Biodiversity and
Conservation Science

Dirk Hartog Island National Park Ecological Restoration Project: Vegetation Restoration - Remote Sensing Monitoring Program Report 2018/19

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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 2018 and photo point observations. From the analysis of this data the influence of the feral goat removal program is evident. Of the 33 sites being monitored 17 (52%) are showing increases in vegetation cover since the removal of sheep in 2008. A map identifying areas of significant vegetation cover change since destocking (2008) was also created. This suggests that to 2019, 38% of DHI has experienced a significant increase in vegetation cover, this is up from 35% in 2018. The area of sand dunes on the Island also continues to decrease.

Beyond the vegetation cover statistics mentioned above the monitoring program focused on three areas of work. A scientific paper detailing the DHI vegetation monitoring program has been submitted for publication in the Environmental Monitoring and Restoration journal. Work has commenced with Curtin University Masters student Lucy Wilson to use remotely piloted aircraft (RPA) imagery to monitor fauna exclusion plots. Ms. Wilson accompanied the group on the 2019 field trip and is due to report on her findings in December 2019. The fieldwork methodologies transitioned from using nadir photography (using a camera attached to a 4m pole) to monitor vegetation cover change to using RPA imagery.

Objectives for 2019/20:

- 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.

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 2018/19 were:

- Analyse vegetation cover changes over DHI from Landsat imagery (1990 to 2018).
- Provide a report with summary statistics of vegetation change from analysis of Landsat imagery.
- Report on vegetation change related to destocking and goat removal.
- Update measurements of sand dune extent.
- Submit a paper for publication in a scientific journal on the analysis of vegetation change on DHI.
- Capture and analyse RPA imagery of exclusion plots and carry out an analysis in collaboration with Curtin University.

Additional work:

- Transition monitoring methodology from nadir imagery to RPA imagery.
- A post on the exclusion plot work was submitted for a twitter post.
- An update on the vegetation monitoring program was provided for inclusion in the Wirruwana News.

Achieving the 2018/19 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.
- Increase community awareness of the ecological restoration project: twitter post and Wirruwana article
- 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 2018/2019 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   Field Validation

A key component of any monitoring program is measurement consistency. However as new technologies become available which may improve monitoring capacity they should be evaluated and where possible implemented. To date nadir photographs taken from a 4 m telescopic pole have been used to record small scale changes in vegetation cover at several monitoring sites. This is now being transitioned to RPA imagery.

To compare image resolution and quality, RPA imagery flown at 20 m (5 mm resolution) and nadir photography (1 mm resolution) was captured over several monitoring sites in May 2018. In May 2019 RPA imagery was flown at 5 m altitude (2 mm resolution). Comparisons of these are shown in Figure 1.

Figure 1: A comparison of imagery from nadir photography (1 mm resolution), RPA at 5 m altitude (2 mm) and RPA at 20 m altitude (5 mm).

The nadir imagery provides the clearest picture and allows (in many cases) for plant species to determined. This contrasts with RPA imagery at 20 m, where all leaf shape is lost. The image from the RPA at 5 m is not as clear as the nadir photograph but some plant characteristics can still be discerned.

There is a trade-off however between resolution and capture footprint (data volumes and time). The current footprints for nadir photography, and RPA imagery at 5 and 20 m altitudes are shown in Figure 2.

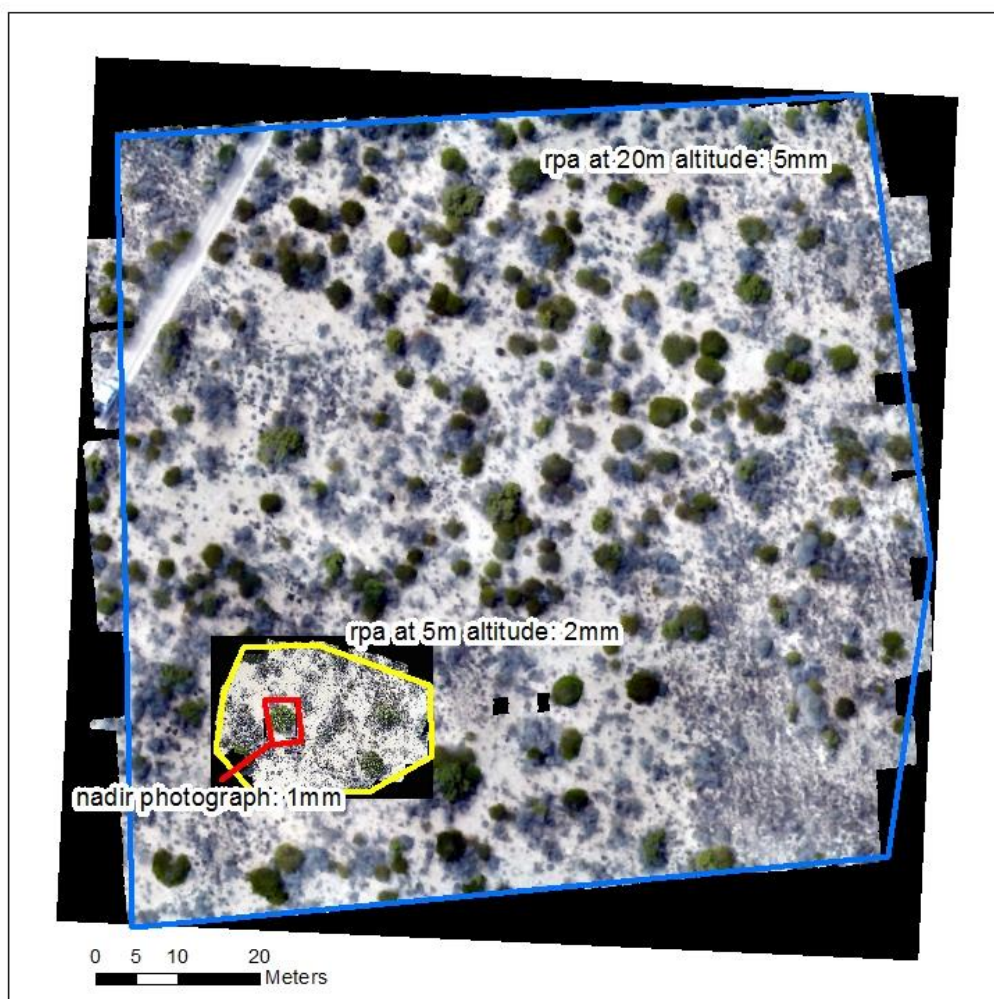*Figure 2: Capture footprints for nadir imagery (red) and RPA imagery at 5 (yellow) and 20 m (blue) altitudes.*

Based on comparability with nadir photography it was decided to fly future RPA captures of monitoring sites at 5 m (2 mm resolution). However, to accommodate the increased data volume and capture time four subsets will be captured. The captures will be made at the corner points of the existing grids Figure 3.
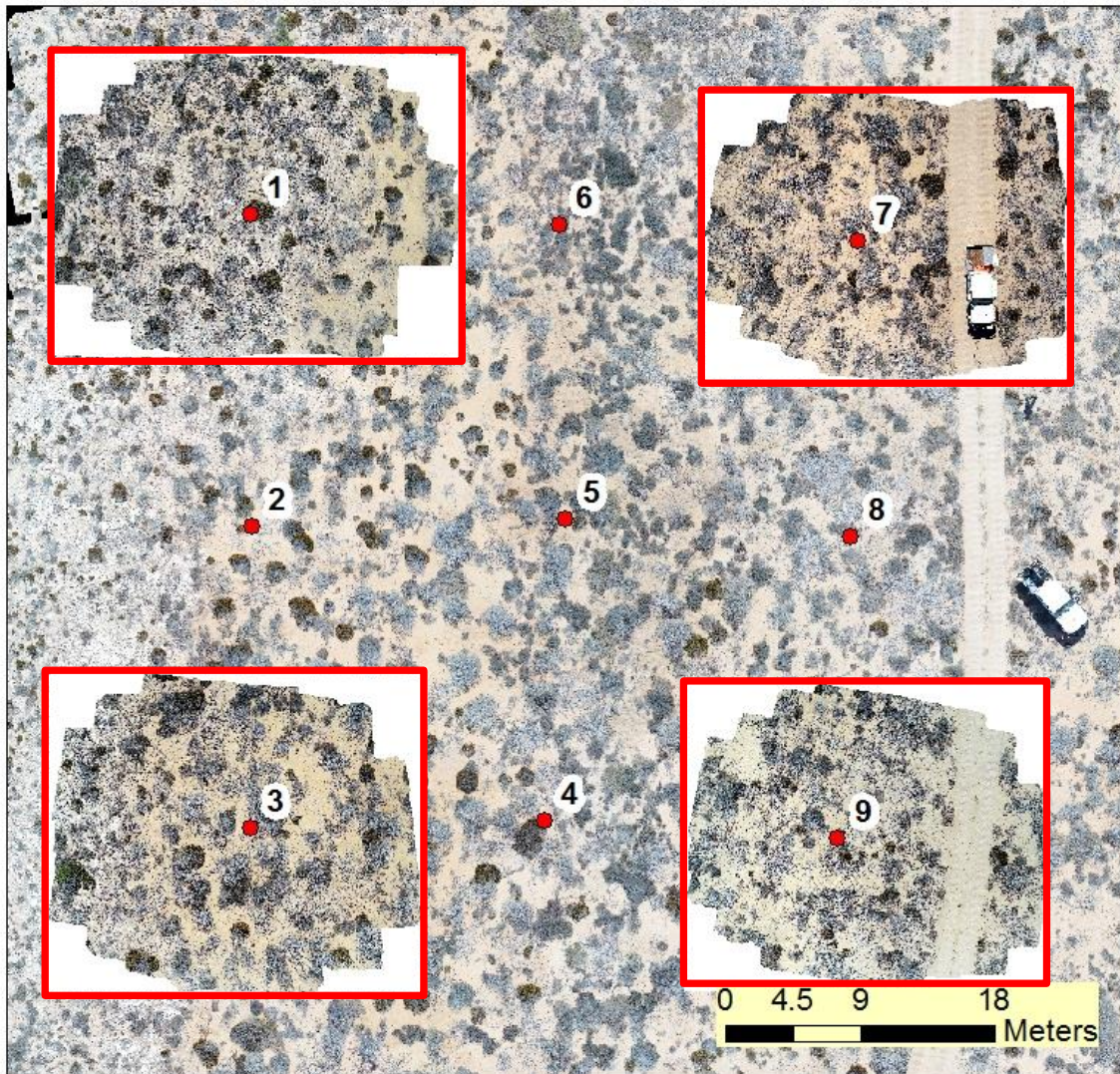
Figure 3: Configuration of RPA image captures at monitoring sites on DHI (red boxes).

The move to capture plot data with RPA imagery will make fine scale measurements of vegetation change much easier to measure. Plant measurements from nadir imagery can be made but the process is laborious. Once the processing of RPA data is automated, statistical analysis of the imagery can be developed and incorporated into the automated workflow.

The change in canopy of an *A. ligulata* from 2018 to 2019 is shown in Figure 4. The mean diameter increases from 2.025 m to 2.245 m (10%). A greater focus on analyzing changes such as this will be made in the future.
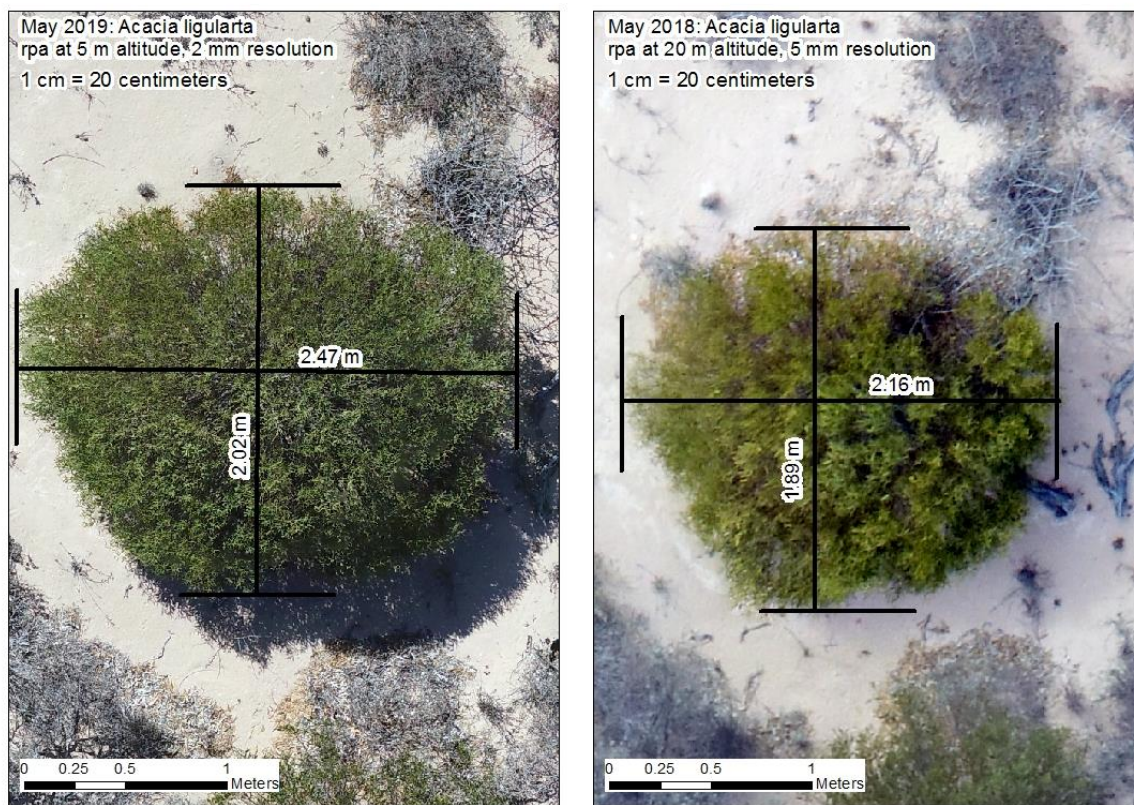
Figure 4: Canopy measurements of an A. ligulata from 2018 and 2019.

2.3 Scientific Journal Submission

A scientific paper detailing the vegetation monitoring work being carried out on DHI has been accepted by Ecological Management & Restoration and is scheduled for publication in September 2019.

2.4 Exclusion plot monitoring

An analysis of the exclusion plots with Curtin University student Lucy Wilson has commenced. The aim of the Lucy's project is to analyse high resolution RPA imagery of the fauna exclusion plots. The goal is to see what ecological parameters can be extracted from the RPA data and theorise as to how these parameters could be used to assess the impact of reintroduced fauna.

