Acacia linophylla, Threlkeldia diffusa, Scaevola tomentosa

Over low grassland (30 % cover) of Triodia plurinervata

Over scattered herbs of Salsola australis and Angianthus tomentosus/ Acanthocarpus preissii/ Austrostipa nitida



*Photo point photographs of plot 15.*



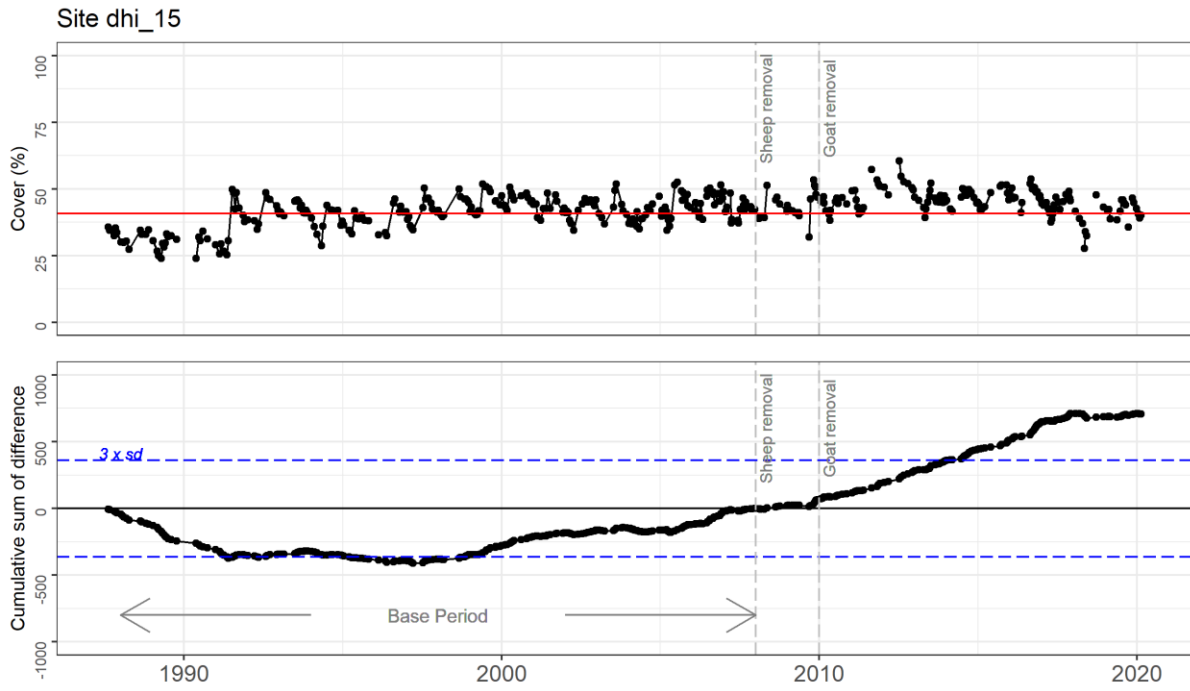


**Vegetation cover time series analysis:**

A continual upward trend is evident with a step increase following 1991. The increase in cover may be due to long term recovery from reduced grazing pressure. Grazing in the north of DHI is known to have decreased from the 1960s. This is supported by nearby fence posts (see image below), indicating that the area was once a yard and would therefore have been grazed heavily.



The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



**Recommendations:**

Reassess baseline period due to trend within the baseline period.

## Site 16

### Description:

Tall very open shrubland, 2-3 metres (< 2% cover) of scattered *Pittosporum phillyraeoides*

Low Open Shrubland (10-30% cover) 1-2 metres; *Acacia ligulata* dominated (70%) with *Exocarpus aphyllus* (20%) and *Alectryon oleifolius*

Over low shrubland (2-10% cover) 0.5 metre of *Thryptomene baeckeacea* with scattered shrubs of *Mirbelia viminea*, *Olearia dampieri*, *Westringia rigida*, *Rhagodia crassifolia*, *Acanthocarpus robustus*, *Acacia leptospermoides* and *Melaleuca cardiophylla*, *Scaevola spinescens*, *Scaevola tomentosa*, *Solanum orbiculatum*, *Zygophyllum eremaeum*, *Westringia dampieri*

Over low dense grassland (30-70 % cover) of *Triodia plurinervata*

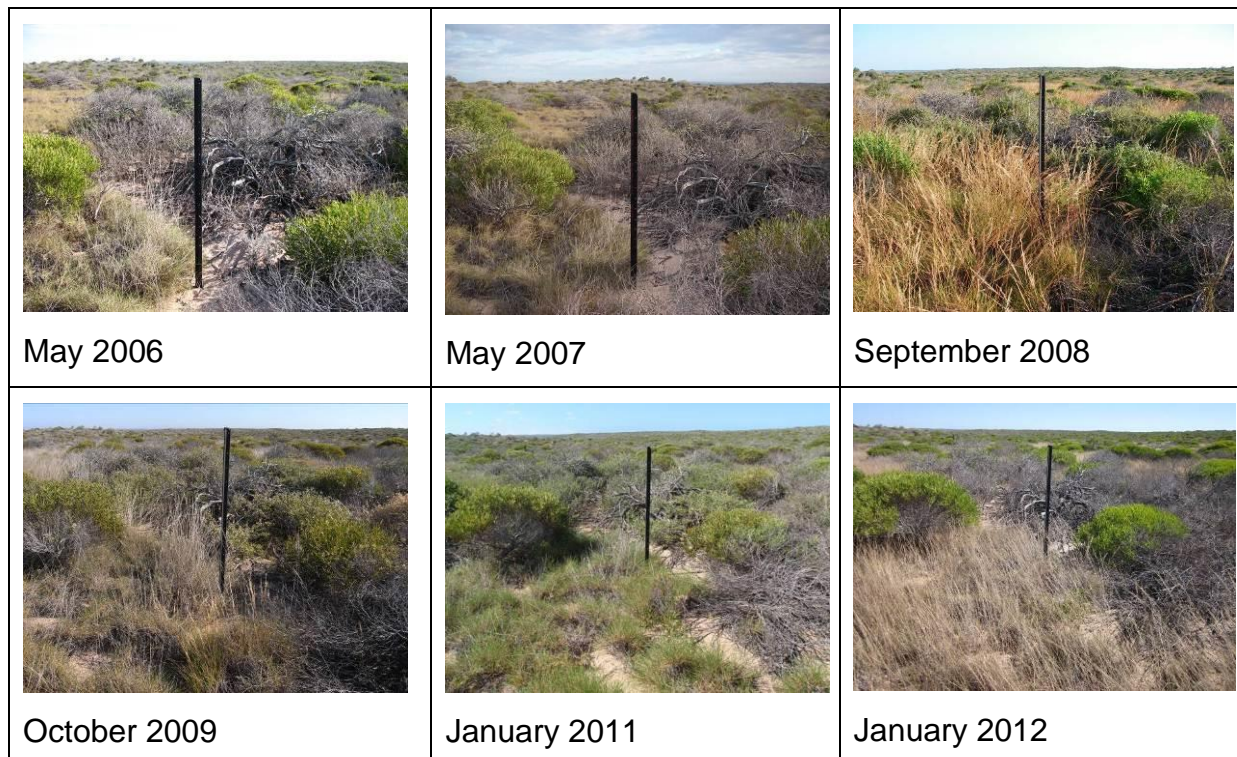
Over scattered herbs of *Salsola australis*, *Maireana triptera*, *Ptilotus gaudichaudii* and *Angianthus tomentosus*.

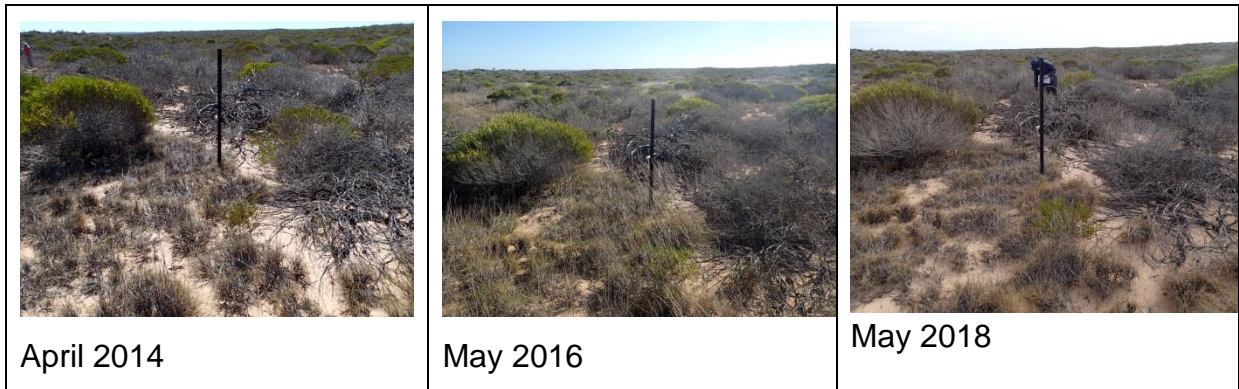
With vine *Aphanopetalum clematidium*

cryptogamic soil crust (30% cover)



Photo point photographs of plot 16.

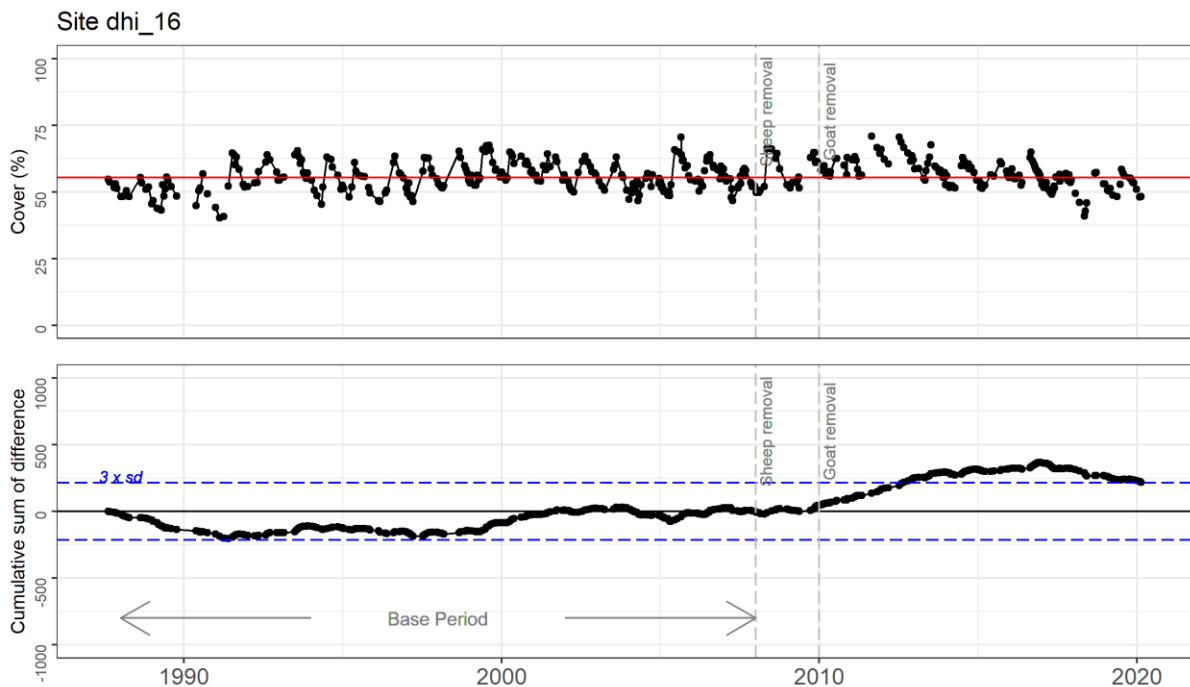




**Vegetation cover time series analysis:**

A significant increase in vegetation cover was recorded at this site. This increase appears to be part of a continual upward trend, with a step increase following 1991. The increase in cover may be due to long term recovery from reduced grazing pressure. Grazing in the north of DHI is known to have decreased from the 1960s.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



**Recommendations:**

Reassess baseline period due to trend within the baseline period.

