Dirk Hartog Island National Park Ecological Restoration Project: Vegetation Restoration - Remote Sensing Monitoring Program Report 2013/14

Landsat image of Dirk Hartog Island, captured December 2006

by
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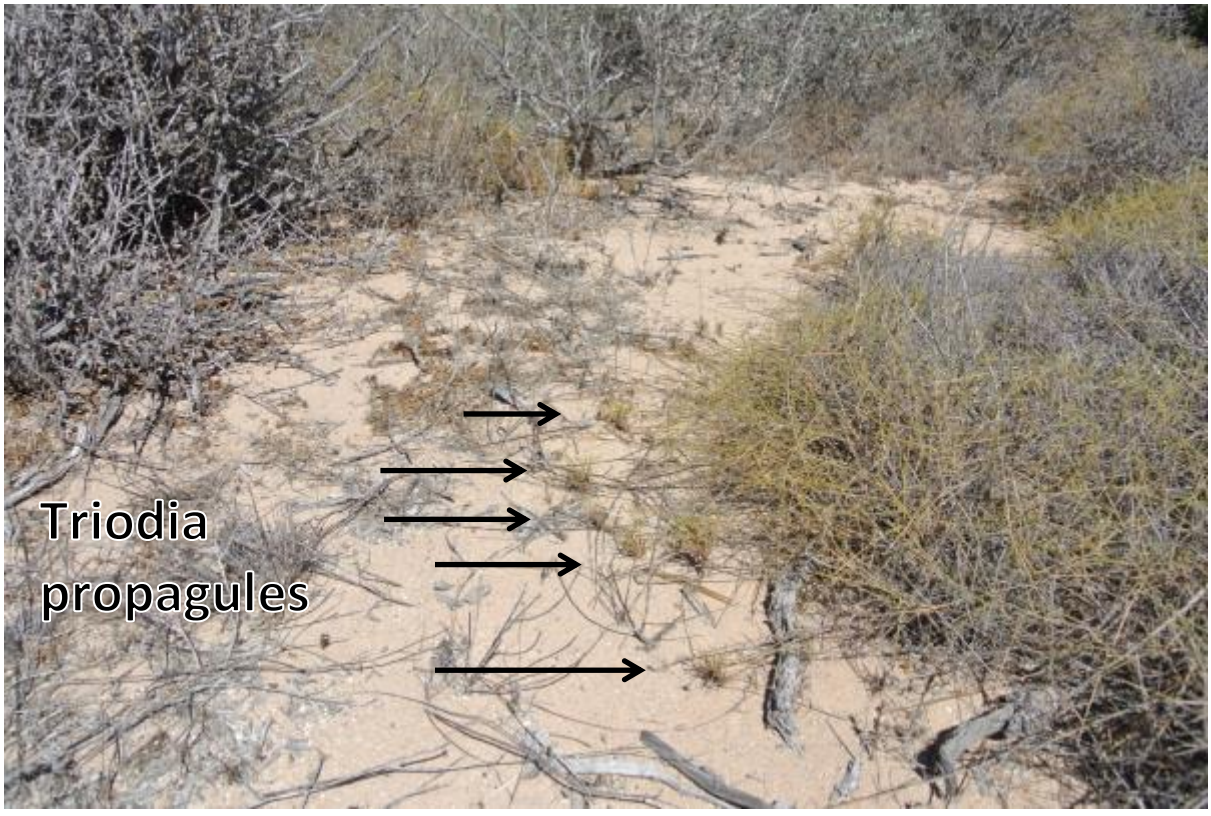
Executive Summary

Changes in vegetation cover across Dirk Hartog Island (DHI) were assessed using imagery from the Landsat satellite, captured between 1988 and 2014. Field assessments of 20 established photo points and were carried out along with 7 additional sites. Plots of vegetation cover estimates, derived from Landsat imagery, for all monitoring sites were created. A map identifying areas of significant vegetation cover change since destocking (2008) was also created. This suggests that 20% of DHI has experienced a significant increase in vegetation cover. Field validation indicates that the increase can be firstly attributed an increase in density of buffel grass due to reduced grazing pressure, but that increases in cover from native species were also evident.

The picture below was taken at monitoring point 34, in April 2014. It shows propagules from a *Triodia* sp. extending into an area which is likely to have been used as a pathway for livestock. Analysis of the Landsat time series indicates that a statistically significant increase in vegetation cover occurred following destocking and observations from the field indicate that this increase can be attributed to native vegetation.



Recommendations:

Continue field investigation focusing on areas where significant increases in vegetation cover are identified in the Landsat satellite imagery.

Objectives for 2014/15:

- Analyse and produce vegetation cover change images from high resolution satellite imagery (2009 to 2015);
- Analyse vegetation cover changes over DHI from Landsat imagery (1990 to 2014);
- Provide a report with statistical analysis of vegetation change from analysis of high resolution imagery and Landsat imagery; and
- Conduct field validation of vegetation cover change (April 2015).