Lucy was included in the May 2019 field trip and helped collect field data for the analysis. The field data consisted of plant locations, heights and species name (Figure 5).
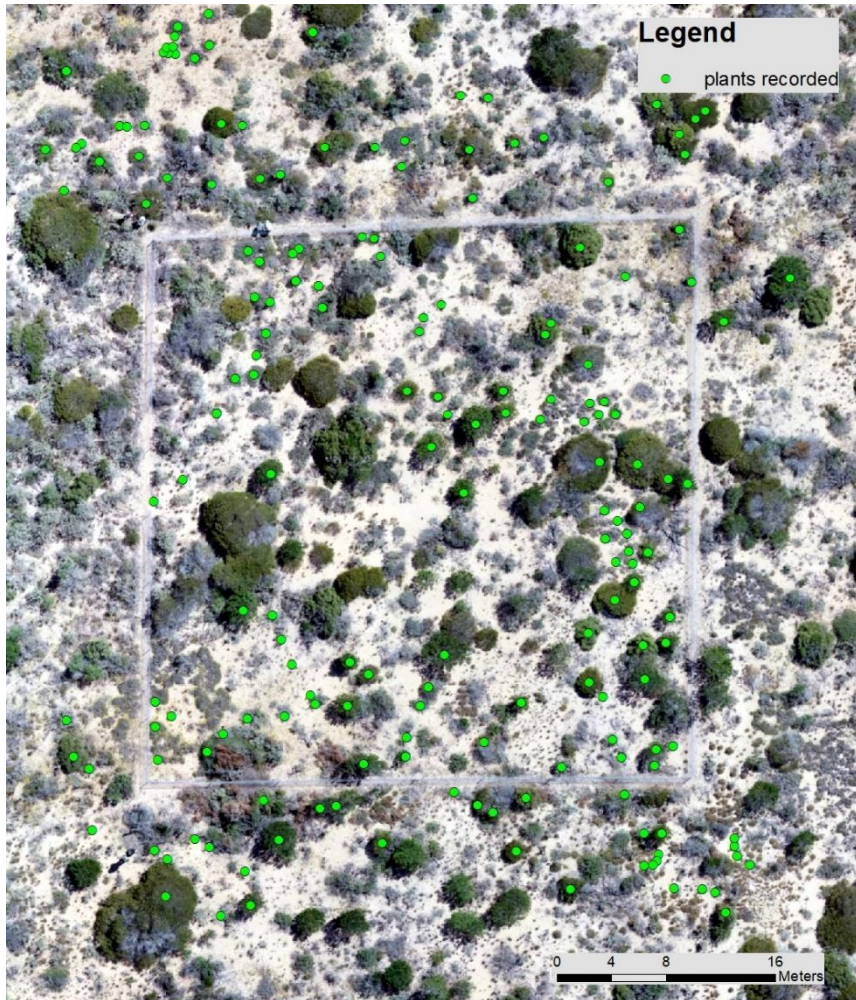
Figure 5: RPA photo mosaic and plant locations example.

To examine the spectral and structural separability of different plant species the plant location can be intersected RPA imagery. Some preliminary statistics of DHI plant species from an exclusion plot is shown in Figure 6. This figure shows the variability height in the "Max_nsm" box plot and a reasonable degree of difference in the red, green and blue bands. Detailed methodologies and results will be included in Lucy's thesis which is due in December 2019.
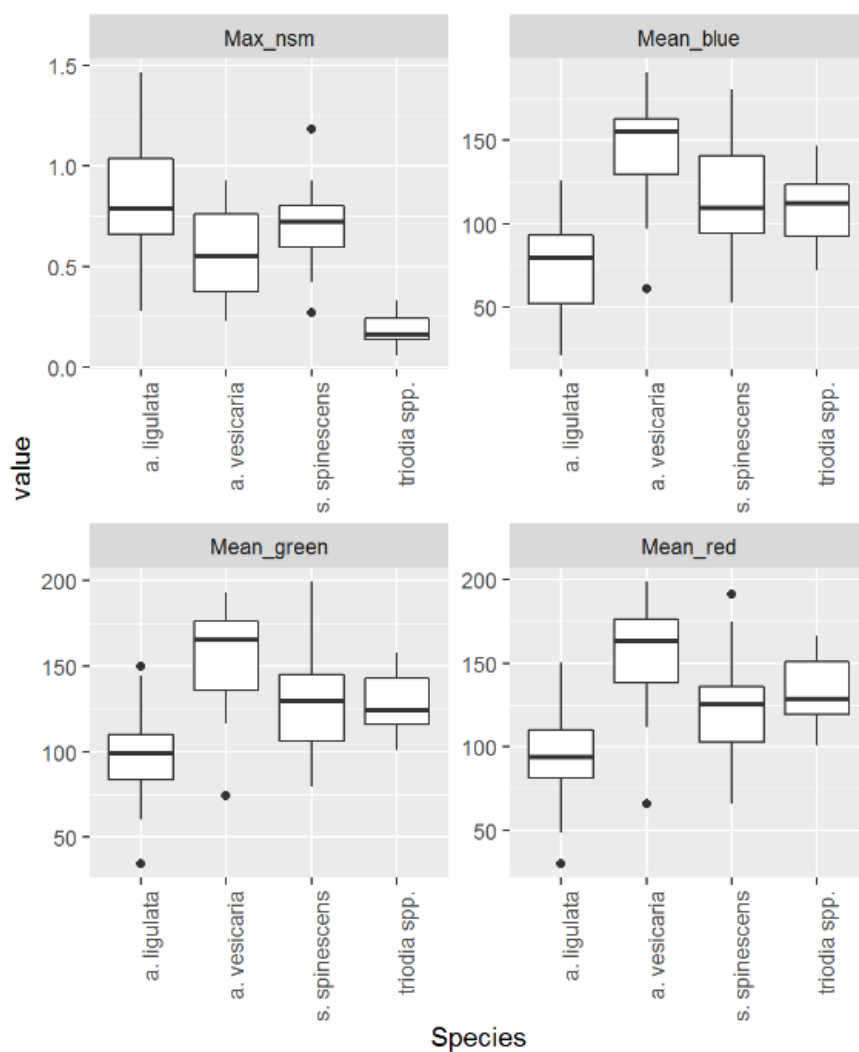
Figure 6: RPA imagery parameters for four plant species from exclusion plot 6. Parameters include maximum height (max_nsm), and the mean reflectance values for the red, green and blue bands (Mean_red, Mean_green, and Mean_blue).

3　Results

3.1　Spatial extent of change

A map showing areas of significant vegetation change to 2013, 2015, 2017 and 2019 based on a 1988 to 2008 baseline are shown in Figure 7. 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.
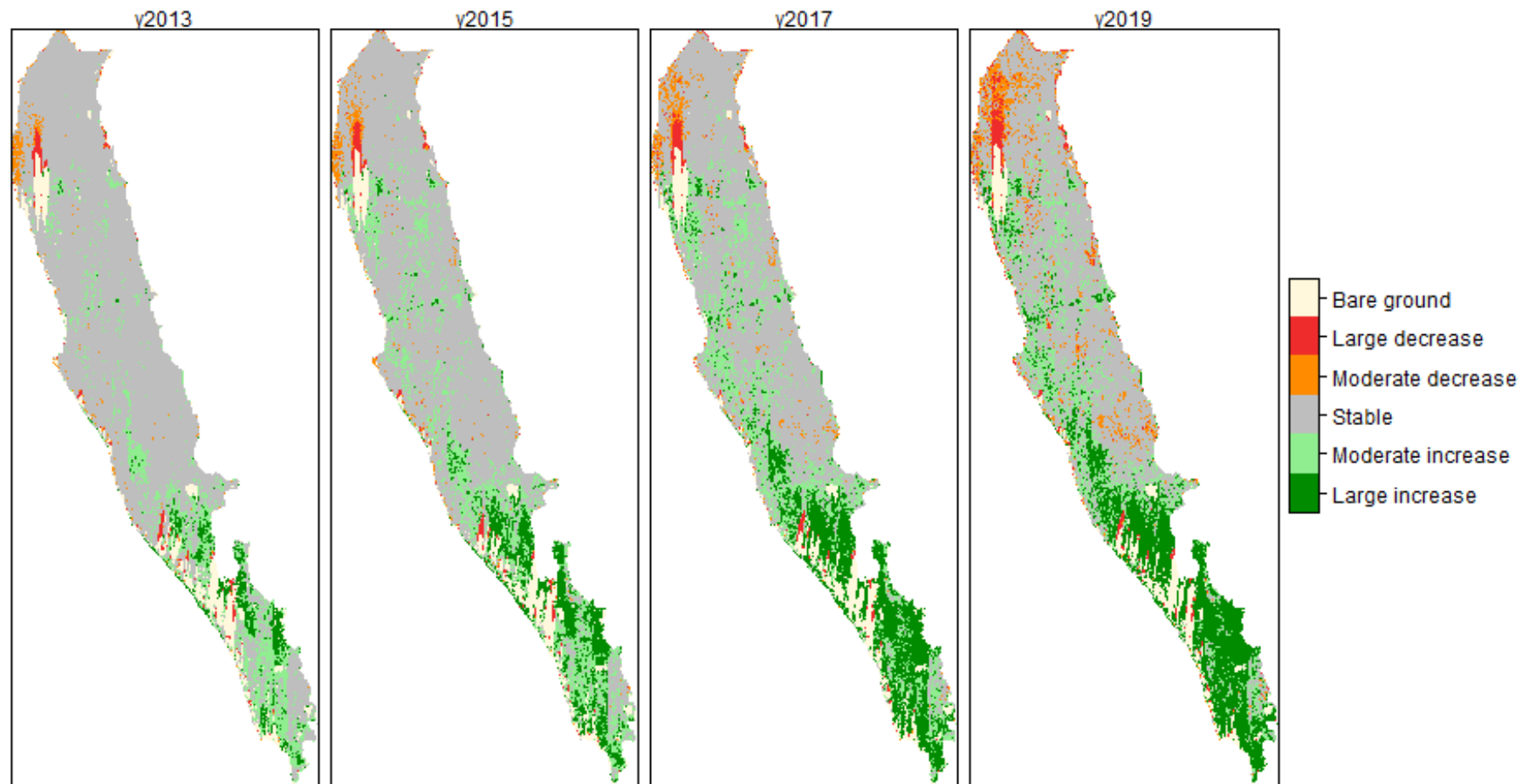
Figure 7: Significant vegetation cover change for years 2013, 2015, 2017 and 2019 based on the 1988 to 2008 baseline.

Area calculations for the classes in Figure 7 are shown in Table 1. The majority of DHI (46%) recorded no significant increase in vegetation cover since destocking, while 38% recorded either a moderate or significant increase. A decrease was recorded over 9% up from 8% in 2018. 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 2019 on Dirk Hartog Island.

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

3.2   Sand dune extent changes

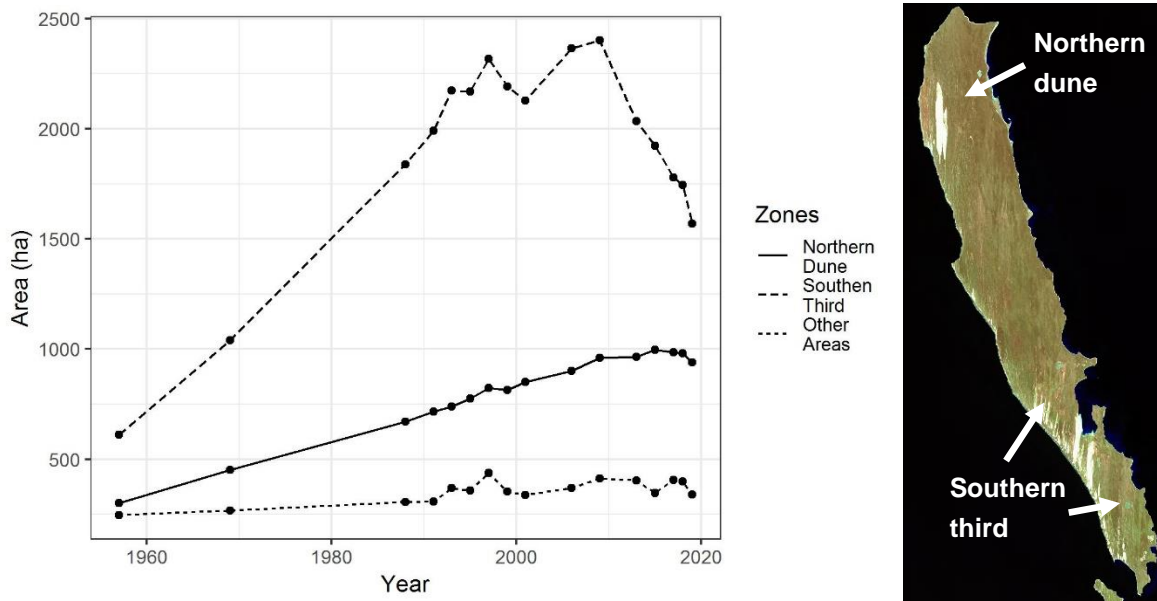The area of sand dune extent on DHI over the period 1957 to 2019 is shown in Figure 8.

Figure 8: Sand dune extent changes across Dirk Hartog Island from 1957 to 2019.

The area of sand dune on the southern third reached a maximum of 2402 ha in 2009. By 2019 the area had dropped to 1569 ha. This is a reduction of 833 ha which can be seen in (Figure 8). 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 2019 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

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.

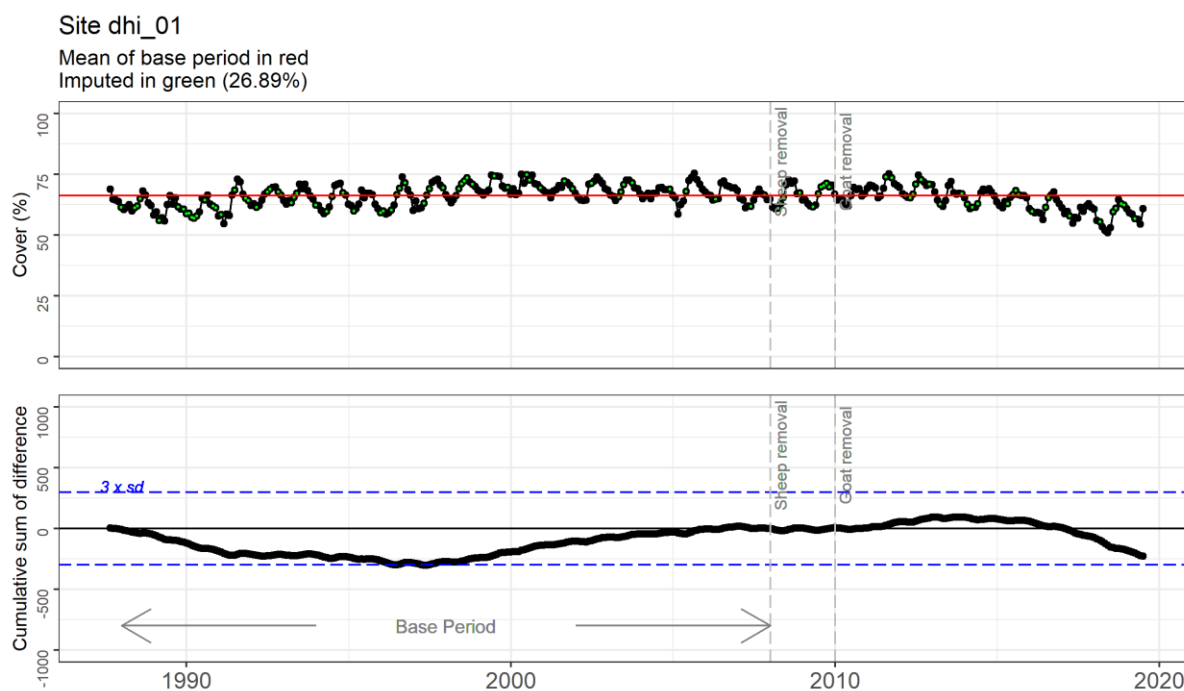**Photo point photographs of site 1.**

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 2019 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 2020 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.

May 2006	May 2007	September 2008
October 2009	January 2011	January 2012
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 2019 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 2020 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.