## Site 17

### Description:

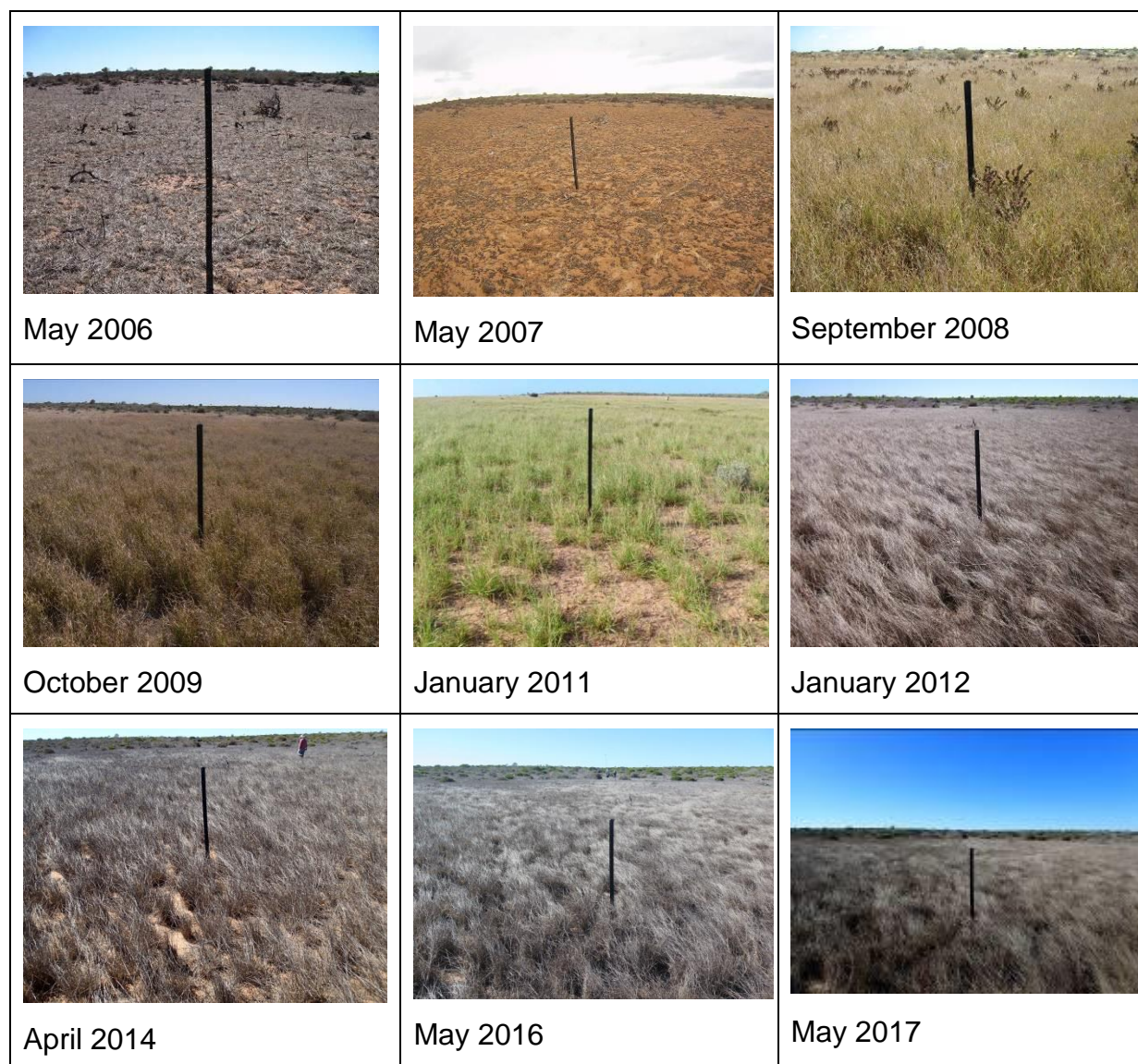
Low dense bunch grassland (>80 % cover) of *Cenchrus ciliaris*

With rare shrubs of *Keraundrinia hermaniifolia*

Note: Site of interest for long term monitoring for shrub encroachment.



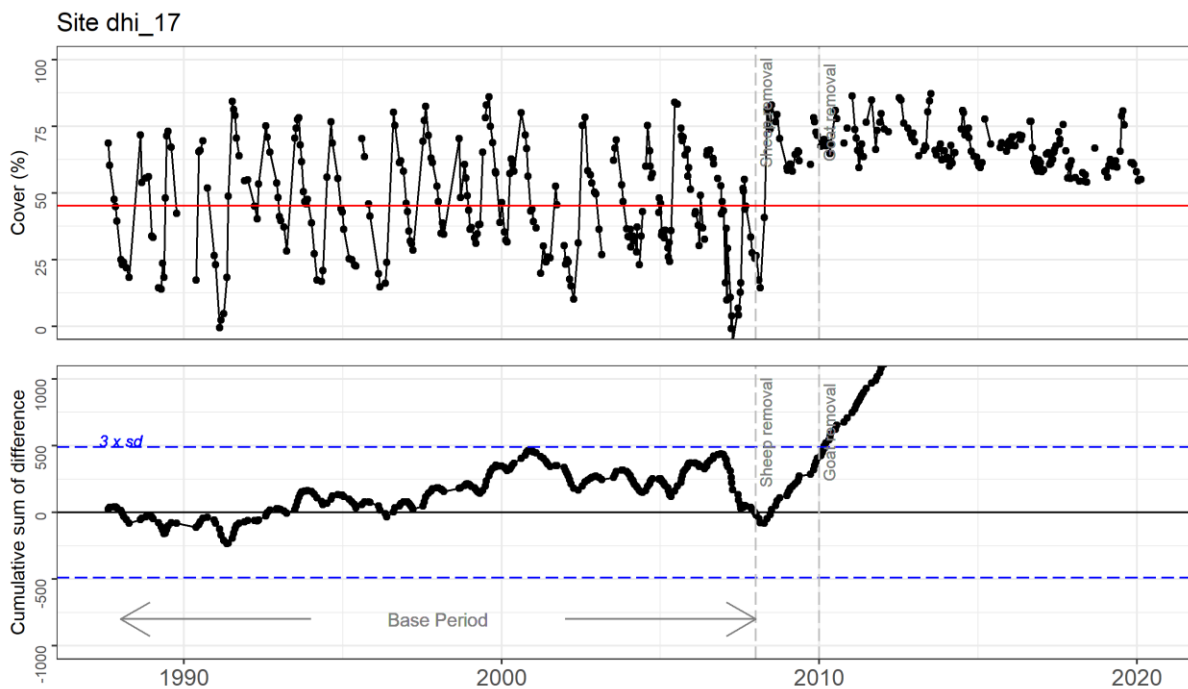
### Photo point photographs of plot 17.



## Vegetation cover time series analysis:

A significant step increase in vegetation cover was recorded at this site following destocking. This increase appears directly related to a reduction in grazing pressure following the removal of livestock in 2008. The increase can be attributed to buffel grass (*Cenchrus ciliaris*).

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



## Recommendations:

As the cusum chart indicates a significant change since destocking, monitoring should be continued on a biennial basis. The baseline will need to be reassessed to be sensitive to further change.

## Site 18

### Description:

Low Open Shrubland (2-10% cover) 1-2 metres of *Acacia ligulata*

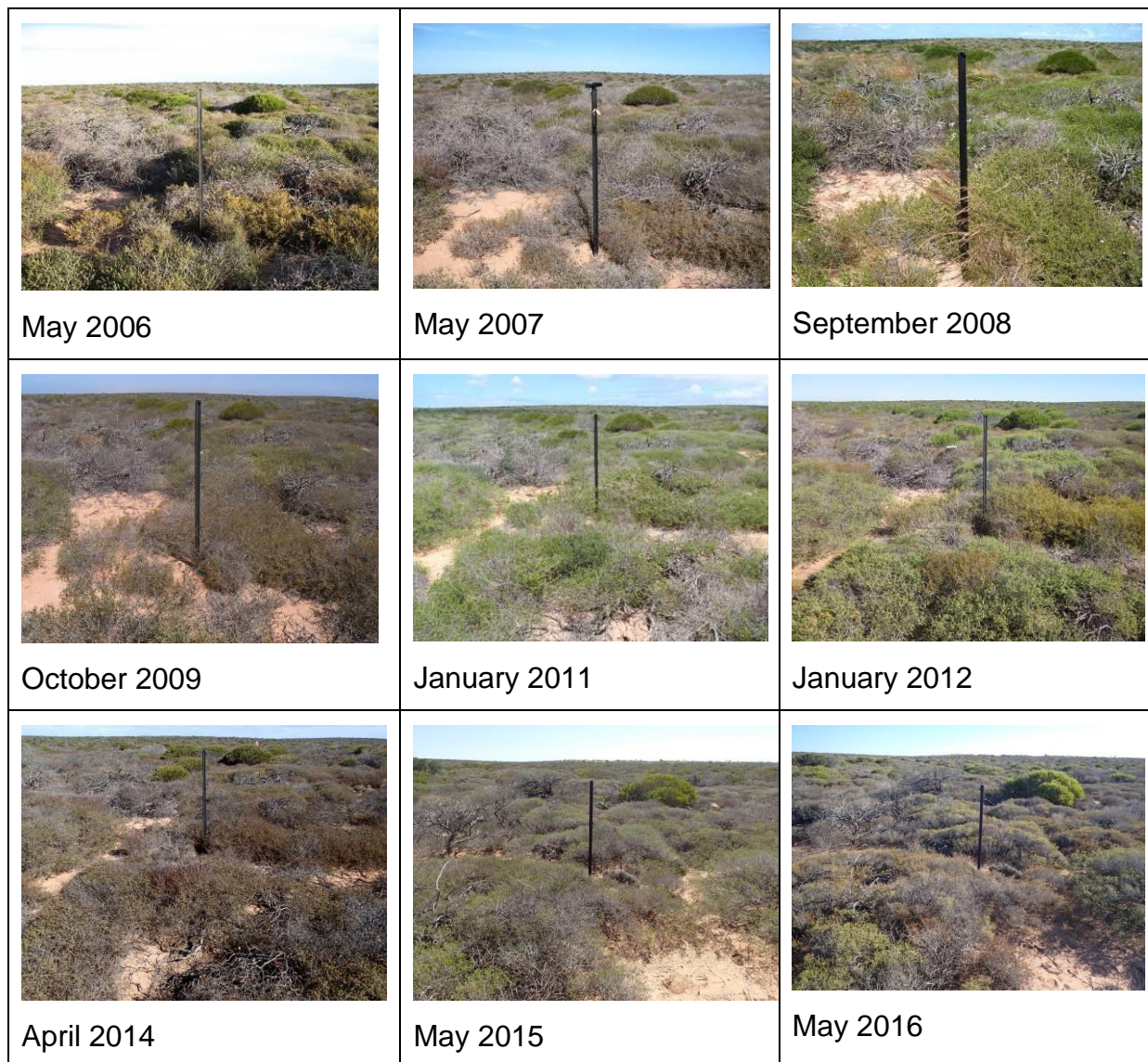
Dense low shrubland (30-70% cover) 20 cm- 0.5 metre of *Thryptomene baeckeacea* (60 %) with *Melaleuca cardiophylla*, *Westringia rigida* and scattered *Hemigenia* sp., *Spyridium* sp., *Alogyne hakeiformis* and *Pileanthus limacis*

Over low hummock grassland (10 % cover) of *Triodia plurinervata*

Over scattered herbs of *Salsola australis* and *Angianthus tomentosus*



### Photo point photographs of plot 18.

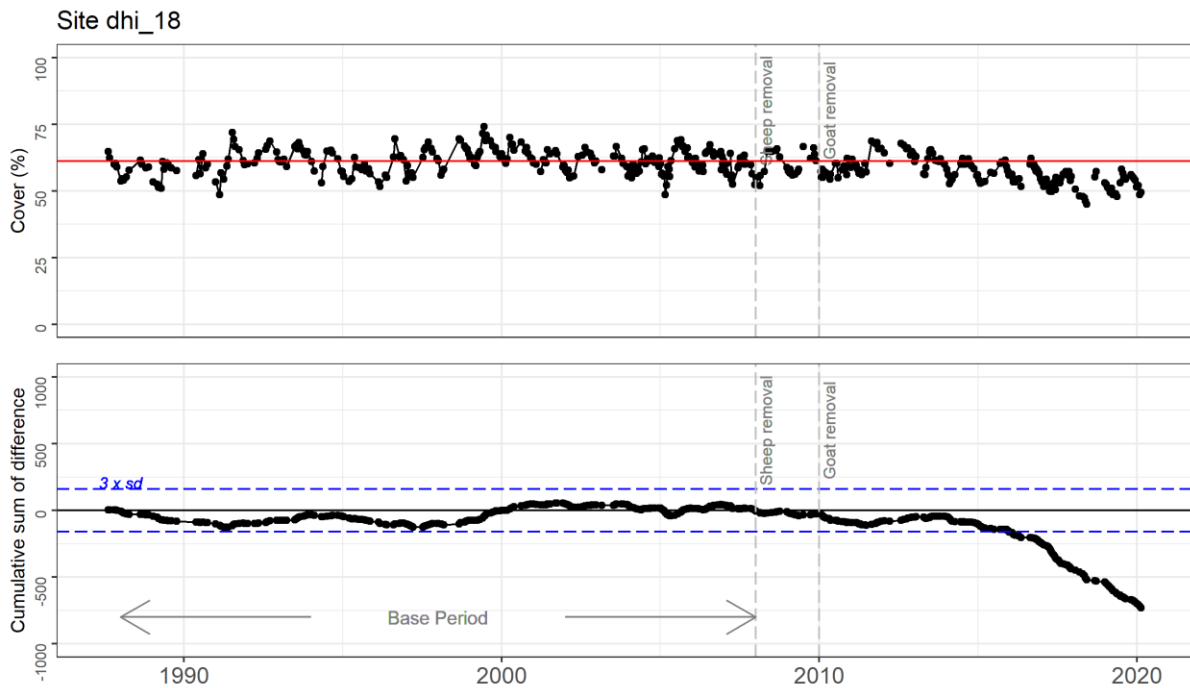




**Vegetation cover time series analysis:**

Vegetation cover has now experienced a significant decline (even though the decline is relatively small).