April 2006	May 2007	September 2008
January 2012	April 2014	May 2017
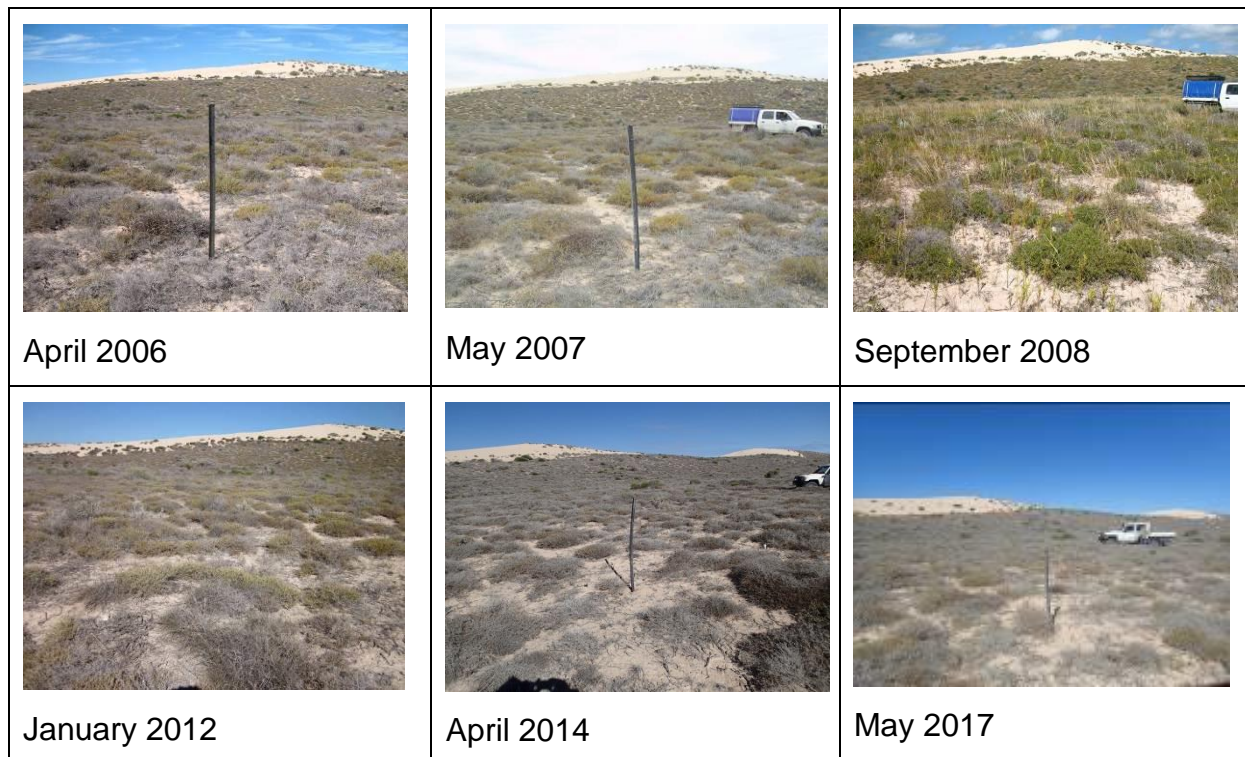
Vegetation cover time series analysis:

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 2019 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).

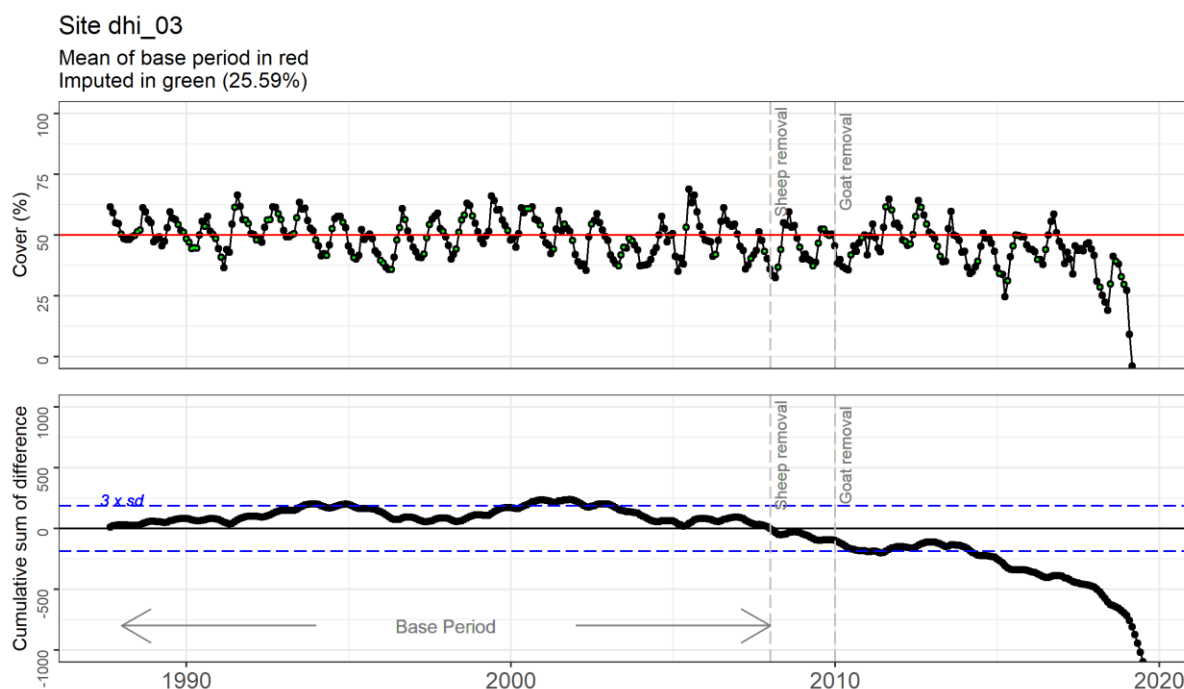*Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2019 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).*

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 eremaeum

1 seedling of Acacia sclerosperma, 3 seedlings of Acacia ligulata

Photo point photographs of plot 4
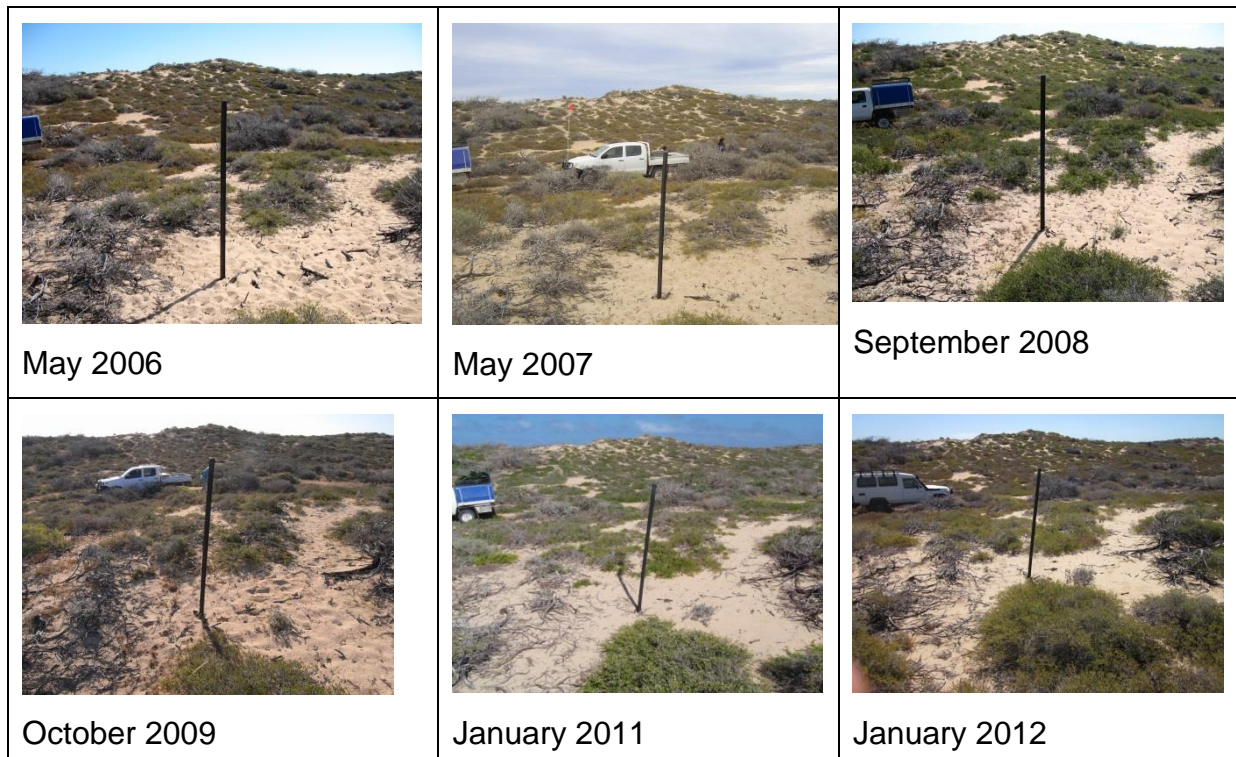
May 2006	May 2007	September 2008
October 2009	January 2011	January 2012

|		
April 2014	May 2015	May 2016
May 2017	May 2018	May 2019

Vegetation cover time series analysis:

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 2019 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).

Site dhi_04
Mean of base period in red
Imputed in green (26.11%)
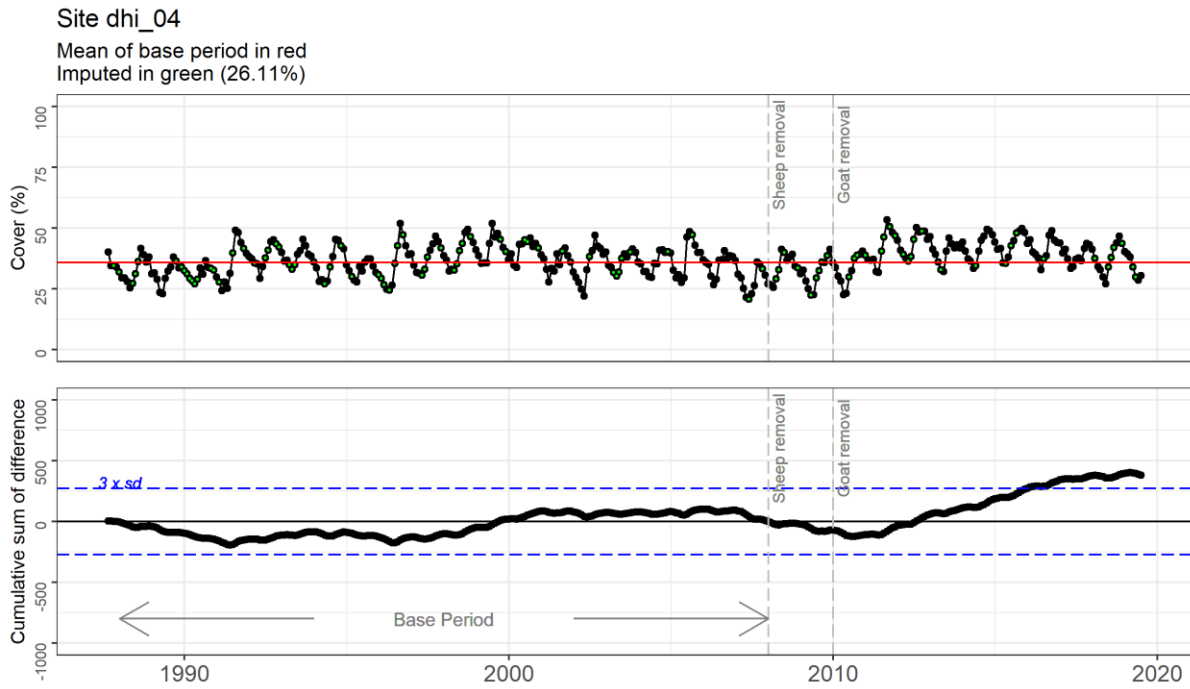
Recommendations:

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	May2017

May 2018	May 2019

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 2019 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).
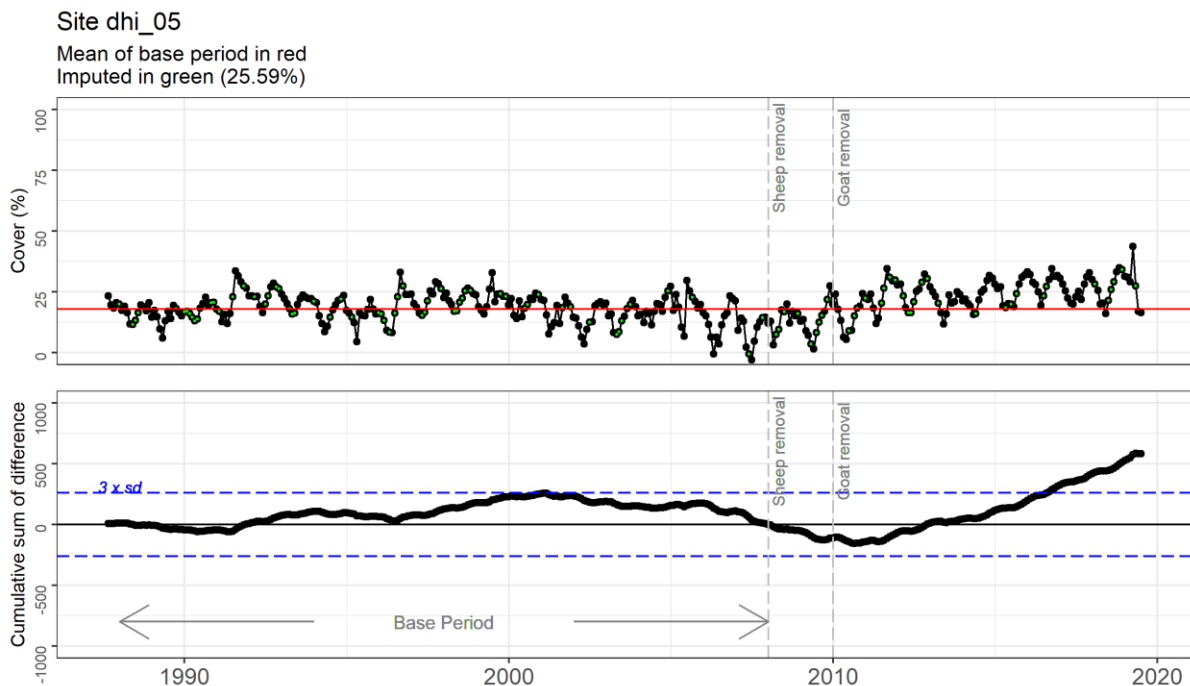
Recommendations:

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 2019 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 2020 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 2019 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).
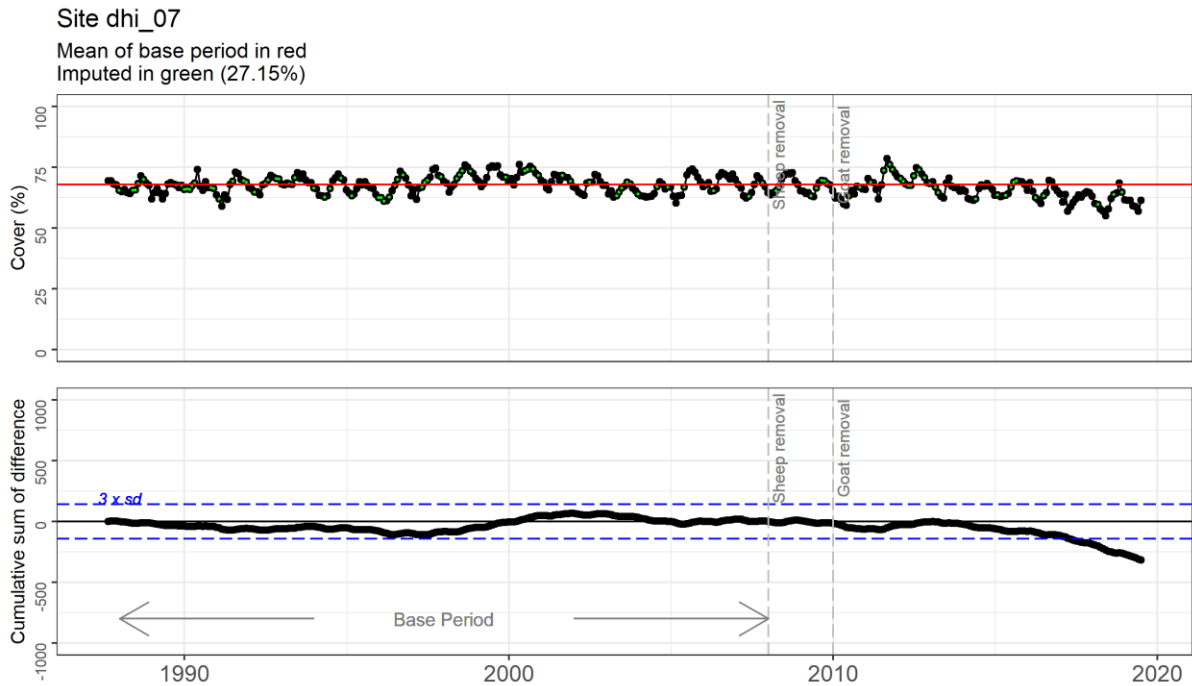
Recommendations:

Recapture photograph points and reassess site condition in 2020.

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 2019 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 2020 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 raely 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.
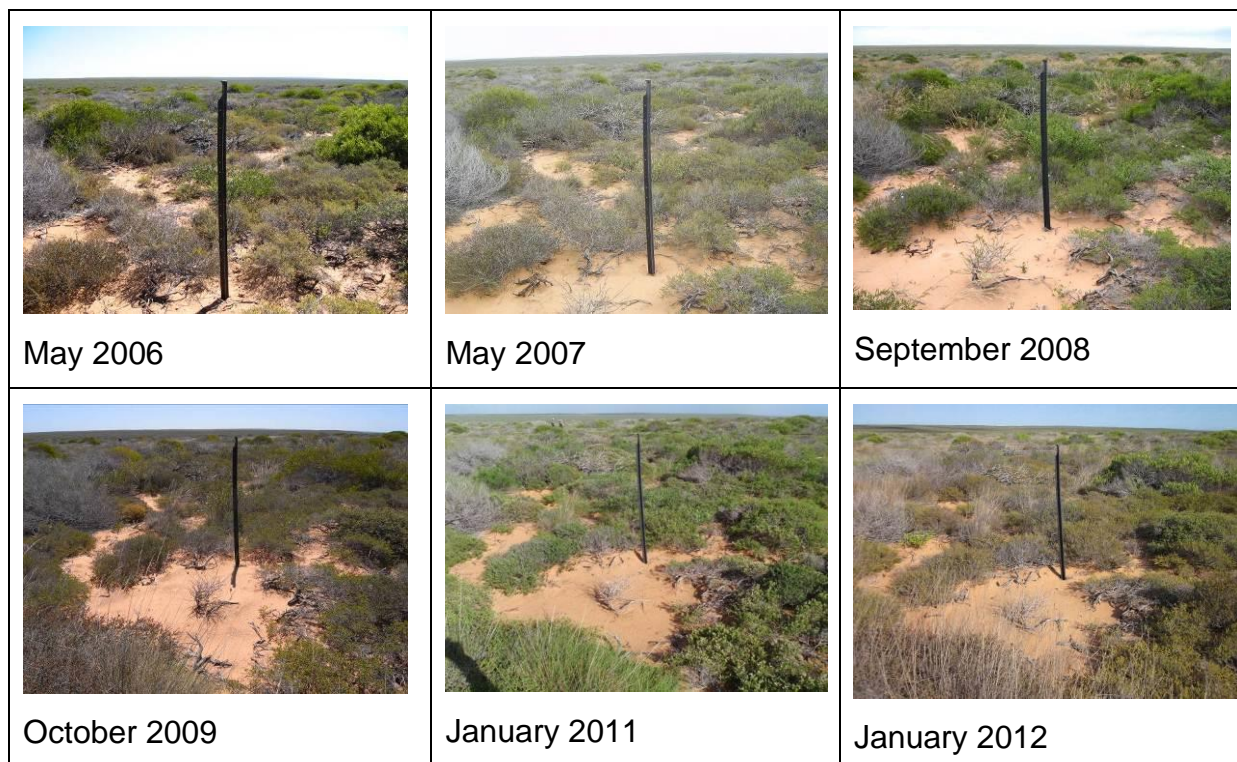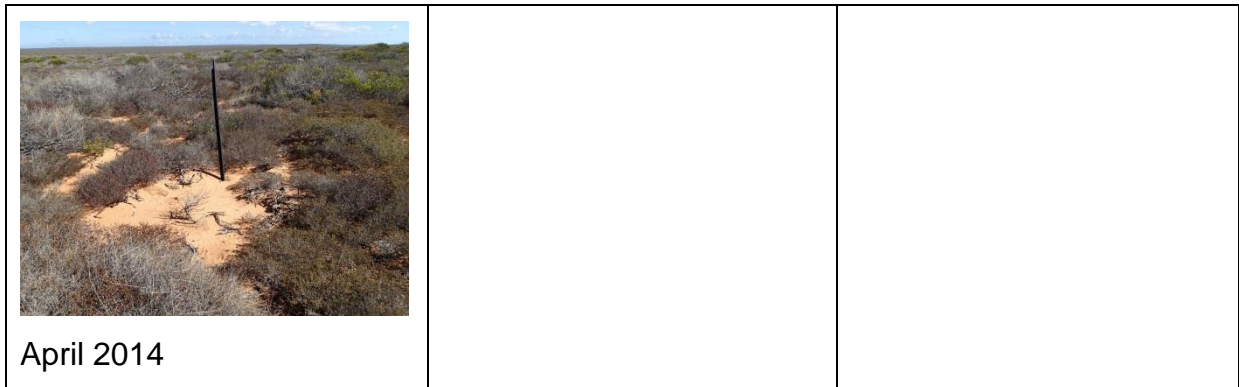
May 2006	May 2007	September 2008
October 2009	January 2011	January 2012

April 2014

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 2019 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).
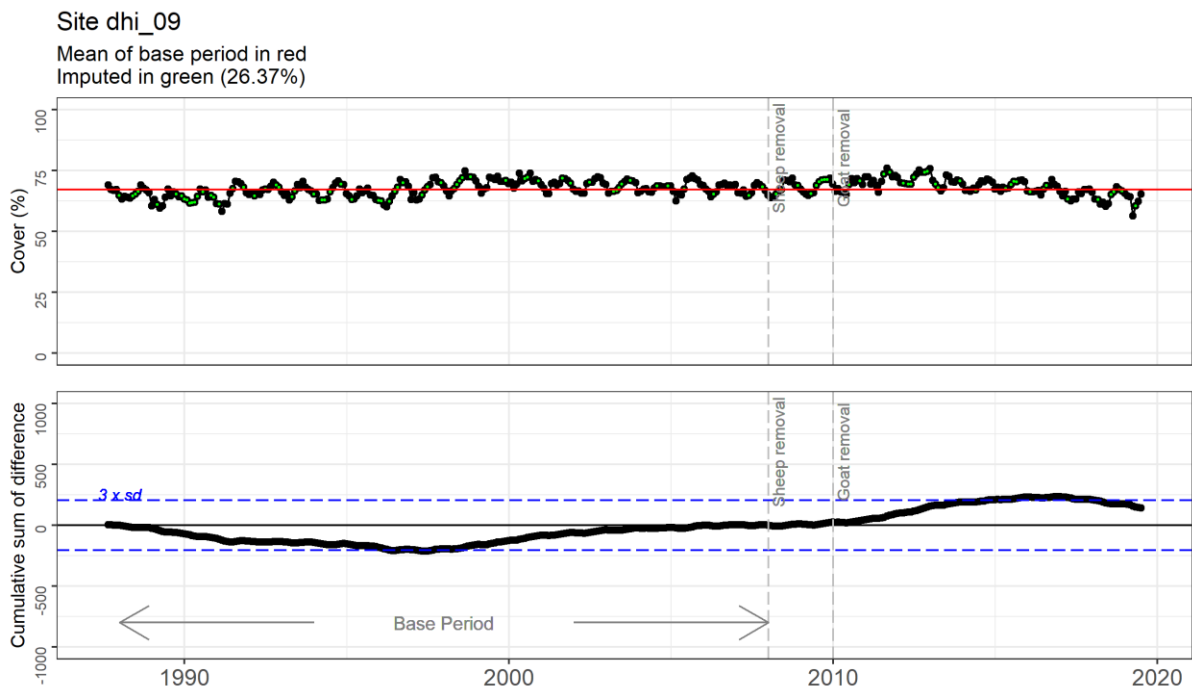
Recommendations:

Recapture photograph points and reassess site condition either in 2020 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 ofThryptomene baeckeacea, with rarely recorded shrubs of Melaleuca cardiophylla, Stennathemum 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.

| May 2006 (view angle inconsistent) | May 2007 | September 2008 |

October 2009	January 2011	January 2012
April 2014	May 2015	May 2016
May 2017	May 2018	May 2019
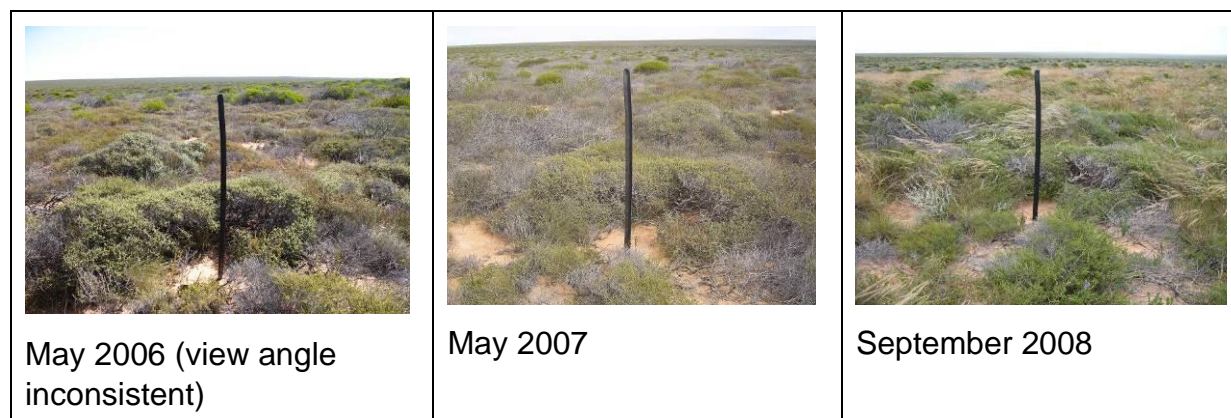
Vegetation cover time series analysis:

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 2019 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).

Site dhi_10
Mean of base period in red
Imputed in green (26.11%)
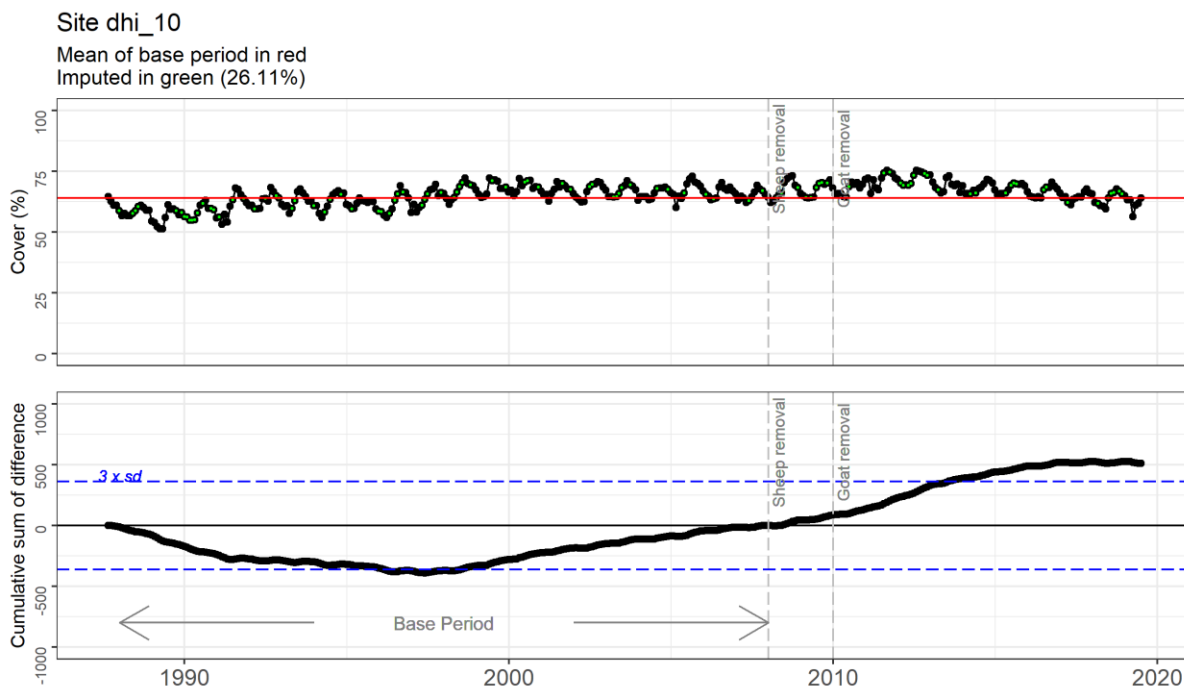
Recommendations:

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 2019 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 2020 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 2019 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 2020 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 2019 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 2020 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 2019 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 2020 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.

May 2006	September 2008	October 2009
January 2011	January 2012	April 2014
May 2015	May 2016	May 2018

May 2019
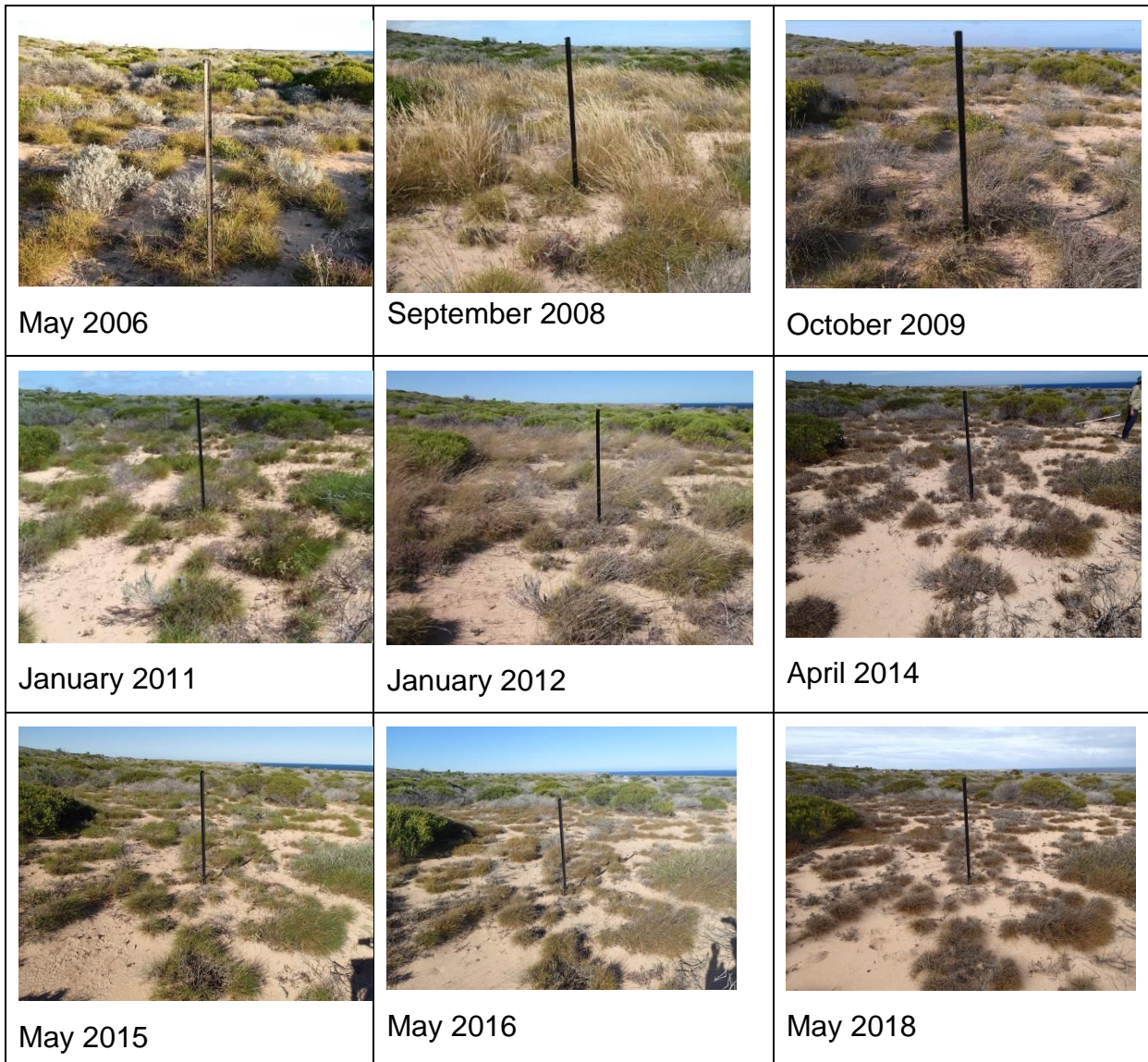
Vegetation cover time series analysis:

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 2019 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).