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



**Recommendations:**

Recapture photograph points and reassess site condition in 2021.

**Site 19**

**Description:**

Open shrubland *Acacia ligulata*/ *Acacia tetragonophylla*/ *Acacia coriacea*/ *Melaleuca* sp? (10-30% cover) 1-2 metres

Very open shrubs of *Exocarpos aphyllus*/ *Rhagodia crassifolia*/ *Atriplex cinerea*/ *Scaevola tomentosa* (<2% cover) 0.5-1 metre

Low very open shrubland of *Frankenia pauciflora*/ *Solanum aviculare* (<25 cover) 0.2 metres over

Low grassland of \**Cenchrus ciliaris* (30-70% cover , 2-10% in areas) 0.3 metres

Scattered herbs of \**Brassica tournefortii*/ \**Sonchus oleraceus*/ \**Silene nocturna*/ \**Reichardia tingitana*, *Acanthocarpus robustus*

Scattered grasses of *Eragrostis dielsii*/ *Austrostipa nitida*/ *Austrostipa elegantissima*/ *Rytidosperma occidentalis*

Vines observed in 2018 *Threlkeldia diffusa*, *Aphanopetalum clematidium*, *Enchylaena tomentosa*

Evidence of major germination of weeds in 2015 and *Ptilotus obovatus*



*Photo point photographs of plot 19.*

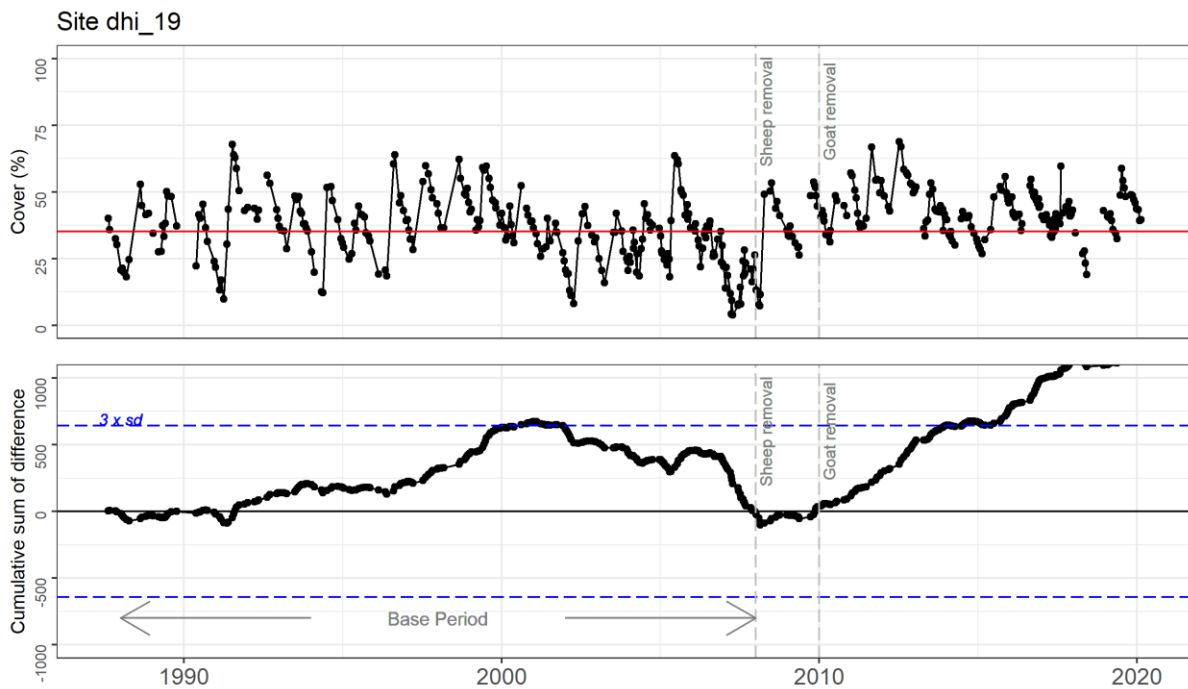




**Vegetation cover time series analysis:**

A significant step increase in vegetation cover was recorded at this site following destocking. Change in cover and composition at the site continues with new species of vines noted in 2018.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



**Recommendations:**

Recapture photograph points and reassess site condition in 2021 if upward trend in vegetation cover continues. Reassess baseline period.

## Site 21

### Description:

Low Open Shrubland (10-30% cover) 1-2 metres *Acacia ligulata*, *Atriplex vesicaria*, *Alectryon oleifolius*, *Exocarpus aphyllus*/ *Scaevola spinescens*/ *Scaevola tomentose*

Low shrubland (10-30% cover) 0.3- 0.5 metres of *Pimelea gilgiana*, *Frankenia pauciflora* and *Sclerolaena diacantha*/ *Myoporum insulare*

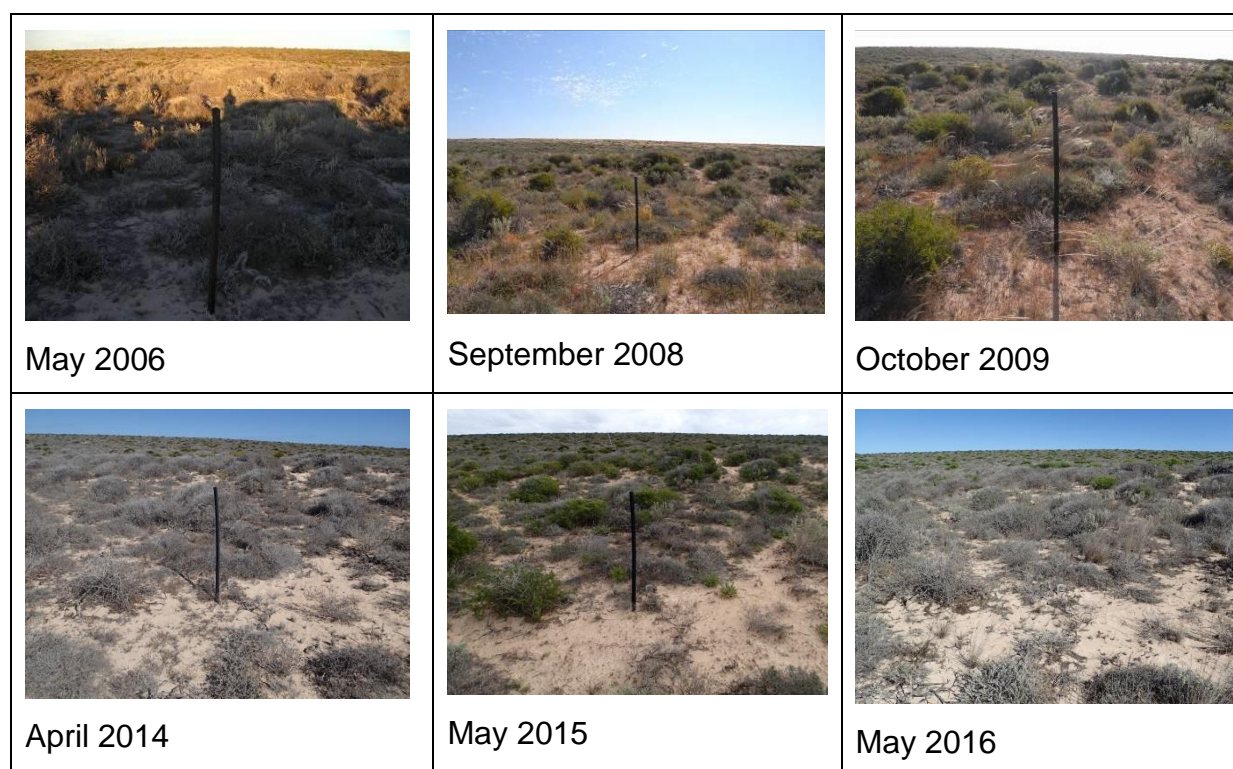
Over low hummock grassland (10-30 % cover) of *Triodia plurinervata*

Herbs (2-10%) *Chenopodium melanocarpum*, *Angianthus tomentosus*, *Calotis hispidula*, *Brachyscome iberioidifolia*, *Maireana georgei* and *Ptilotus gaudichaudii*/ *Lawrencina viridigrisea*

Abundant germination of annual in 2015 of *Lawrencina* sp./ *Euphorbia boophthona*/ *Austrostipa nitida*



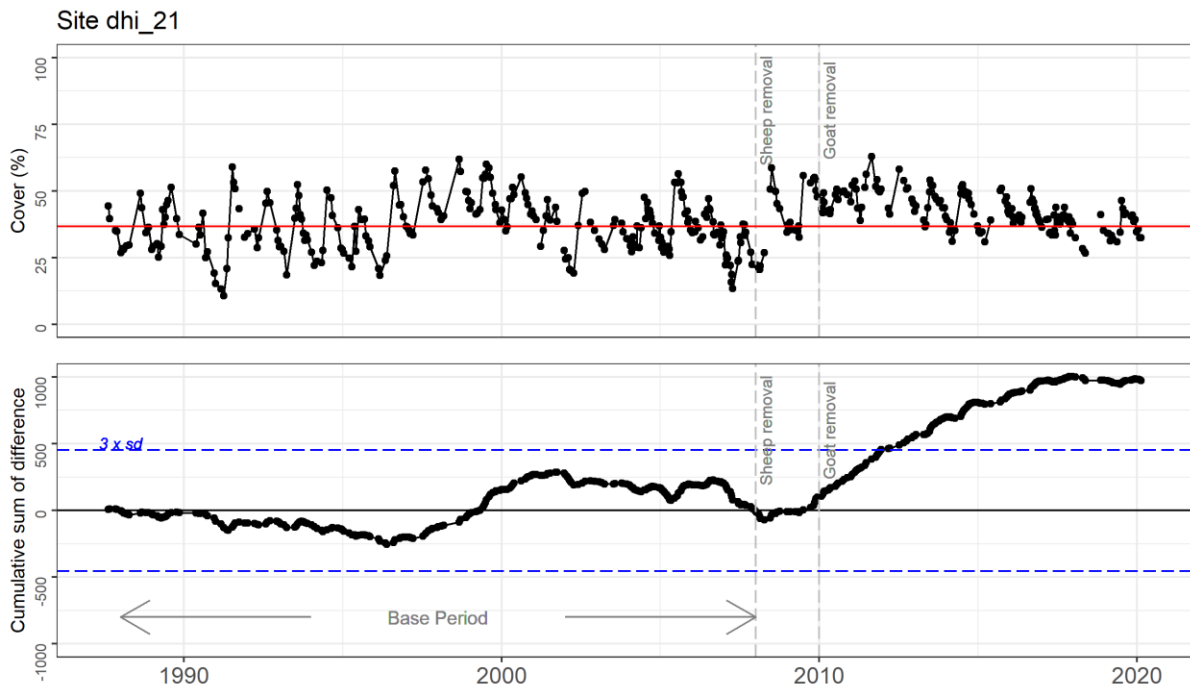
### Photo point photographs of plot 21.