Site dhi_15
Mean of base period in red
Imputed in green (26.63%)
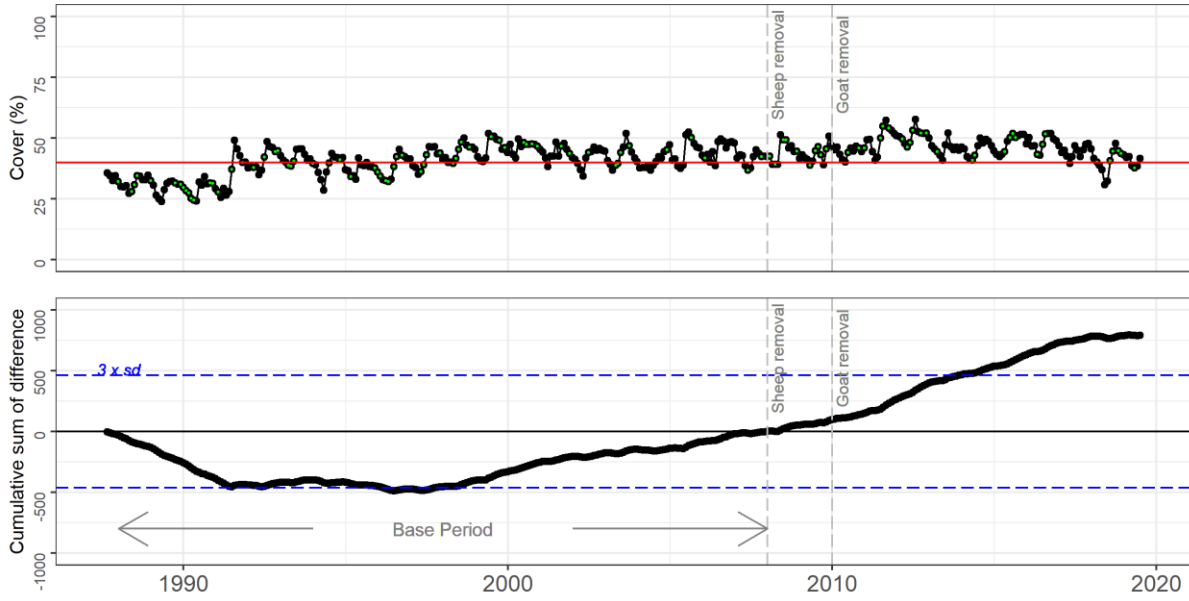
Recommendations:

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 tomentose, 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.
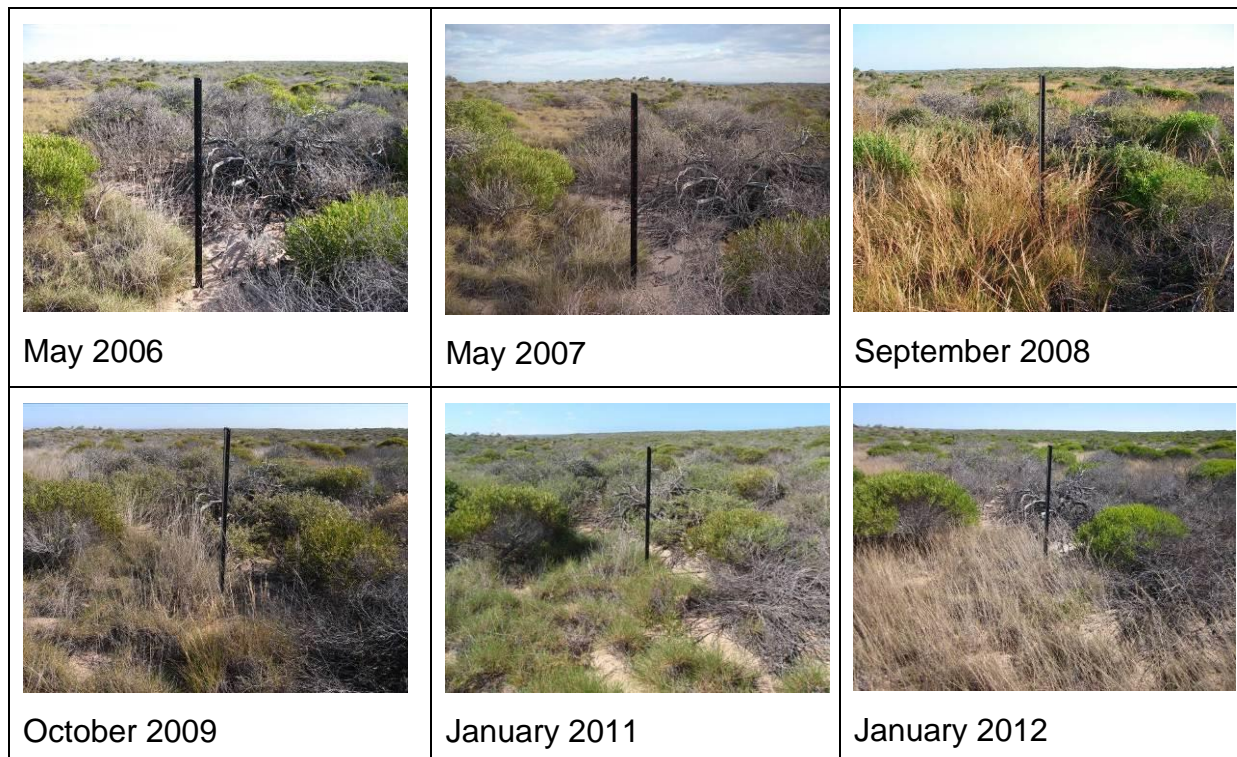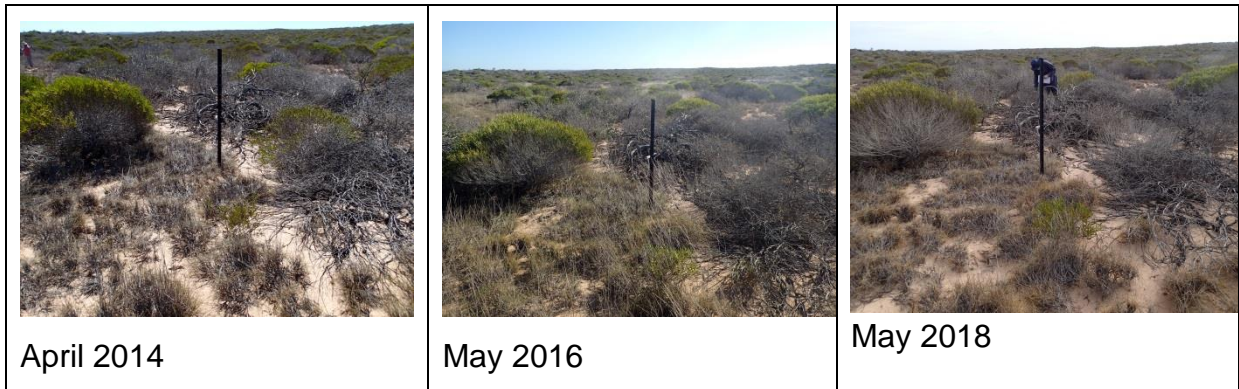
May 2006	May 2007	September 2008
October 2009	January 2011	January 2012

April 2014	May 2016	May 2018

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 2019 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).
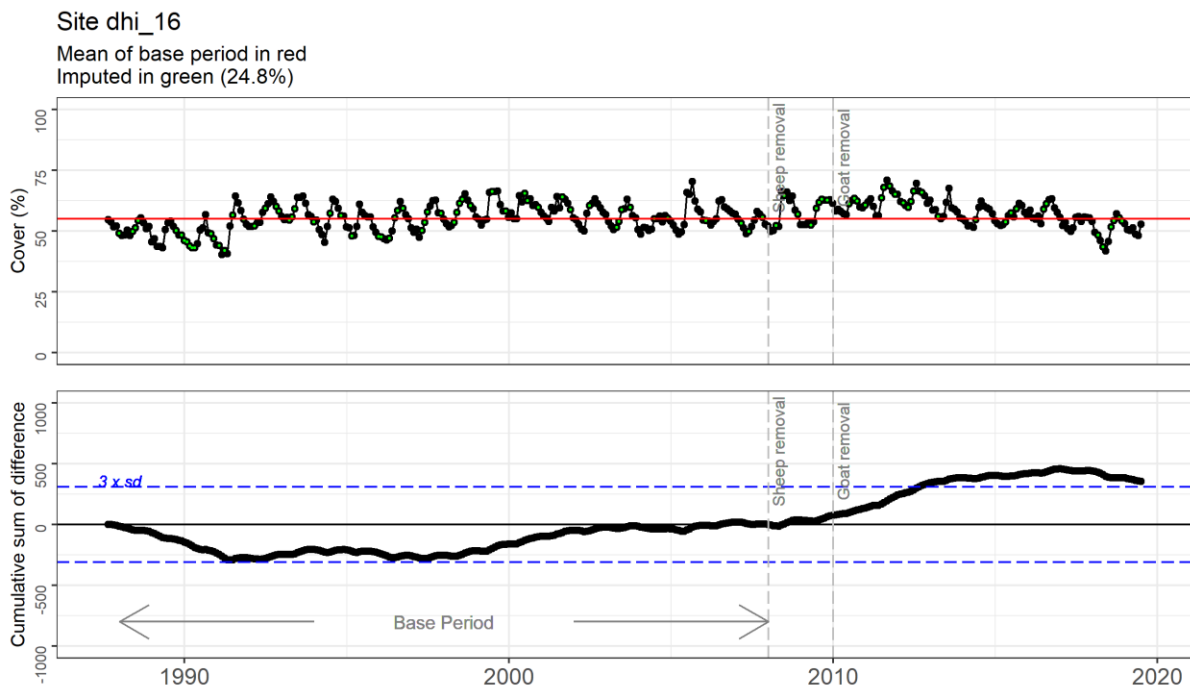
Recommendations:

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.
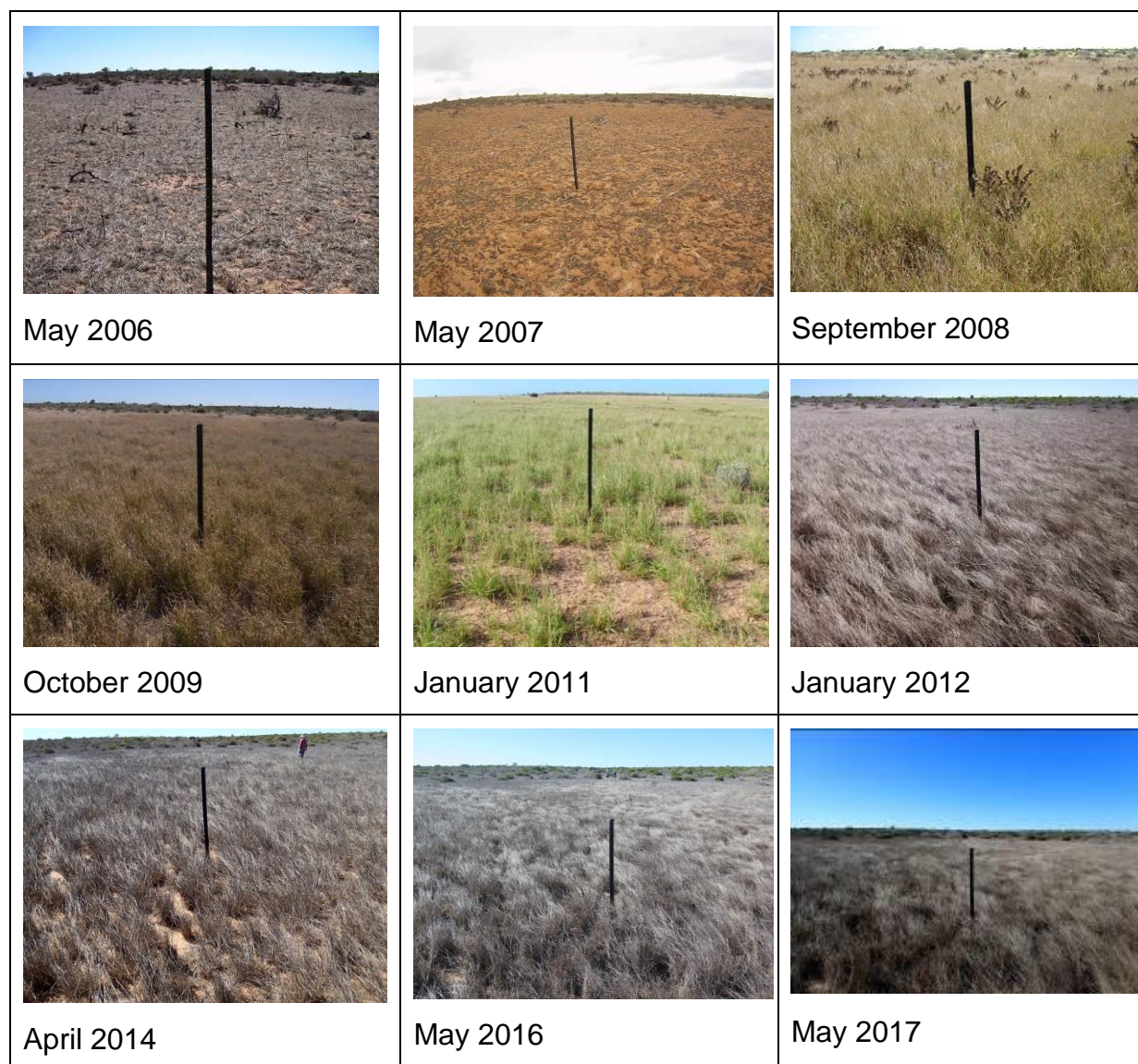
May 2006	May 2007	September 2008
October 2009	January 2011	January 2012
April 2014	May 2016	May 2017

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 2019 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).