**Vegetation cover time series analysis:**

A significant increase in vegetation cover was recorded at this site following destocking.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



**Recommendations:**

Recapture photograph points and reassess site condition in 2021 and reassess baseline period.

**Site 22**

**Description:**

Low Open Shrubland (2-10% cover) 1-2 metres *Acacia rostellifera*, *Exocarpos aphyllus*

Low dense shrubland (30-70 % cover) 0.3-0.6 metres of *Thryptomene baeckea* (40%), with *Rhagodia* (estimated species) *crassifolia*, *Scaevola crassifolia* and *Diplolaena grandiflora*

Low open shrubland (2-10 % cover) of less than 0.5 metres of *Pimelea gilgiana* and *Threlkeldia diffusa*, *Frankenia paniciflora*, *Enchylaena tomentosa*

Over dense hummock grassland (50-70 % cover) of *Triodia plurinervata*

Over herbs, grasses and low shrubs (2-10 % cover) of *Senecio glossanthus*, *Bromus arenarius*, \**Brassica tournefortii*, *Acanthocarpus preissii* and *Angianthus tomentosus*.



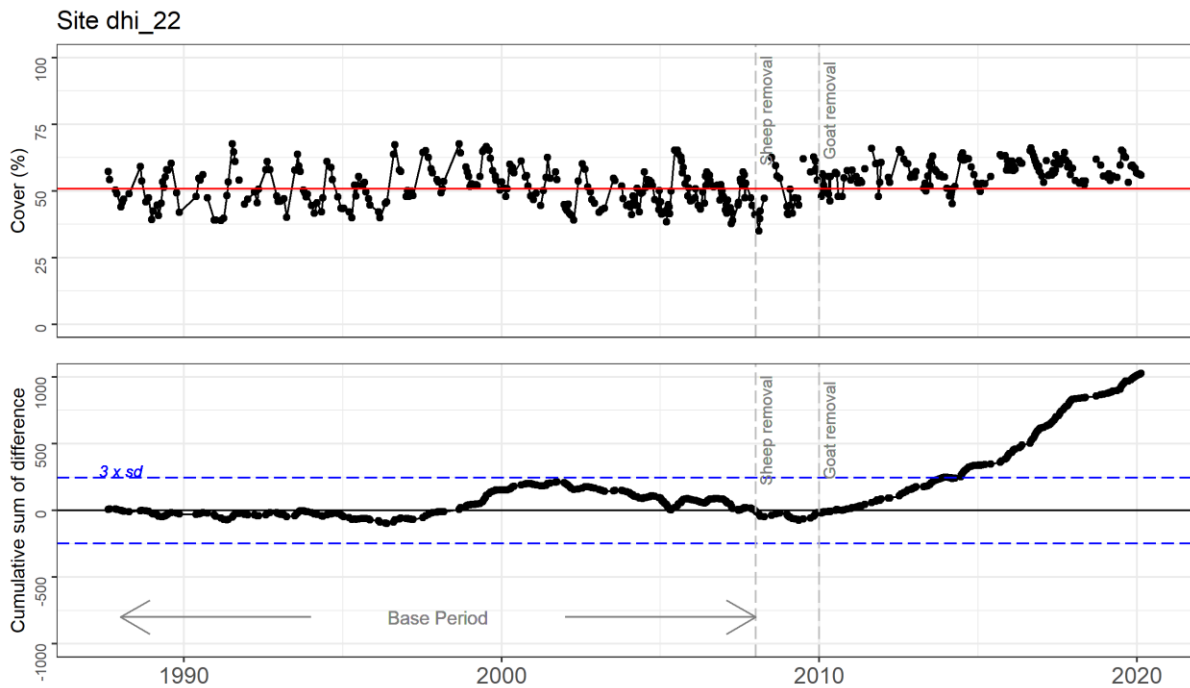
*Photo point photographs of plot 22.*

<p>May 2006</p>	<p>September 2008</p>	<p>October 2009</p>
<p>April 2014</p>	<p>May 2018</p>	

**Vegetation cover time series analysis:**

A significant increase in vegetation cover was recorded at this site following destocking.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



**Recommendations:**

Recapture photograph points and reassess site condition in 2021 and reassess baseline period.

**Site 23**

**Description:**

Low Open Shrubland (2-10% cover) 1-2 metres *Acacia ligulata* and *Pittosporum phylliraeoides*






Low shrubland (30% cover) 0.3- 0.5 metres of *Scaevola nitida*, *Atriplex vesicaria*, *Scaevola tomentosa*, *Thryptomene baeckeacea*, *Pimelea gilgiana*, *Daviesia hakeoides*, *Rhagodia crassifolia*, *Bossiaea spinescens*, *Exocarpus aphyllus*, *Solanum orbiculare*, *Olearia dampieri*, *Threlkeldia diffusa*, *Frankenia pauciflora*, *Ptilotus obovatus*, *Scaevola spinescens*, *Diplolaena grandiflora*



Over low hummock grassland (10-30 % cover) of *Triodia plurinervata*

Over herbs, grasses and low shrubs (2-10 % cover) of *Senecio pinnatifolius*, *Maireana* sp., *Austrostipa* sp., *\*Brassica tournefortii*, *Acanthocarpus robustus*, *Gnephosis arachnoidea* and *Dianella revoluta*.

*Photo point photographs of plot 23.*

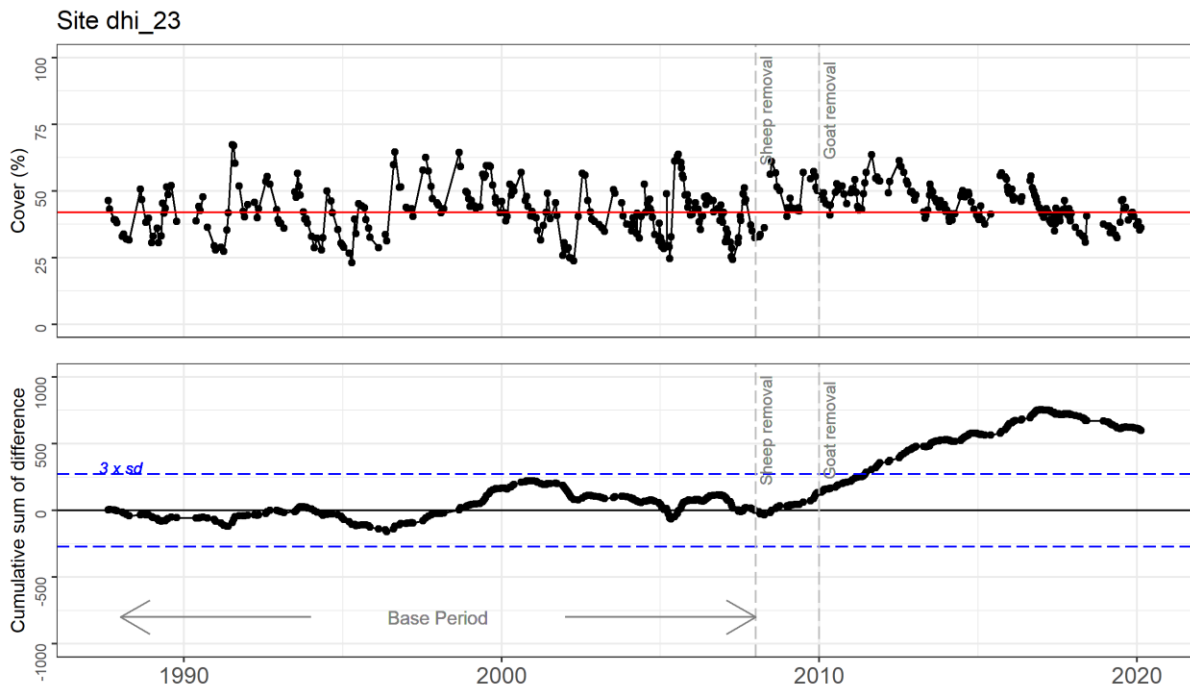
		
May 2006	September 2008	October 2009
		
April 2014	May 2018	



**Vegetation cover time series analysis:**

A significant increase in vegetation cover was recorded at this site following destocking.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



**Recommendations:**

Recapture photograph points and reassess site condition in 2021 and reassess baseline period.

## Site 30

### Description:

Open Shrubland (2-10% cover) 0.5-1metres *Acacia ligulata*, *Capparis spinosa*, *Atriplex vesicaria*, *Rhagodia baccata*, *Scaevola tomentosa*, *Exocarpus aphyllus* and *Scaevola spinescens*

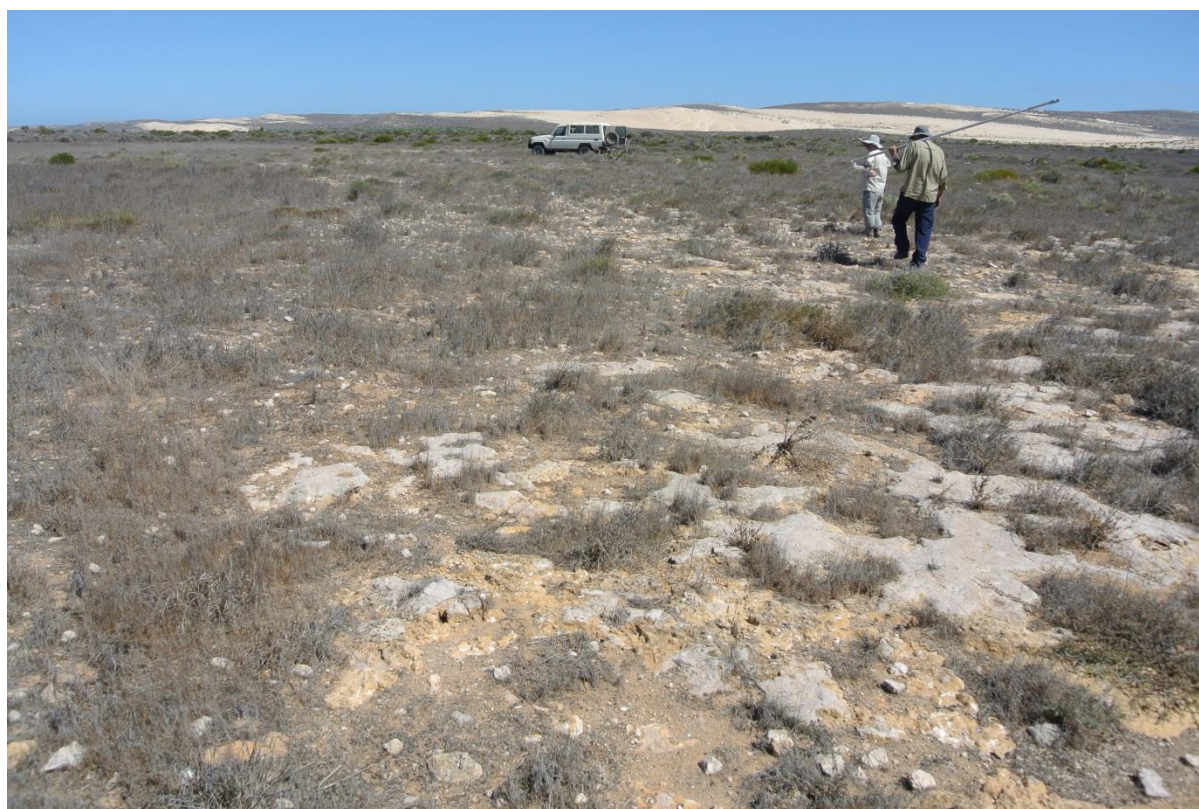
Low shrubland (<2% cover) < 0.5metres of *Frankenia pauciflora*, *Solanum orbiculatum*, *Threlkeldia diffusa*, *Diplolaena grandiflora* and *Pimelea gilgiana*

Over low bunch grassland (10-30 % cover) of \**Cenchrus ciliaris* and \**Cenchrus setiger*

Over herbs, grasses and low shrubs (<10 % cover) of \**Melilotus indicus*, \**Sonchus oleraceus*, \**Brassica tournefortii*, *Euphorbia australis*, *Enchyleana tomenytosa*, \**Urospermum picroides*, \**Malva parviflora*, *Crassula colorata*, \**Bromus diandrus* and \**Chenopodium murakle*.



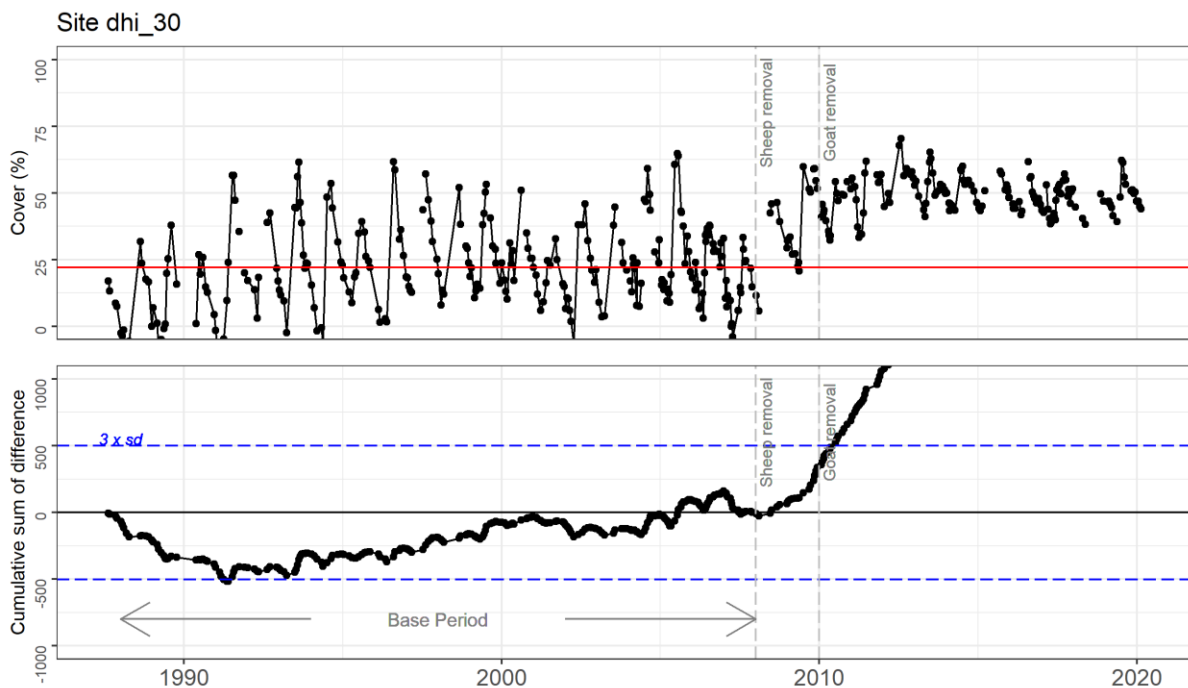
### Site photograph, April 2014



### Vegetation cover time series analysis:

A significant step increase in vegetation cover was recorded at this site following destocking. The increase is likely to be due to an increase in buffel grass (*Cenchrus ciliaris*) cover.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



### Recommendations:

Due to the rocky nature of the site no monitoring stakes have been added and no further field visits are being carried out.

## Site 31

### Description:

Open Shrubland (2-10% cover) 1-2 metres *Diplolaena grandiflora* (mostly dead)

Low shrubland (10-30% cover) 0.5-1 metres of *Acacia ligulata*, *Rhagodia crassifolia*, *Atriplex vesicaria*, *Pembertonia latisquamea*, *Scaevola tomentosa* and *Exocarpus aphyllus*/*Scaevola spinescens*/*Pimelea microcephala*

Over low bunch grassland (2-10 % cover) of *Austrostipa nitida*, *Austrostipa elegantissima*, *Amphipogon* sp. and \**Cenchrus ciliaris*

Over herbs, grasses and low shrubs (10 % cover) of *Bromus arenarius*, \**Bromus diandrus* (both major components), *Frankenia pauciflora*, *Ptilotus gaudichaudii*, *Angianthus tomentosus*, \**Brassica tournefortii*, *Chenopodium melanocarpum*, *Tetragonia diptera*, *Senecio pinnatifolius* and *Ptilotus polystachyus*.

Note: Here the upper shrub *Diplolaena grandiflora* has largely died, however, this species (on Bernier and Dorre) appears en masse after fire or heavy storms grows and eventually dies out. This would be a very interesting site to monitor long term for natural cycles.

2015 abundant germination of *Threlkeldia diffusa*/ *Ptilotus obovatus*



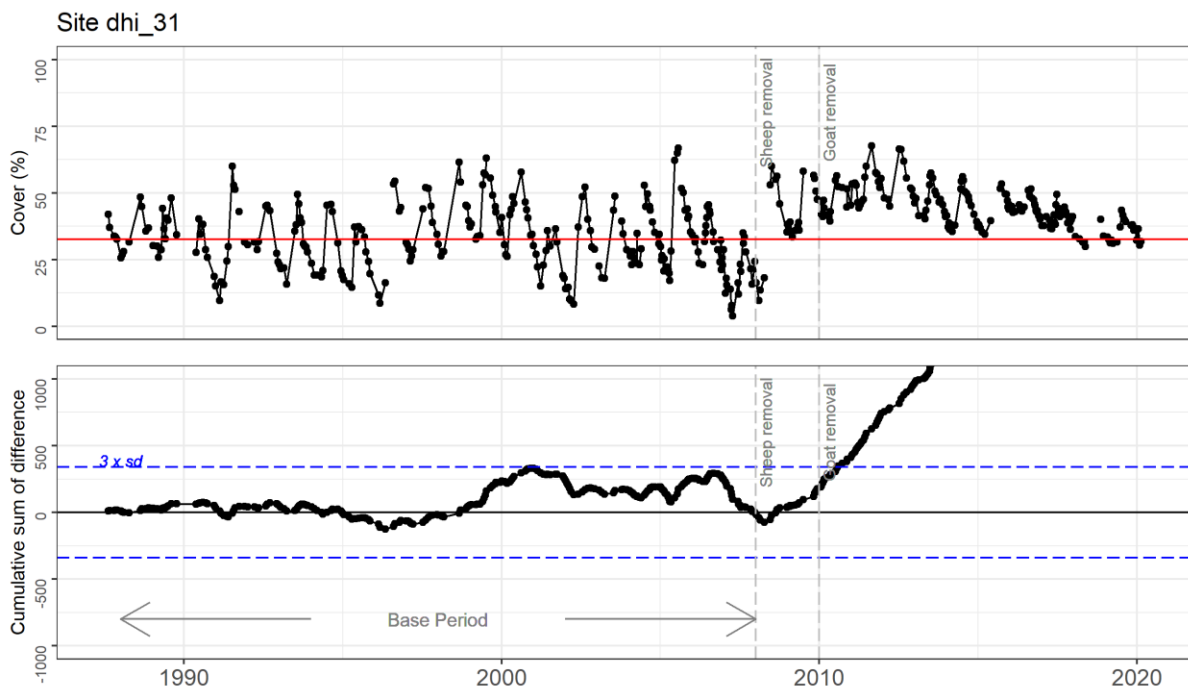
### Site photographs,



### Vegetation cover time series analysis:

A significant step increase in vegetation cover was recorded at this site following destocking. The increase is likely to be due to an increase in buffel grass (*Cenchrus ciliaris*) cover.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



### Recommendations:

Site added as a permanent monitoring plot to be reassessed biennially.

## Site 32

### Description:

Open Shrubland (2-10% cover) 1-2.5 metres *Atriplex vesicaria*,  
*Rhagodia baccata*

Low shrubland (10-30% cover) 0.5-1 metres of *Acacia ligulata*,  
*Rhagodia crassifolia*, *Solanum orbiculatum* and *Threlkeldia diffusa* /  
*Mirbelia ramulosa*

Over low bunch grassland (2-10 % cover) of \**Cenchrus ciliaris*

Over herbs, grasses and low shrubs (10-30 % cover) of *Bromus arenarius*, \**Bromus diandrus* (both major components), \**Mesembryanthemum crystallinum*, \**Centaureum erythraea*, \**Brassica tournefortii*, \* *Centaurea melitensis*/ \**Chenopodium murale*

Note: Site of interest for long term monitoring for changes in buffel grass cover.



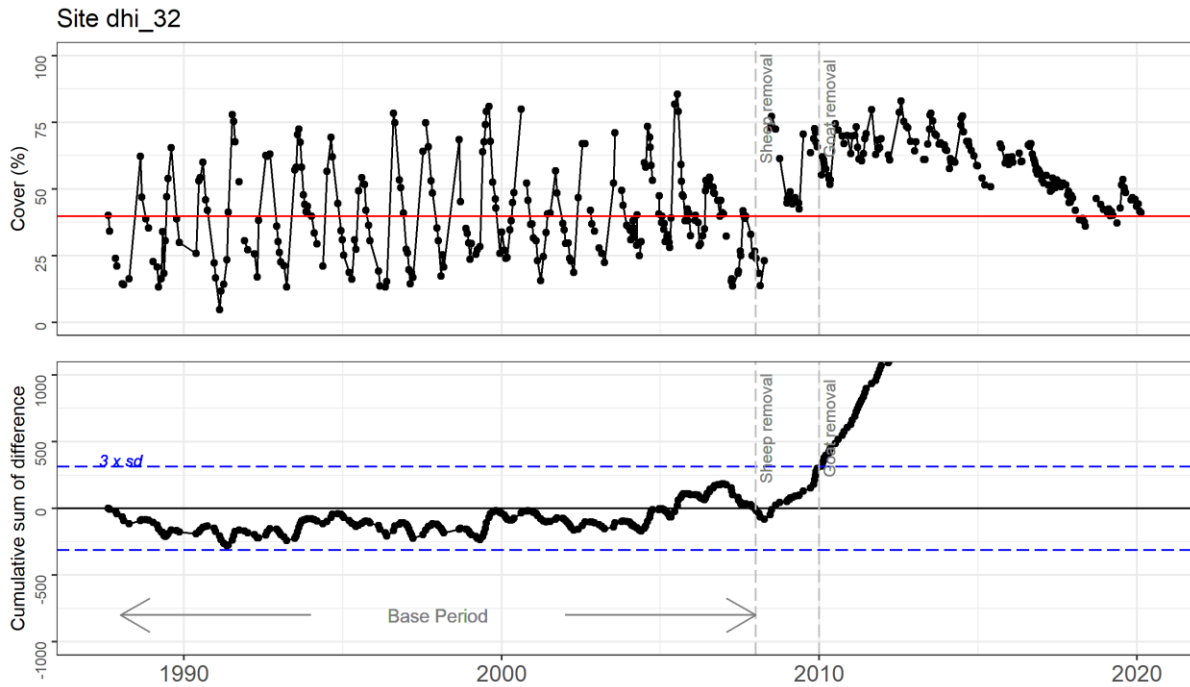
### Site photographs



**Vegetation cover time series analysis:**

A significant step increase in vegetation cover was recorded at this site following destocking. The increase is likely to be due to an increase in buffel grass (*Cenchrus ciliaris*) cover.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



**Recommendations:**

Site added as a permanent monitoring plot to be reassessed biennially.

## Site 33

### Description:

Open Shrubland (10-30% cover) 1-2 metres *Acacia ligulata* (50% dead), *Scaevola tomentosa*, *Exocarpus aphyllus*, *Atriplex vesicaria*

Low shrubland (10-30% cover) of < 0.5 metres of *Threlkeldia diffusa*, *Diplolaena grandiflora*, *Pimelea gilgiana*, *Mirbelia ramulosa*, *Pembertonia latisquamea*, *Rhagodia crassifolia*, *Acacia idiomorpha*, *Dampier asp.*, *Thryptomene baeckeacea*, *Stylobasium spathulatum*,

Over low hummock grassland (30-70% cover) of *Triodia plurinervata*

Over low very open bunch grassland (2-10 % cover) of *Austrostipa nitida*, *Austrostipa elegantissima*, *Amphipogon sp.* and *\*Cenchrus ciliaris*

Over herbs, grasses and low shrubs (<10 % cover) of *Acanthocarpus preissii*, *Acanthocarpus robustus*, *Bromus arenarius*, *\*Bromus diandrus* (both major components), *Frankenia pauciflora*, *Ptilotus gaudichaudii*, *Angianthus tomentosus*, *\*Brassica tournefortii*, *Chenopodium melanocarpum*, *Tetragonia diptera*, *Senecio pinnatifolius* and *Ptilotus polystachyus*.