Site dhi_17
Mean of base period in red
Imputed in green (24.28%)
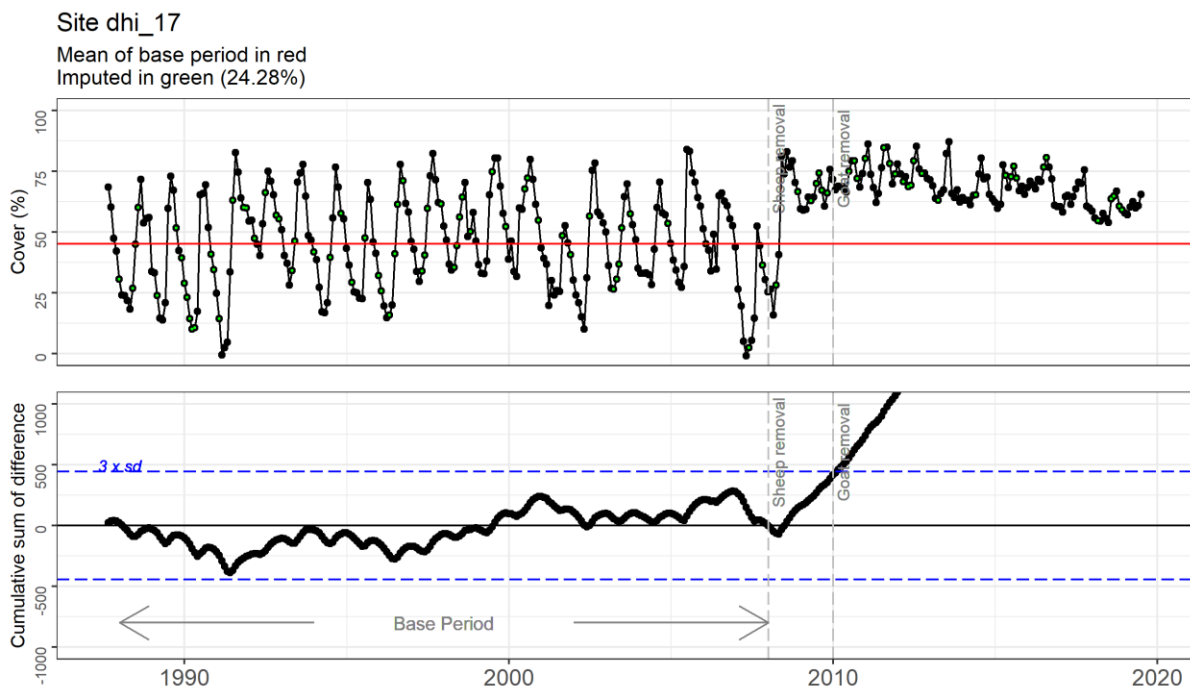
Recommendations:

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.

May 2006	May 2007	September 2008
October 2009	January 2011	January 2012
April 2014	May 2015	May 2016

Department of Biodiversity, Conservation and Attractions
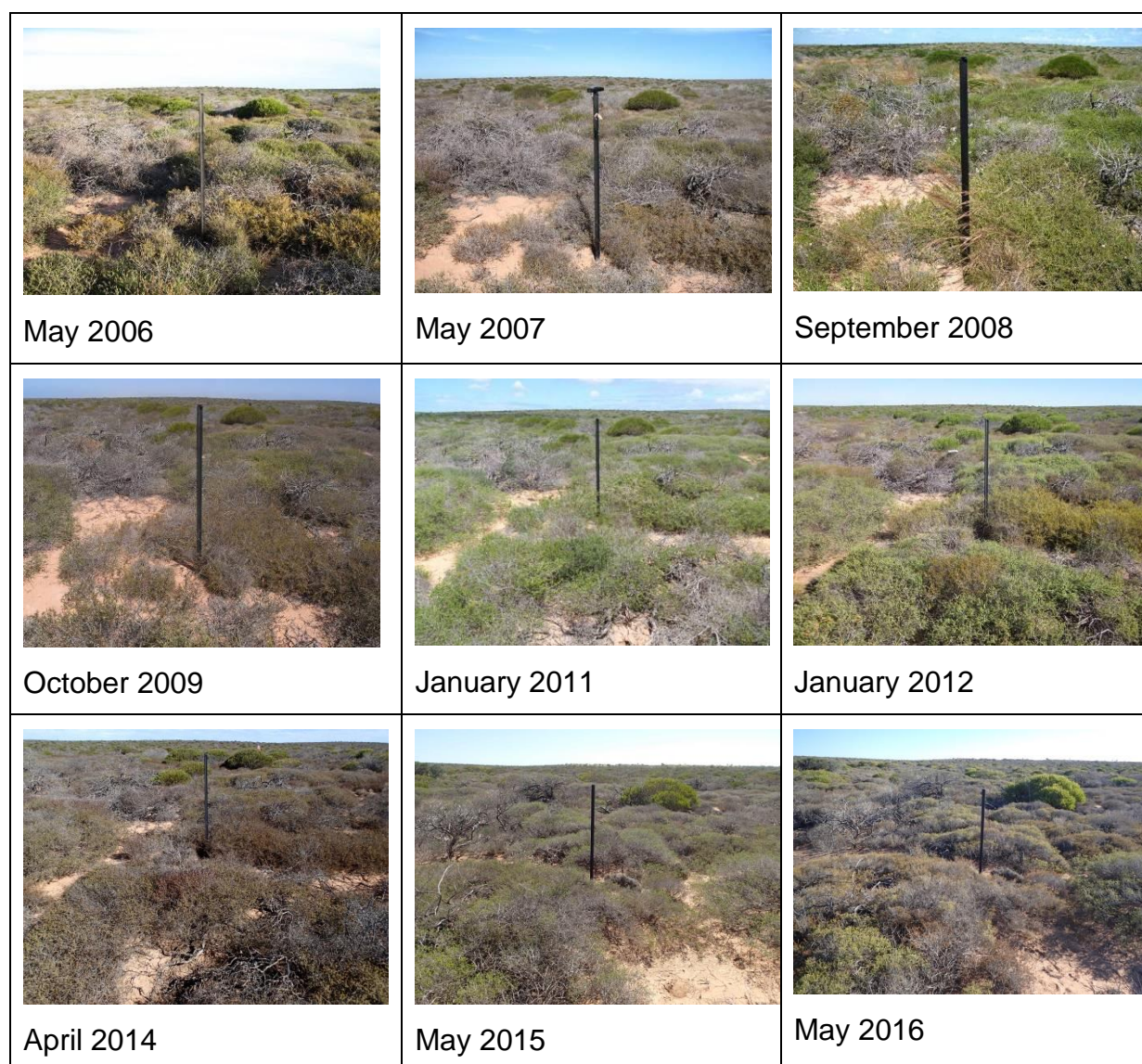
Vegetation cover time series analysis:

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 2019 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).
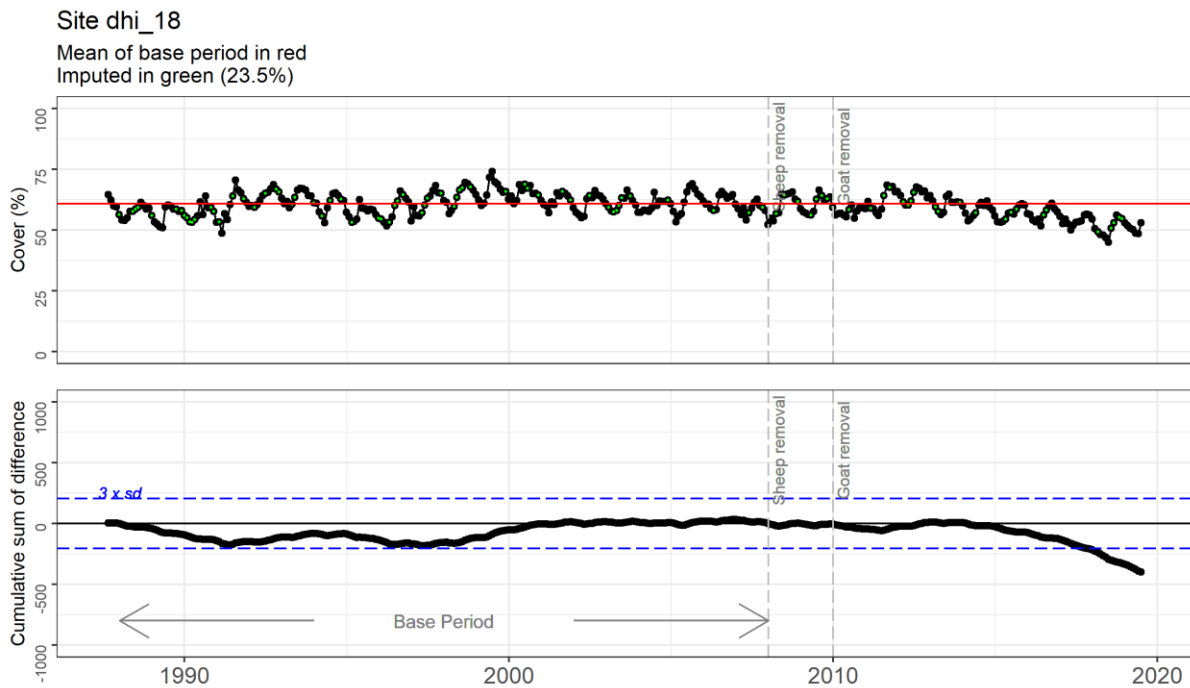
Recommendations:

Recapture photograph points and reassess site condition in 2020.

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 cilaris (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/ Astrostipa 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.

May2006	May 2007	September 2008
October 2009	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. 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 2019 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).
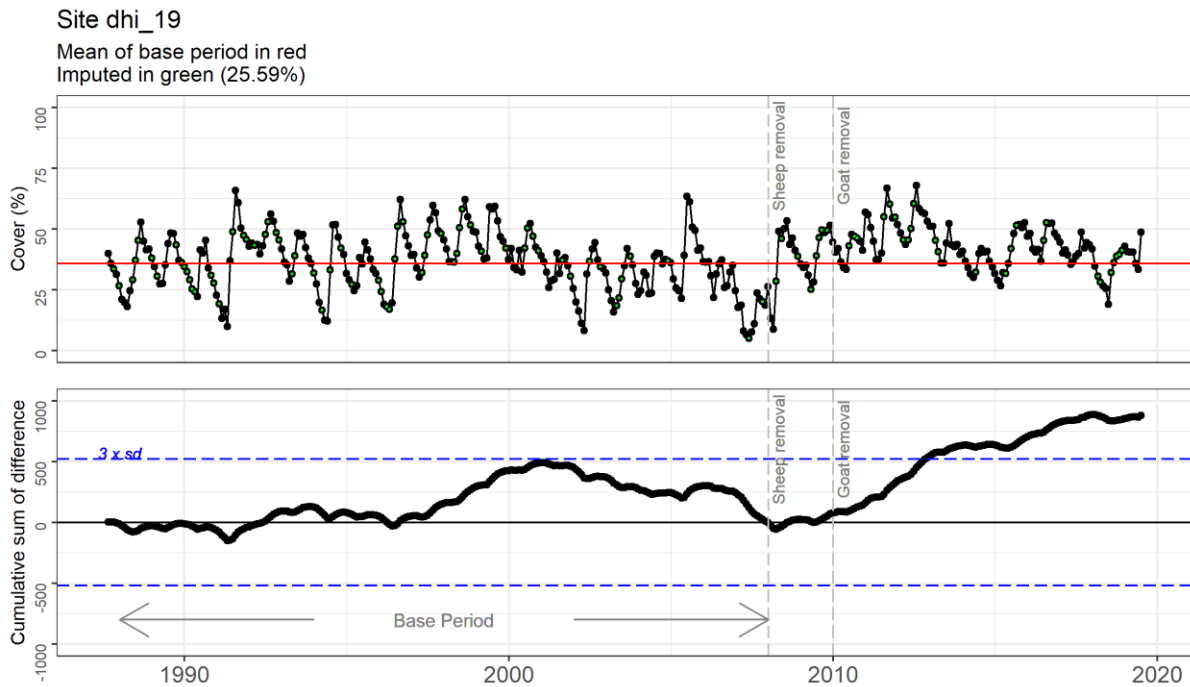
Recommendations:

Recapture photograph points and reassess site condition in 2019 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%) Chenopdium melanocarpum, Angianthus tomentosus, Calotis hispidula, Brachyscome iberiidifolia, Maireana georgei and Ptilotus gaudichaudii/ Lawrencia viridigrisea

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

Photo point photographs of plot 21.
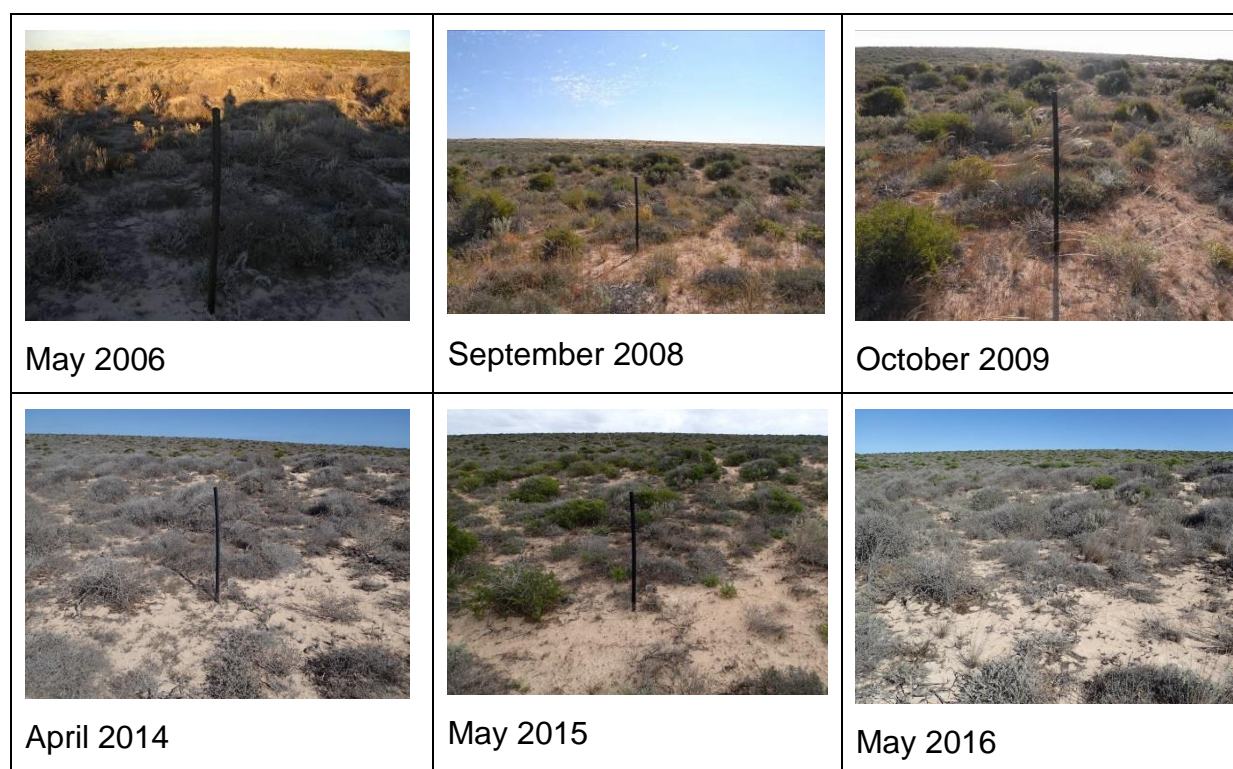
May 2006	September 2008	October 2009
April 2014	May 2015	May 2016

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 2019 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).
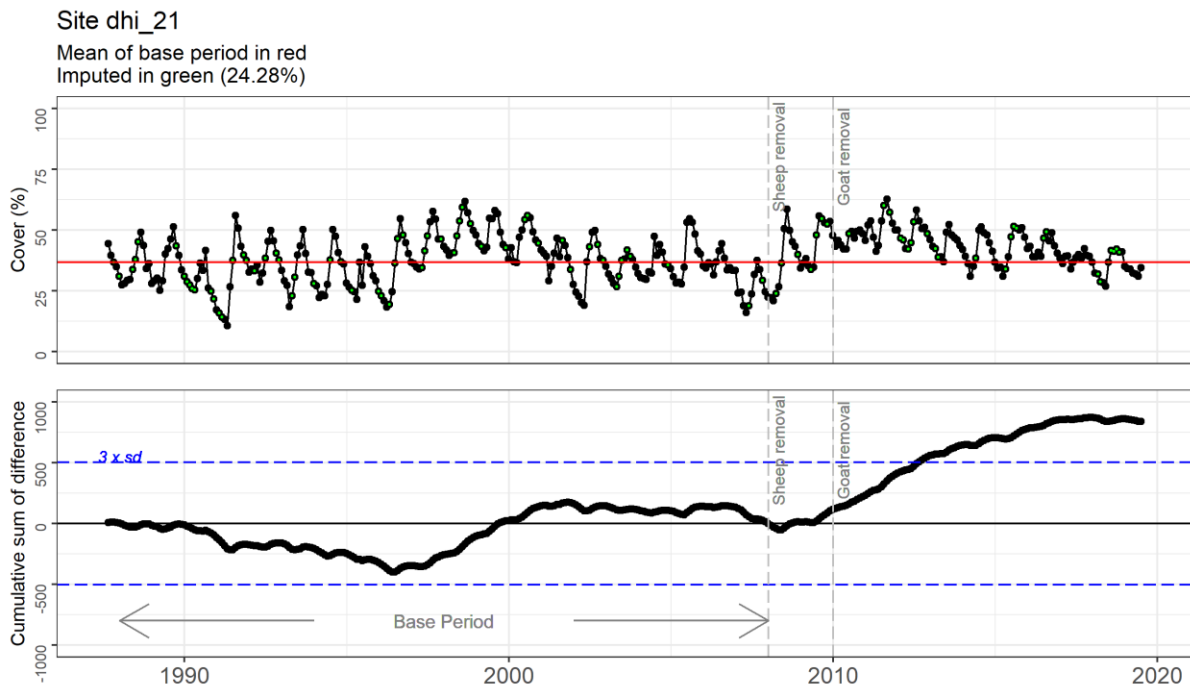
Recommendations:

Recapture photograph points and reassess site condition in 2018 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 panciflora, 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.

|		
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 2019 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).