### Site photograph, April 2014

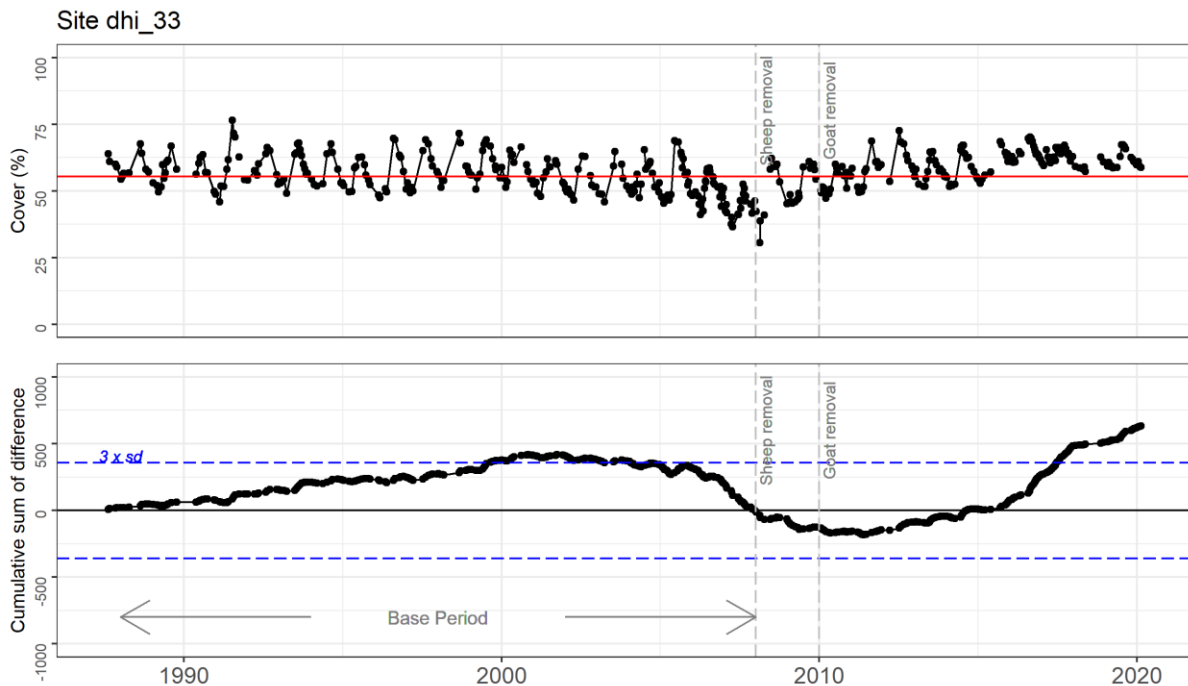




### Vegetation cover time series analysis:

No significant change in vegetation cover is evident in the time series. Cover values appear to drop rapidly in 2006 and 2007 coinciding with low rainfall but return to the normal range after 2008.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



### Recommendations:

Recapture photograph points and reassess site condition either in 2021 or if a significant deviation from baseline vegetation cover are observed (3 standard deviation lines on cusum chart are breached).

**Site 34**

**Description:**

Low very open trees (<2%) *Pittosporum phylliraeoides*

Open Shrubland (10-30% cover) 1-2 metres *Acacia ligulata*, *Alectryon oleifolius*, *Atriplex vesicaria*, *Exocarpus aphyllus*, *Ptilotus obovatus* and *Stylobasium spathulatum*/ *Scaevola spinescens*/*Scaevola tomentosa*

Low shrubland <2% cover) 0.3- 0.5 metres of *Pembertonia latisquamea*, *Frankenia pauciflora*, *Rhagodia crassifolia*, *Pimelia gilgiana*, *Enchylaena tomentosa*

Over low hummock grassland (30-70 % cover) of *Triodia plurinervata*

Over low bunch grassland (2-10 % cover) of *Austrostipa nitida* and *Austrostipa elegantissima*

Over herbs, grasses and low shrubs (10 % cover) of *Bromus arenarius*, \**Bromus diandrus* (both major components), *Angianthus tomentosus*, \**Brassica tournefortii*, *Chenopodium melanocarpum*, *Senecio pinnatifolius* and *Ptilotus polystachyus*.

2015 rain abundant annuals of *Ptilotus nobilis*/ *Euphorbia boophthona*/ \* *Sisymbrium erysimoides*/ *Lobelia gibbosa*



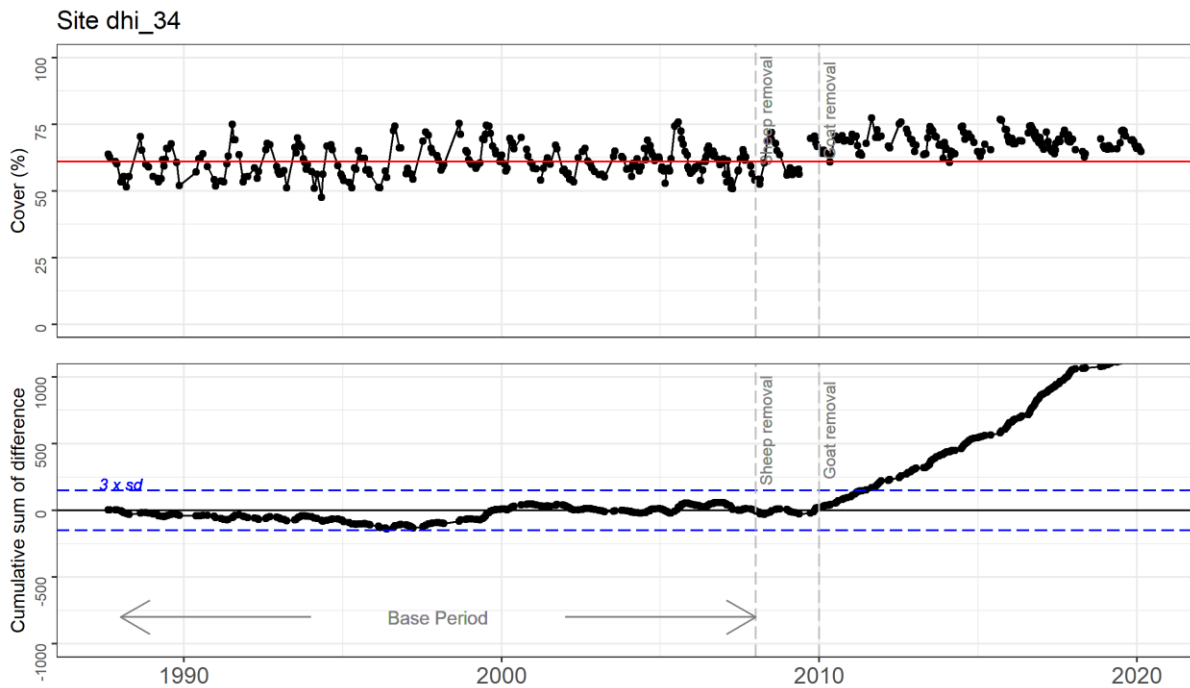
**Site photographs**

<p>April 2014</p>	<p>May 2017</p>	<p>May 2018</p>
<p>May 2019</p>		

**Vegetation cover time series analysis:**

A significant step increase in vegetation cover was recorded at this site following destocking. No buffel grass (*Cenchrus ciliaris*) was evident at the site.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



**Recommendations:**

Site added as a permanent monitoring plot to be reassessed biennially.

**Site 35**

**Description:**

Low Open Shrubland (10-30% cover) 1-2 metres *Acacia ligulata* and *Scaevola spinescens*

Low shrubland (30% cover) 0.3- 0.5 metres of *Atriplex vesicaria*, *Threlkeldia diffusa* and *Frankenia pauciflora/ Rhagodia candolleana/ Pimelea microcephala/ Bossiaea spinescens*

Over low hummock grassland (10-30 % cover) of *Triodia plurinervata* and *Triodia schinzii*

Over low bunch grassland (2-10 % cover) of *Austrostipa nitida* and *Austrostipa elegantissima*

Over herbs, grasses and low shrubs (10 % cover) of *Bromus arenarius*, \**Bromus diandrus*, *Angianthus tomentosus*, *Angianthus sp.*, \**Brassica tournefortii*, *Chenopodium melanocarpum*, *Goodenia sp.*, *Enchylaena tomentosa*

Abundant germination of annuals – *Lawrenca viridigrisea*



Note: Buffel grass evident at 2-10 % cover in 2014 and 2016 but could not be found alive or dead in 2018.

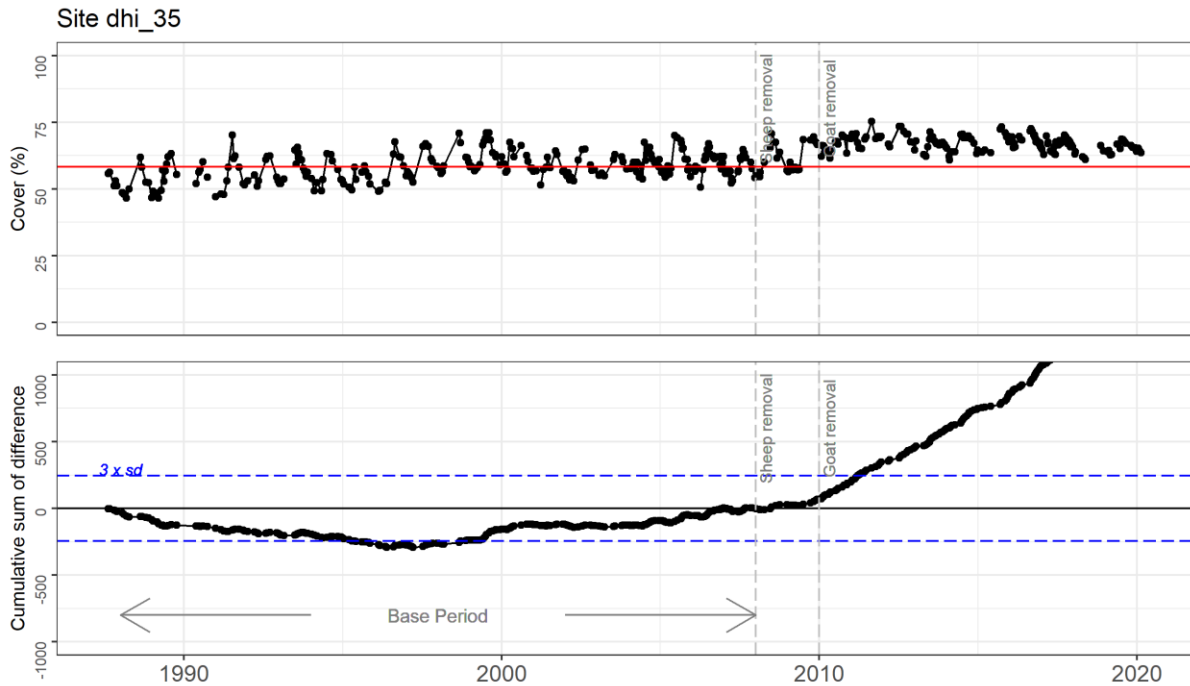
**Site photographs**

<p>April 2014</p>	<p>May 2016</p>	<p>May 2018</p>
<p>May 2019</p>		

**Vegetation cover time series analysis:**

A significant step increase in vegetation cover was recorded at this site following destocking. Some buffel grass (*Cenchrus ciliaris*) was evident at the site.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



**Recommendations:**

Site added as a permanent monitoring plot to be reassessed biennially.

## Site 36

### Description:

Low Open Shrubland (2-10% cover) 1 metre *Acacia teragonophylla* and *Acacia coriacea* (90% dead) with *Diplolaena grandiflora* (60% dead)

Low shrubland (10-30% cover) 0.1- 0.5 metres of *Capparis spinosa* (30%), *Atriplex vesicaria*, *Alogyne hakeifolia*, *Solanum lasiophyllum*, *Pimelea microcephala*, *Thryptomene baeckeacea*, *Threlkeldia diffusa*, *Rhagodia crassifolia* and *Ptilotus obovatus*

Over grassland (10-30 % cover) of *Cymbopogon obtectus*, \**Cenchrus ciliaris*, \**Bromus japonicas*

Over herbs and low shrubs (2-10% cover) of \**Urospermum picroides*, \**Bidens bipinnata*, \**Solanum nigrum*, \**Sonchus oleraceus*, \**Centaureum erythraea*, *Conostylis stylidioides*, *Acanthocarpus preissii*, \**Hypochoeris glabra*, *Euphorbia boophona*, \**Brassica tournefortii*, *mHalganina cynea*, *Cassytha* sp., *Logania* sp. and *Dianella revolute*, *Goodenia* sp 2, *Senecio pinnatifolius*, *Maireana* sp., *Austrostipa* sp., \**Brassica tournefortii*, *Gnephosis arachnoidea* and *Eragrostis dielsii*.