Site dhi_22
Mean of base period in red
Imputed in green (23.76%)

Recommendations:

Recapture photograph points and reassess site condition in 2020 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 2019 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 2020 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
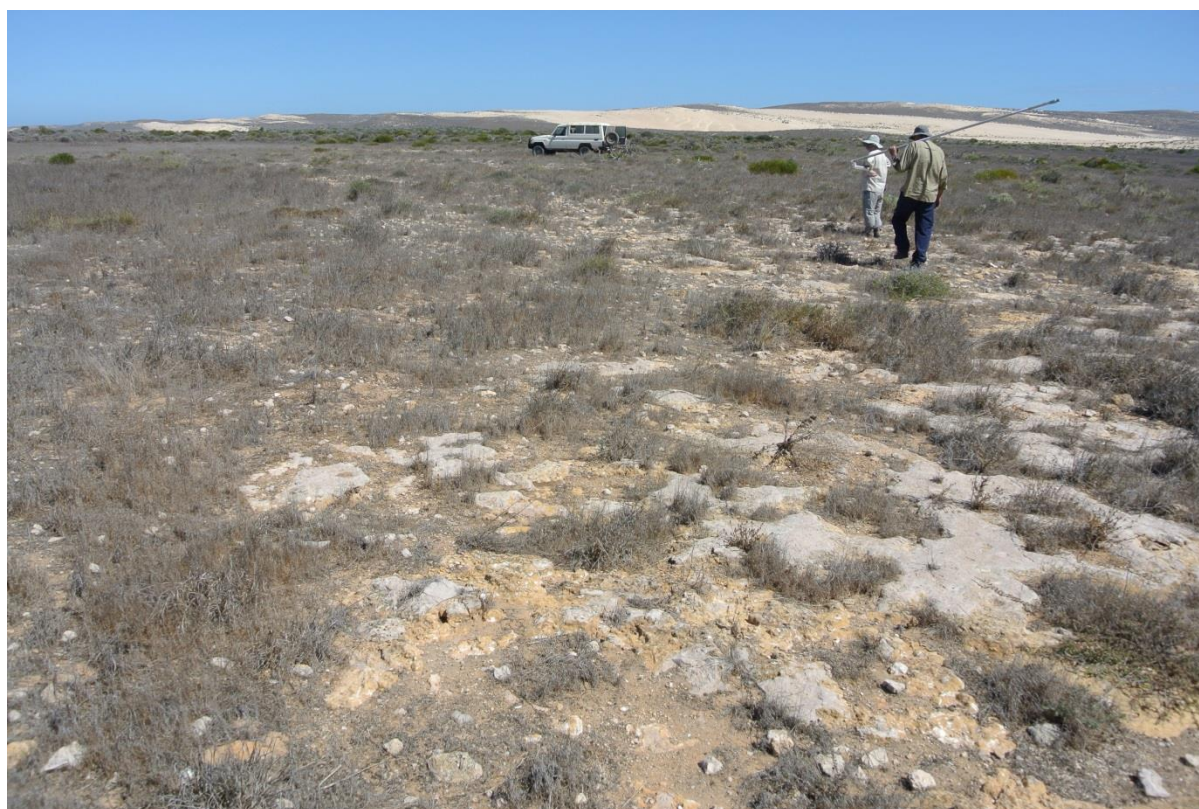
Vegetation cover time series analysis:

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 2019 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, Chenopdium 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,

| May 2015 | May 2016 | May 2017 |

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 2019 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, *Centaurium erythraea, *Brassica tournefortii, * Centaurea melitensis/ *Chenopodium murale

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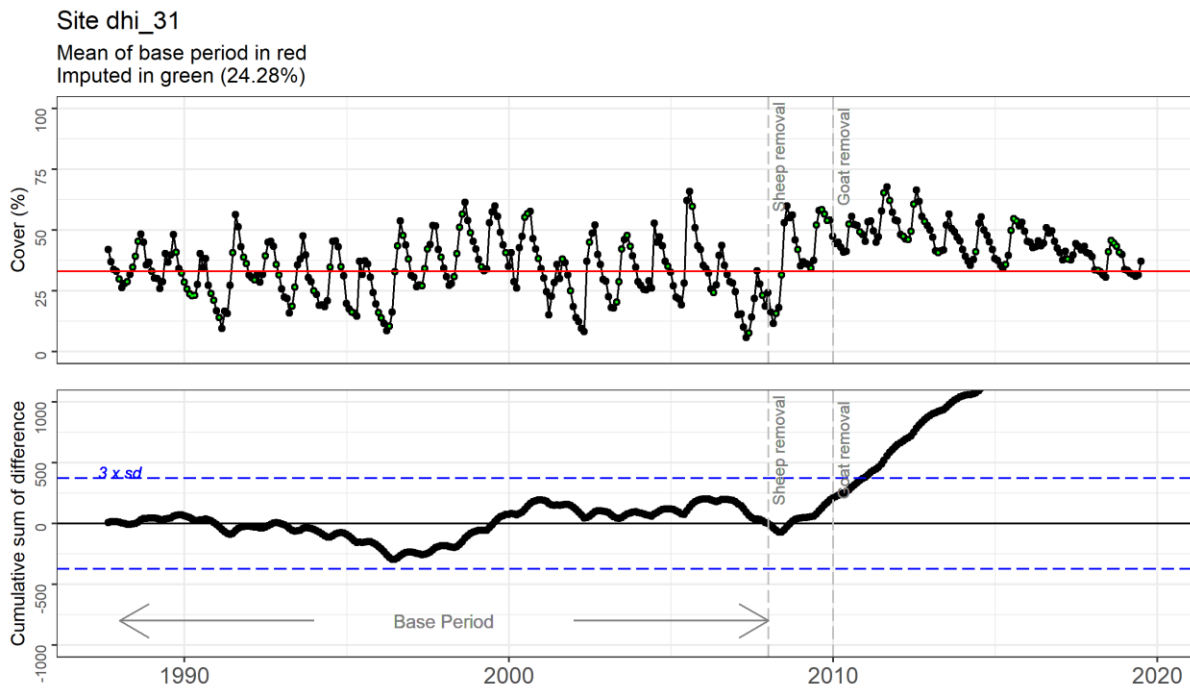
Site photographs

May 2015	May 2017	

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 2019 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< 0.5metres 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, Chenopdium 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 2019 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).
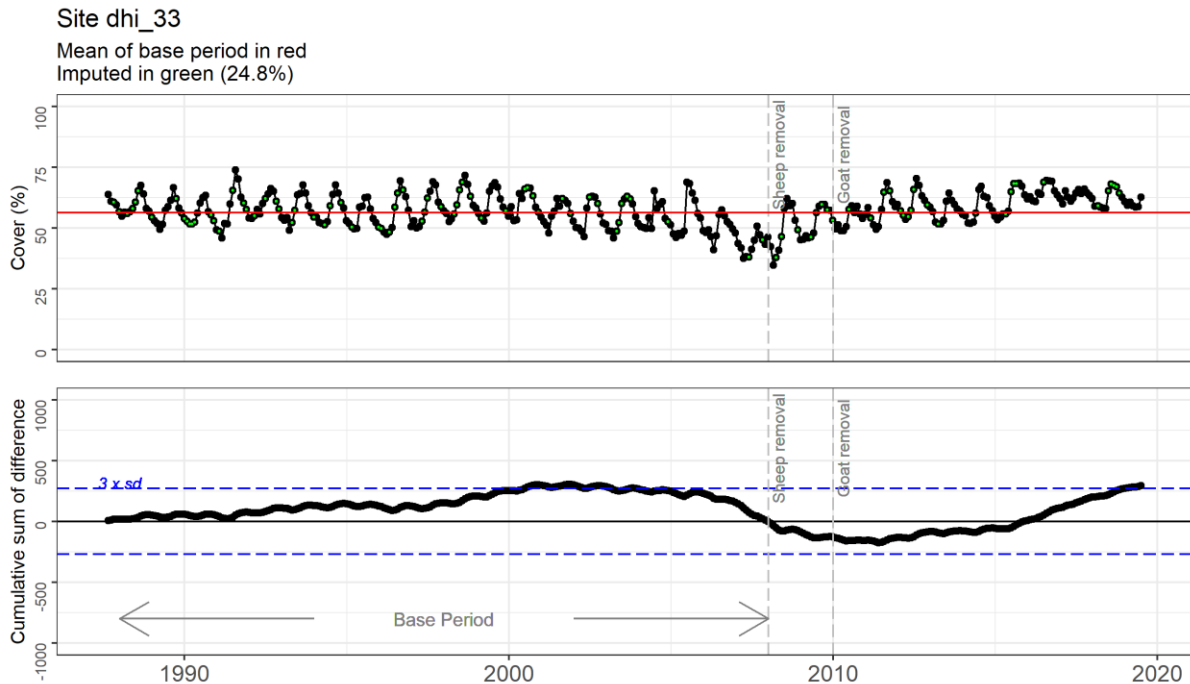
Recommendations:

Recapture photograph points and reassess site condition either in 2020 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 vesicara, Exocarpus aphyllus, Ptilotus obovatus and Stylobasium spathulatum/ Scaevola spinescens/Scaevola tomentose

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, Chenopdium melanocarpum, Senecio pinnatifolius and Ptilotus polystachyus.

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

Site photographs

April 2014	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. No buffel grass (Cenchrus ciliaris) was evident at the site.

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2019 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).
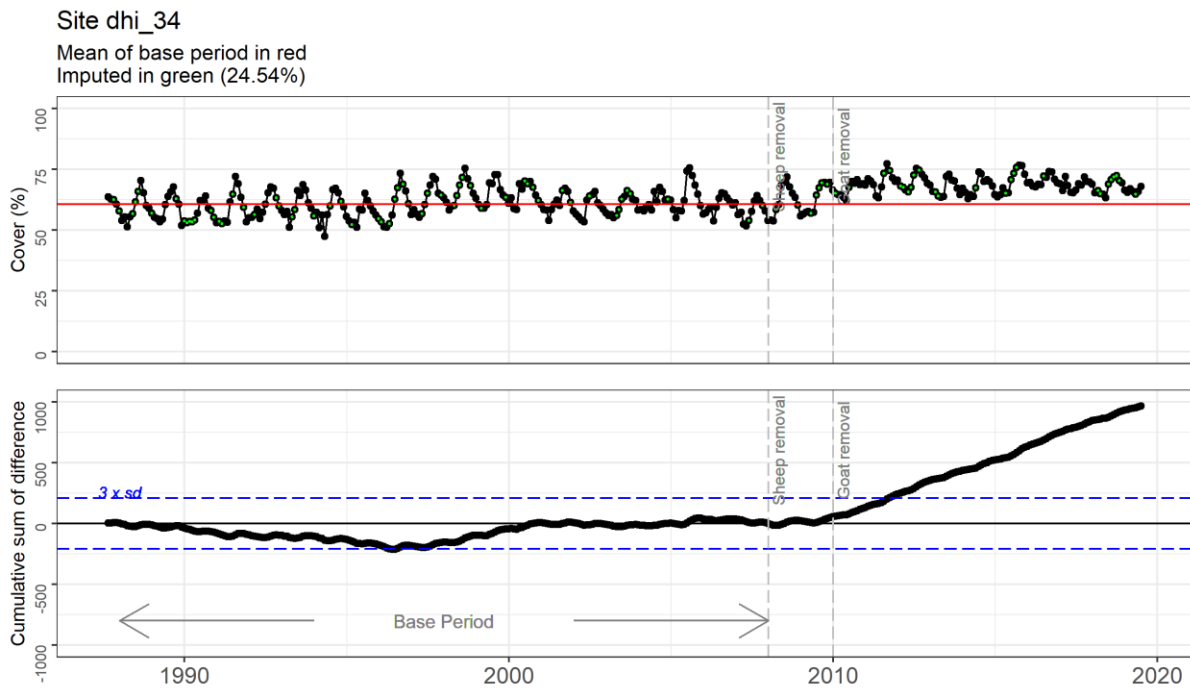
Recommendations:

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, Chenopdium melanocarpum, Goodenia sp., Enchylaena tomentosa

Abundant germination of annuals – Lawrencia 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

April 2014	May 2016	May 2018
May 2019		

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 2019 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).
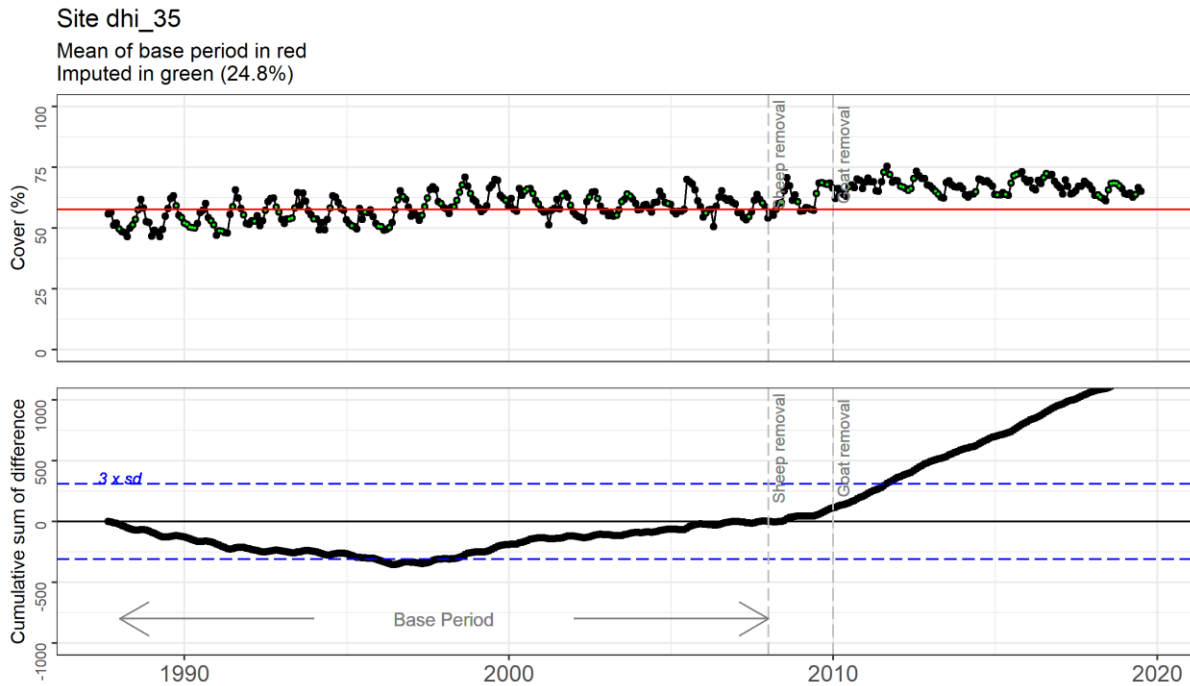
Recommendations:

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)

dhi_36

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 Cymbypogon obtectus, *Cenchrus ciliaris, *Bromus japonicas

Over herbs and low shrubs (2-10% cover) of *Urospermum picroides, *Bidens bipinnata, *Solanum nigrum , *Sonchus oleraceus, *Centaurium eryhthraea, Conostylis stylidioides, Acanthocarpus preissii, *Hypochaeris glabra, Euphorbia boopthona, *Brassica tournefortii, mHalgania 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.
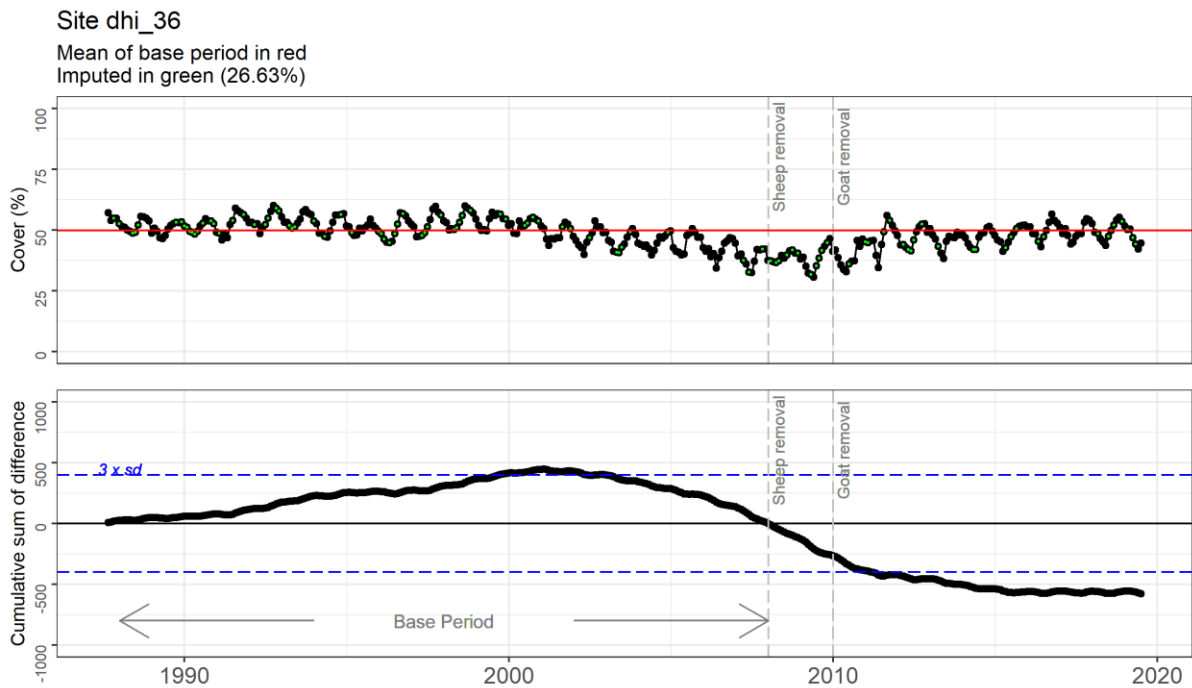
Site photo, April 2014

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 2019 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
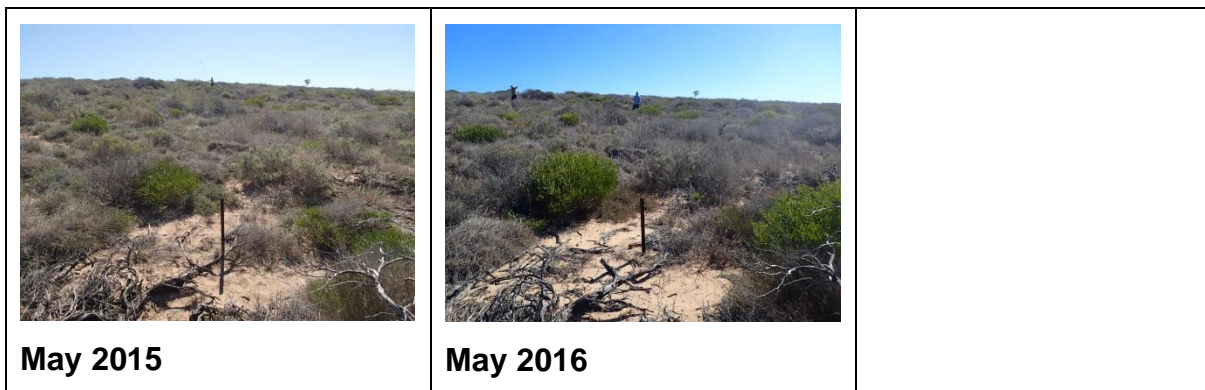
Open grassland of Trioda plurinervata (30-70% cover) 0.2-0.5 metres, rare Austrostipa elegantissima

Herbfield of Salsola australis/ Acanthocarpus robustus/ Urospermum picroides

Annual grasses of Austrostipa nitida

Many young Acacia ligulata plants

Few scattered Diplolaena grandiflora

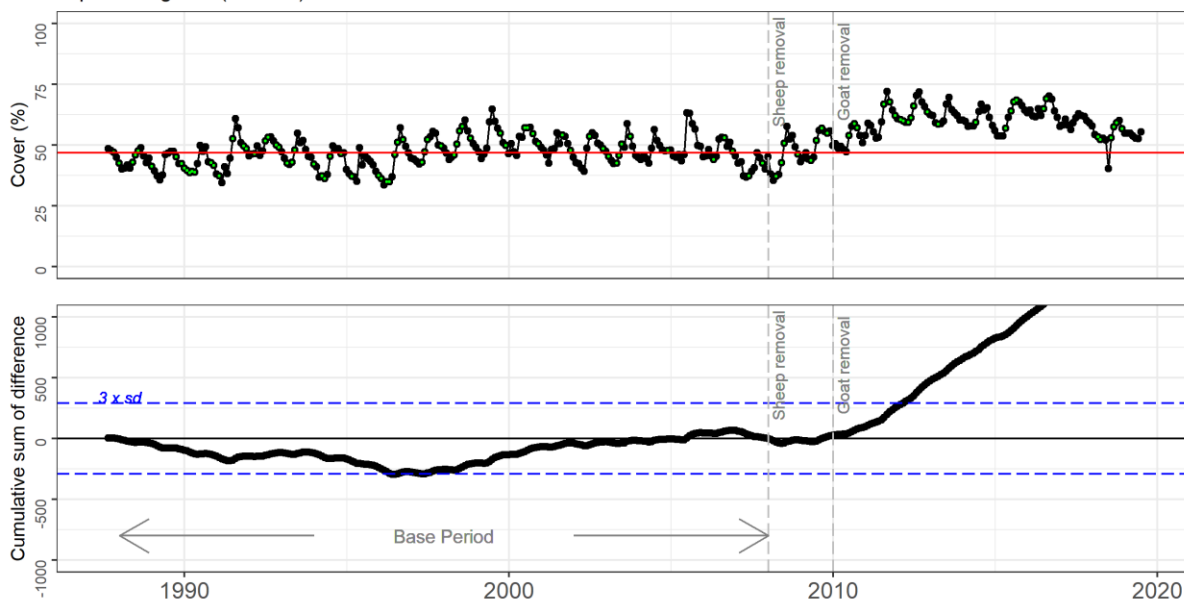|		
May 2015	**May 2016**	

Vegetation cover time series analysis:

The graph below shows vegetation cover derived from Landsat satellite data from 1987 to 2019 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).

Site dhi_37
Mean of base period in red
Imputed in green (27.15%)

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, Chenopdium 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).
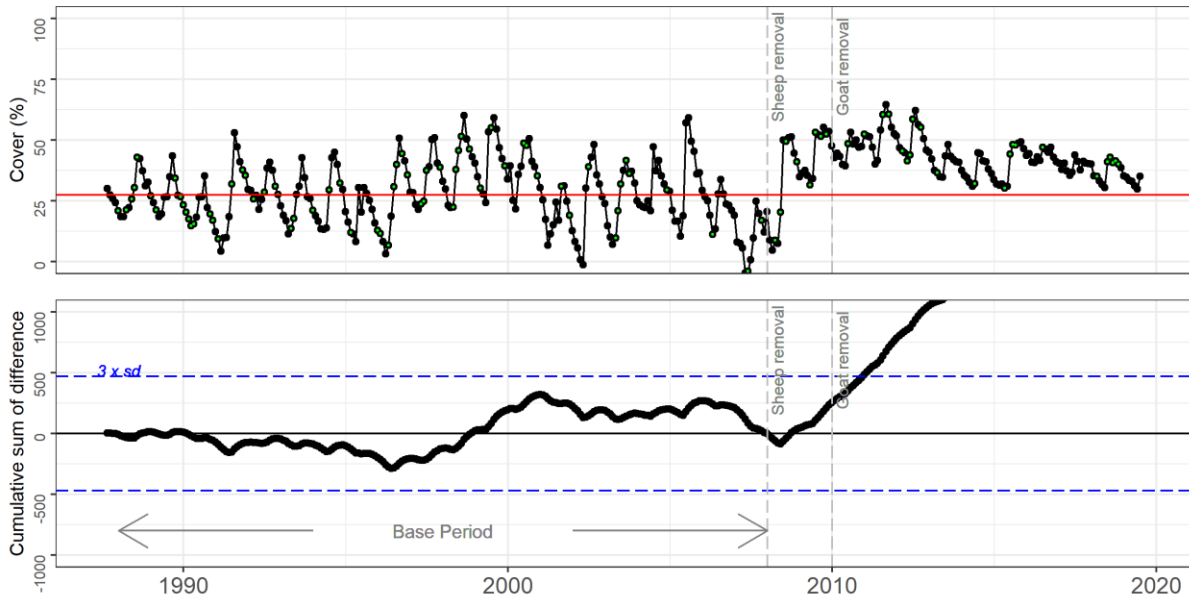
Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2019 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).

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
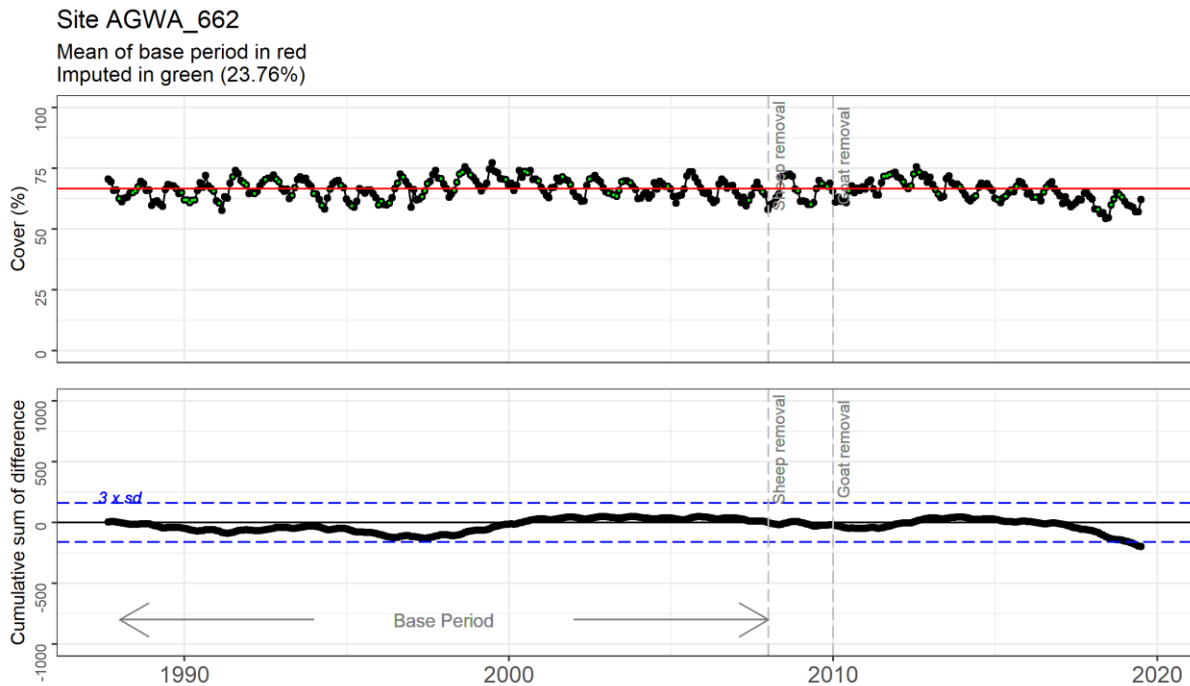
Over scattered herbs of Salsola australis

Photo point photographs of plot RHR633.

January 2011	April 2014	

Vegetation cover time series analysis:

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

Site AGWA_662
Mean of base period in red
Imputed in green (23.76%)

Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2019 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
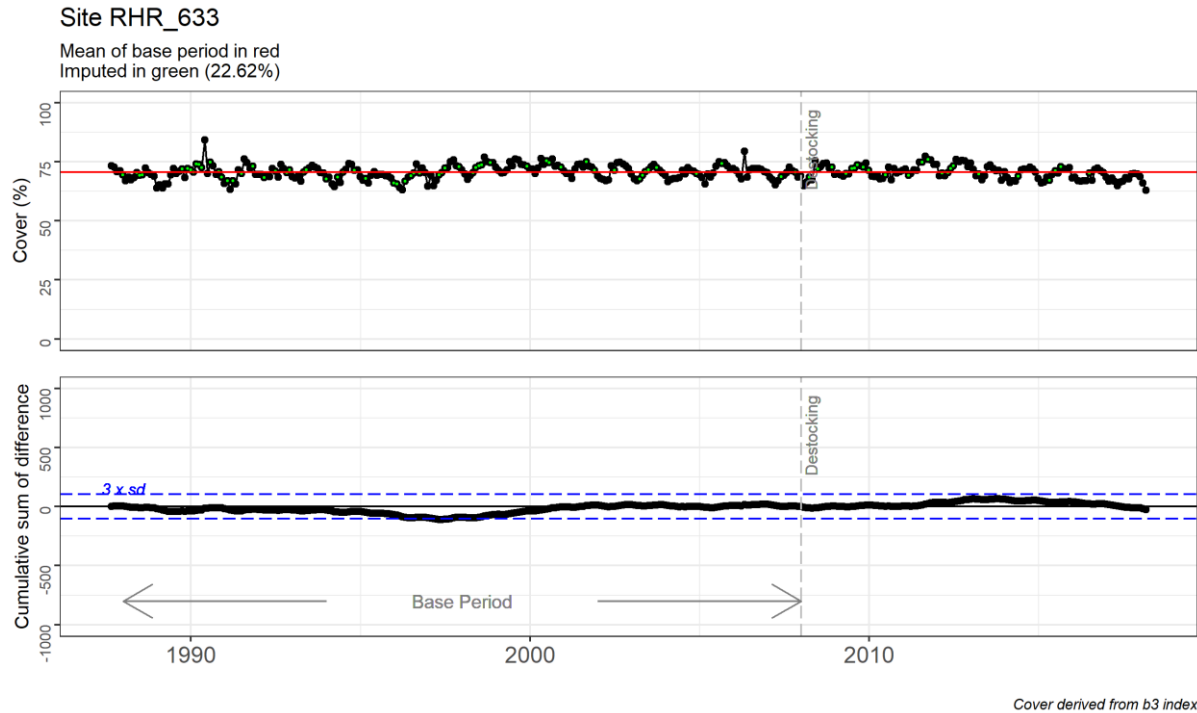
Over scattered sedges (2-10%) of Lepidobolus preissianus.

Photo point photographs of plot RHR633.

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

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 2019 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).