Note: *Acacia* layer has died no apparent regeneration. Lots annual weeds. Obviously must have been heavily grazed, perhaps after a fire and sheep/goats ate all the seedlings or there was a drought after a small fire or both.

### Site photo, April 2014

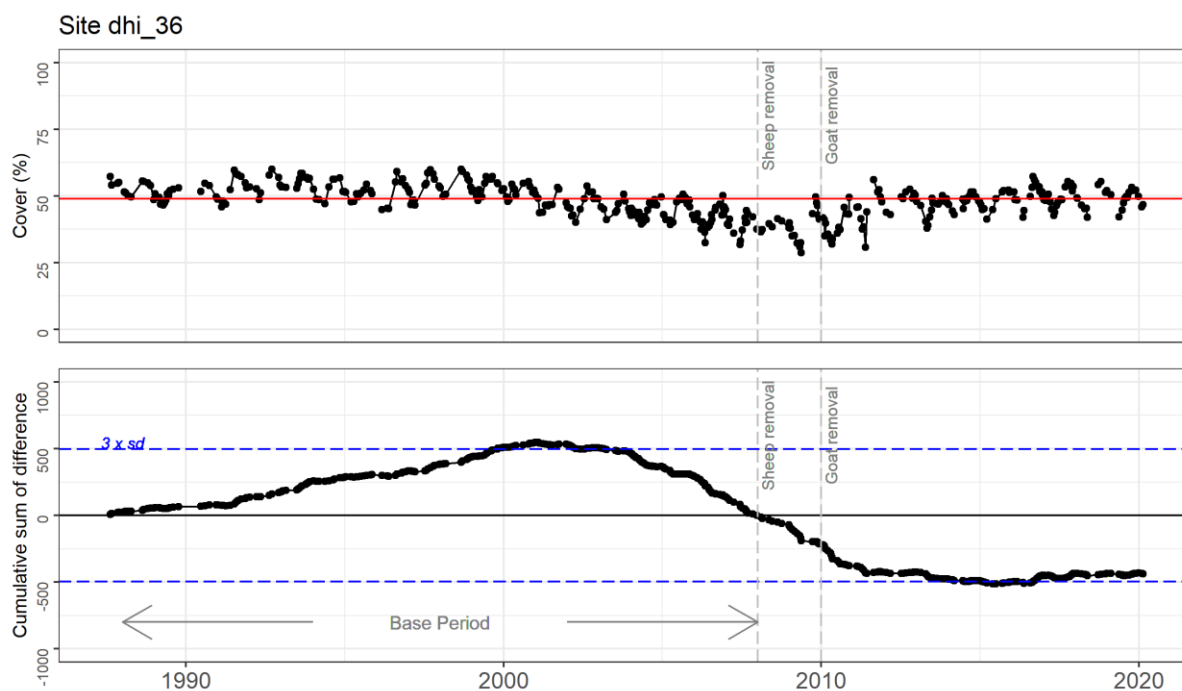




### Vegetation cover time series analysis:

A step decrease in vegetation cover appears to occur following 2000. The cause for this is not evident.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



### Recommendations:

Site added as a permanent monitoring plot to be reassessed biennially.



**Site 37**

**Description:**

Low mixed heath of *Thryptomene baeckeacea*/ *Atriplex vesicaria*/ *Scaevola tomentosa*/ *Melaleuca cardiophylla*/ *Acacia ligulata*/ *Frankenia pauciflora*/ *Dodonaea aptera*/ *Rhagodia baccata*/ *Exocarpos aphyllus* (30-70% cover, avg 60%) 0.2-0.5 metres

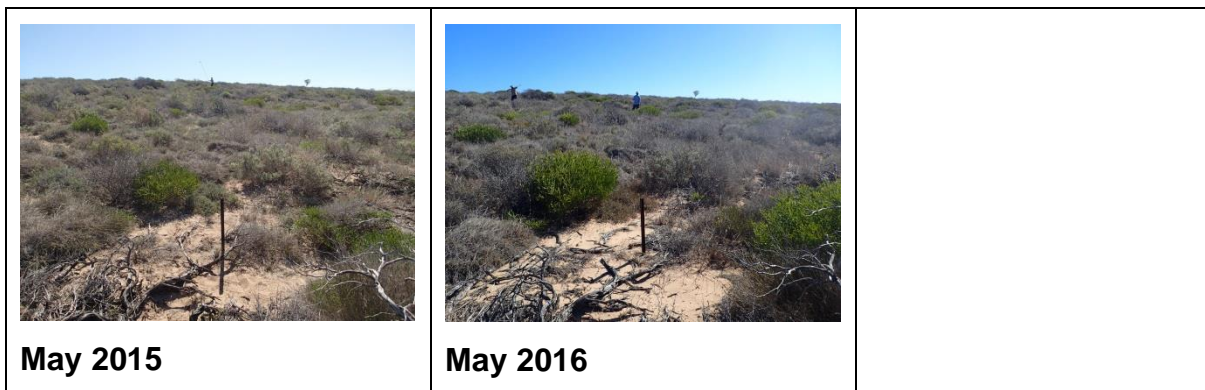
Open grassland of *Trioda plurinervata* (30-70% cover) 0.2-0.5 metres, rare *Austrostipa elegantissima*

Herbfield of *Salsola australis*/ *Acanthocarpus robustus*/ *Urospermum picroides*

Annual grasses of *Austrostipa nitida*

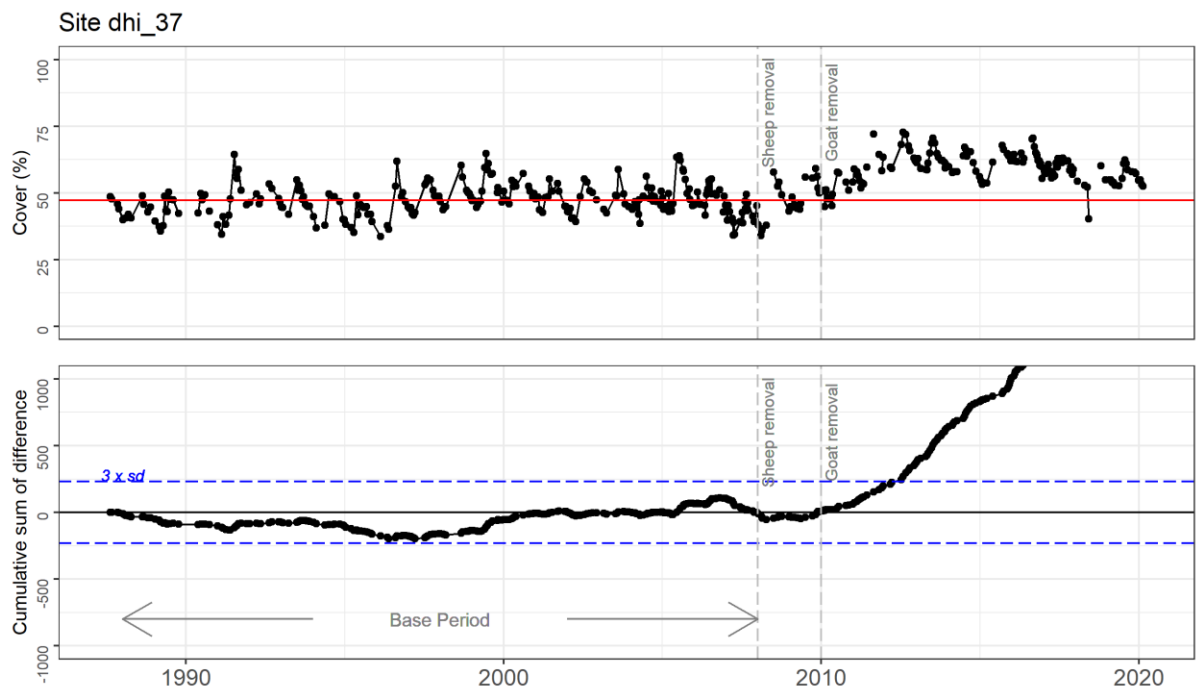
Many young *Acacia ligulata* plants

Few scattered *Diplolaena grandiflora*



**Vegetation cover time series analysis:**

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).



**Site AGWA 657**

**Description:**

Low very open trees (<2%) *Pittosporum phylliraeoides*

Low Open Shrubland (2-10% cover) 1-2 metres of *Exocarpus aphyllus*, *Scaevola tomentosa*, *Diplolaena grandiflora* and *Scaevola spinescens*

Low shrubland (10-20% cover) 0.5-1 metres of *Atriplex vesicaria*, *Scaevola nitida*, *Teragonia implexicoma/ Stylobasium spathulatum/ alectryon oleifolius*

Low shrubland (2-10% cover) 0.3- 0.5 metres of *Pembertonia latisquamea*, *Ptilotus obovatus*, *Frankenia pauciflora*, *Rhagodia crassifolia*, *Threlkeldia diffusa*, *Aphanopetalum clematidium* and *Pimelia gilgiana/ Solanum orbiculatum/ Acanthocarpus preissii*

Over low bunch grassland (10-30 % cover) of *\*Cenchrus ciliaris*, *Austrostipa nitida* and *Austrostipa elegantissima*




Over herbs, grasses and low shrubs (10 % cover) of *Acanthocarpus robustus*, *Bromus arenarius*, *\*Bromus diandrus*, *Angianthus tomentosus*, *Angianthus sp.*, *\*Brassica tournefortii*, *Chenopodium melanocarpum*, *Goodenia sp.*, *Goodenia sp 2*, *Senecio pinnatifolius*, *\*Brassica tournefortii*.

2015 germination of *Ptilotus obovatus*

In 2018 some coverage of buffel but plants appear to be only surviving as rootstock.

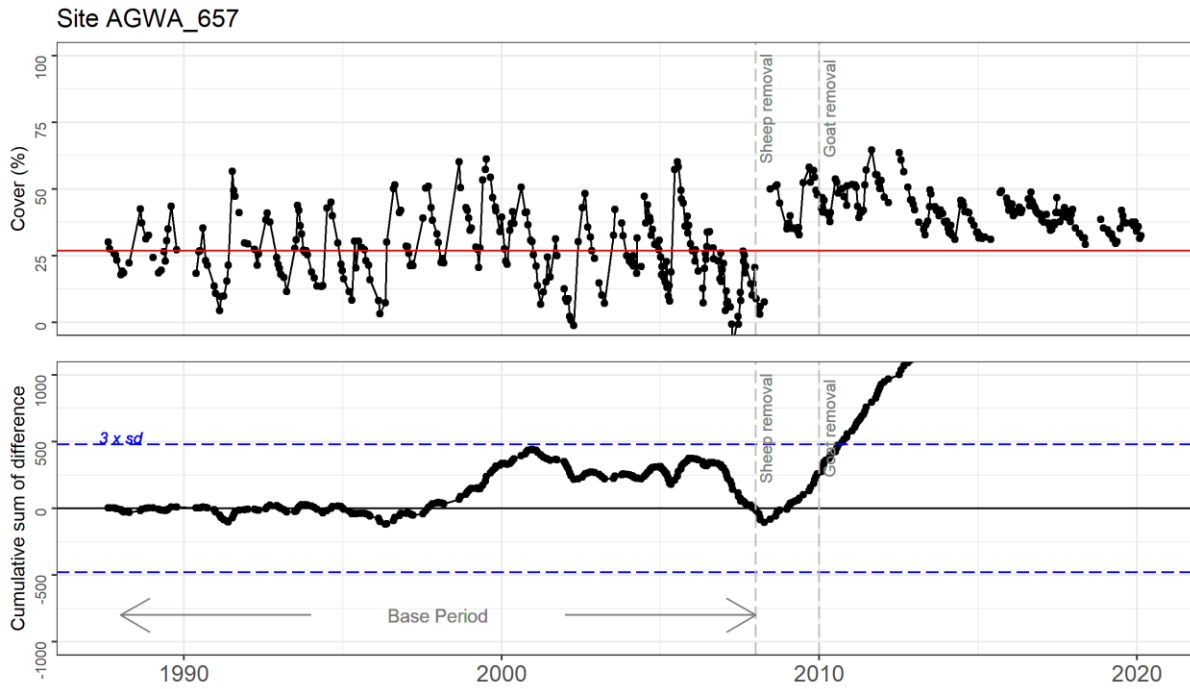
*Photo point photographs of plot AGWA657.*



May 2007	September 2008	October 2009
		
January 2011	January 2012	April 2014
		
May 2015	May 2016	May 2017
		
May 2018	May 2019	

**Vegetation cover time series analysis:**

A significant step increase in vegetation cover was recorded at this site following destocking. This may be attributed to an increase in cover of buffel grass (*Cenchrus ciliaris*).



*Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).*

**Recommendations:**

Recapture photograph points and reassess site condition in 1 year. Reassess baseline period in 1 year.

## Site AGWA 662

### Description:

Low Very Open Shrubland (2% cover) 0.5- 0.6 metre of *Acacia ligulata*

Dense low shrubland (40-70% cover) 0.3- 0.5 metre of *Melaleuca cardiophylla*, *Thryptomene baeckeacea* and scattered *Stenanthemum* sp., *Pileanthus limacis*, *Halgania cyanea*, *Mirbelia ramulosa* and *Exocarpus aphyllus*

Over low hummock grassland (10-30 % cover) of *Triodia plurinervata*

Over scattered herbs of *Salsola australis*

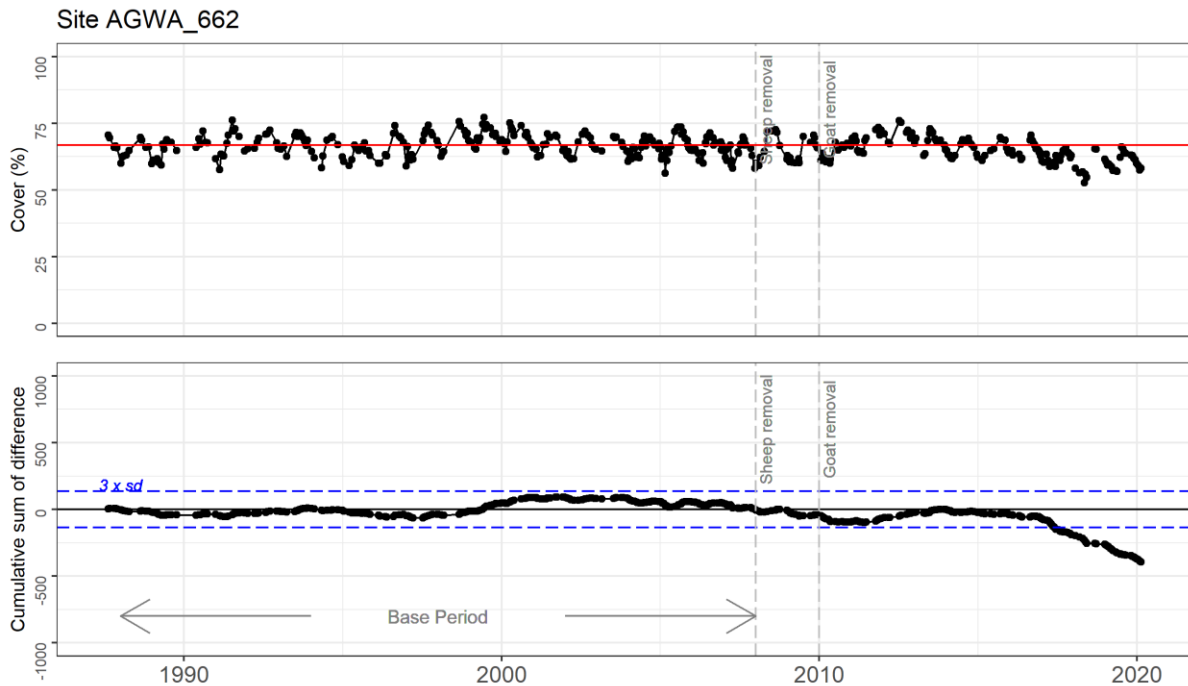


### Photo point photographs of plot RHR633.



## Vegetation cover time series analysis:

No significant change in vegetation cover is evident in the time series.



*Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).*

## Recommendations:

Recapture photograph points and reassess site condition either in 4 year or if a significant deviation from baseline vegetation cover are observed (3 standard deviation lines on cusum chart are breached).

## Site RHR 633

### Description:

Very Open Shrubland (2-10%) 1-2 metres of *Acacia coriacea* and *Acacia tetragonophylla*

Low Open Shrubland (10% cover) 0.5-1 metres *Acacia ligulata*

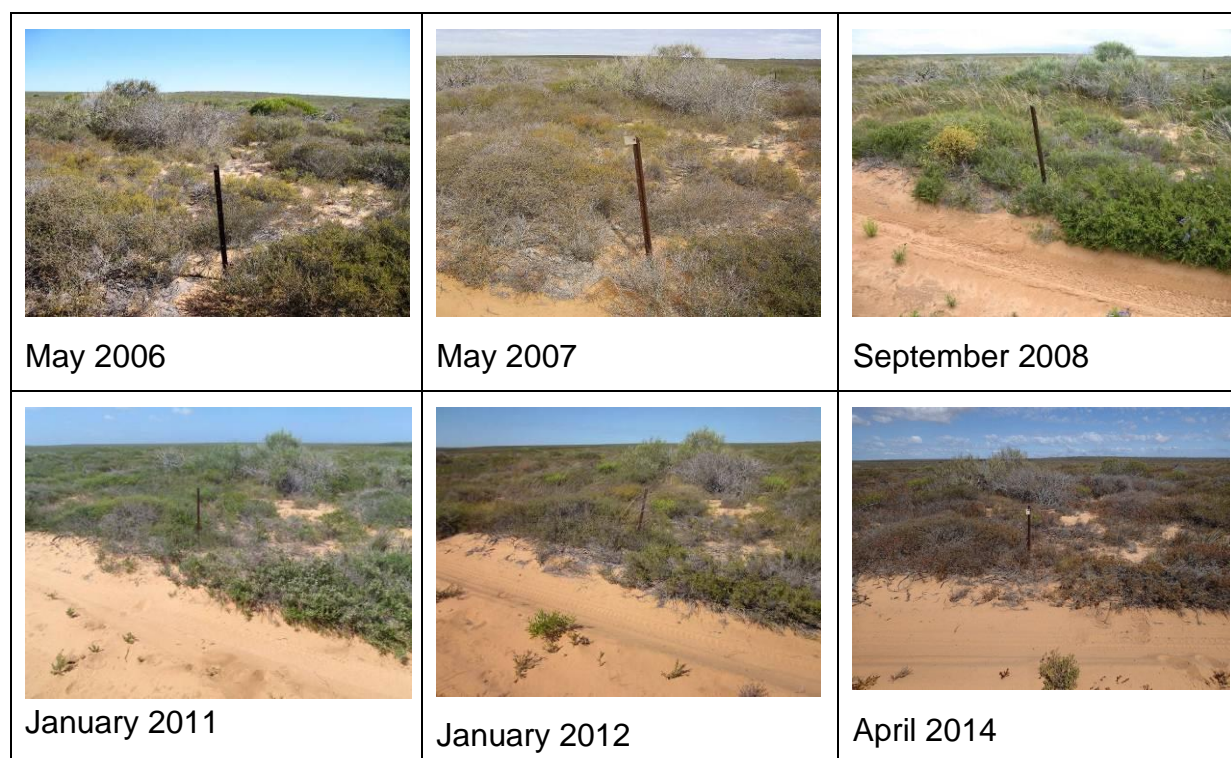
Low shrubland (30% cover) 0.3- 0.5 metre of *Thryptomene baeckeacea* and *Melaleuca cardiophylla*, with rarely recorded shrubs of *Stylobasium spathulatum*, *Mirbelia viminea*, *Leptosema macrophyllum*, *Acacia bidiomorpha*, *Halgania cynanea*, *Stenanthemum sp.* and *Pileanthus limacis*

Over low open hummock grassland (2-10 % cover) of *Triodia plurinervata*

Over scattered sedges (2-10%) of *Lepidobolus preissianus*.



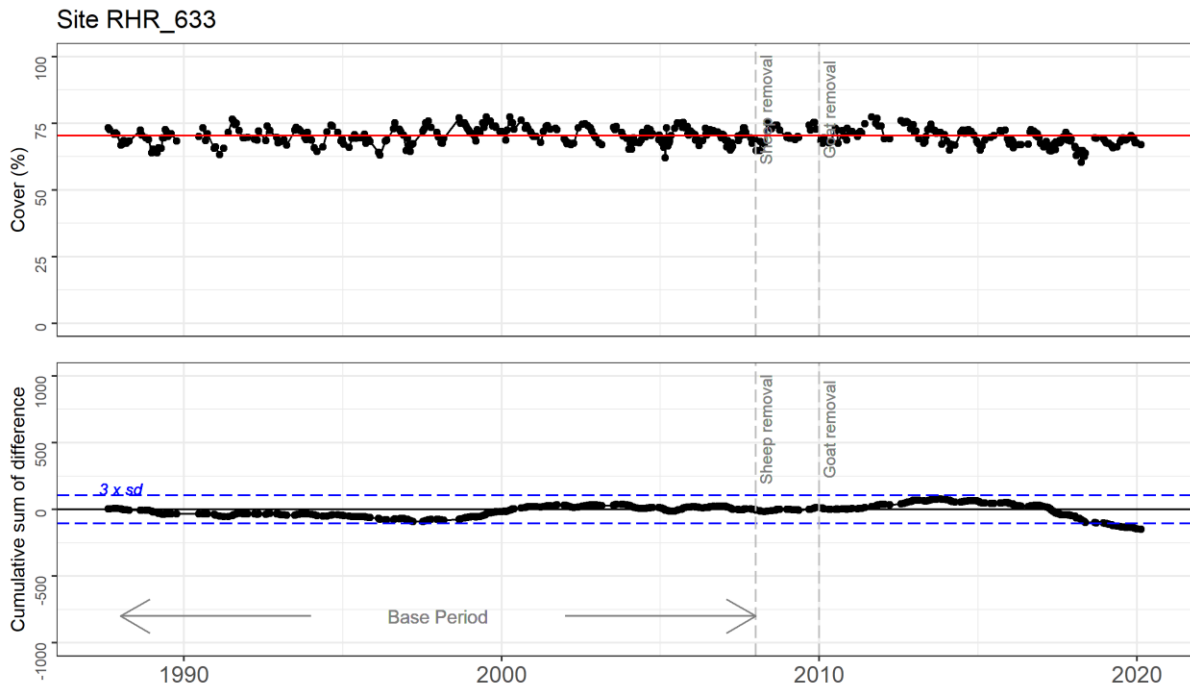
### Photo point photographs of plot RHR633.





## Vegetation cover time series analysis:

No significant change in vegetation cover is evident in the time series.



*Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2020 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).*

## Recommendations:

Recapture photograph points and reassess site condition either in 4 years or if a significant deviation from baseline vegetation cover are observed (3 standard deviation lines on cusum chart are breached).

## Appendices 2

Table 2: Sand dune extent (ha) across Dirk Hartog Island from 1957 to 2020.

year	North	South	Other	Total
1957	300.245	611.0599	244.766	1156.071
1969	450.8025	1039.658	265.555	1756.016
1988	670.32	1837.592	305.1576	2813.069
1991	714.78	1989.949	307.1316	3011.86
1993	737.55	2172.917	368.5355	3279.003
1995	775.08	2168.649	358.4969	3302.226
1997	823.41	2317.608	437.5255	3578.544
1999	814.32	2191.656	353.9596	3359.935
2001	851.22	2128.026	336.4117	3315.658
2006	899.82	2365.371	368.687	3633.878
2009	960.48	2402.303	412.9332	3775.716
2013	964.8	2035.238	402.7142	3402.752
2015	995.13	1922.851	346.3259	3264.307
2017	983.7	1778.031	404.8416	3166.573
2018	979.92	1744.919	399.3131	3124.152
2019	939.06	1569.17	340.3515	2848.581
2020	937.62	1429.027	299.589	2666.236