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 2013/14 were:

1. Analyse and produce vegetation cover change images from high resolution satellite imagery (2009 to 2013);
2. Analyse vegetation cover changes over DHI from Landsat imagery (1990 to 2013);
3. Provide a report with statistical analysis of vegetation change from analysis of high resolution imagery and Landsat imagery; and
4. Conduct field validation of vegetation cover change (April 2014).

The analysis of high resolution imagery (objective 1) was not completed in 2013/14. The focus in this period was compilation and analysis of the Landsat data. Analysis of the high resolution data will be carried out in 2014/15.

Achieving the 2013/14 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.

Satellite imagery utilised

Satellite imagery from the Landsat and Rapideye satellites is being utilised. The Rapideye program was launched in 2009 and is made up of a constellation of 5 satellites. Imagery is collected at 6.5 m pixel size, which is re-sampled to 5 m during rectification, across 5 spectral bands. These specifications result in the timely, cost effective capture of data at a regional scale. In this project Rapideye imagery, captured in 2009, 2011 and 2013 has been acquired. This imagery will be used to map and monitor changes to vegetation density/cover.

The Landsat series of satellites began capturing data in the 1970's with regular captures from 1988. Imagery is collected at 30 m pixel size across 7 spectral bands. Landsat data is a fundamental dataset which is used to monitor long term vegetation change globally. The Landsat archive has recently been made available to download free of charge from the United States Geological Survey (USGS). In this project, Landsat imagery, from 1988 to present, is being used to map and monitor changes to vegetation cover.

2. Methods

The methodology used to monitor vegetation cover at monitoring point plots is adapted from Zhu et al., (2012) and Gove et al., (2013). Zhu et al., (2012) used all available Landsat imagery to detect forest disturbance at high temporal frequency. While Gove et al., (2013) demonstrated the utility of using control charts as a means of detecting shifts in time series data. The analysis technique involved plotting vegetation cover values from all available Landsat imagery for a site and applying the Cumulative Sum (cusum) test (Gove et al., 2013). The 1988 to 2008 period was used as a baseline. Statistically significant changes in vegetation cover above or below those in the baseline period can

then be detected. This technique was also utilised to produce a spatial representation of significant vegetation cover change. The cause of significant change can then be attributed by field validation.

All Landsat imagery covering Dirk Hartog Island (scene 115/078, Figure 1) available for download from the USGS from 1988 to 2014, with less than 30% cloud cover, was acquired (385 images). The imagery was corrected for variable sun angle and distance using CSIRO software "Sun_Correct" (Wu and Danaher, 2001).

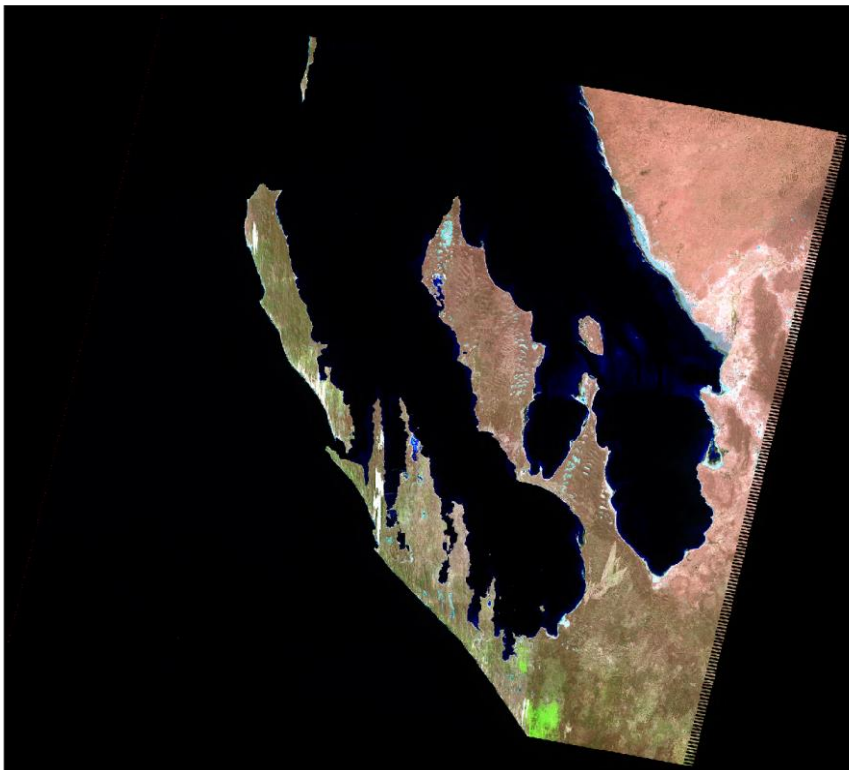


Figure 1: Landsat image extent for scene location 115/078.

Vegetation cover estimates (van Dongen and Zdunic, 2012) for 32 monitoring sites were extracted from the time series Landsat imagery. Of these 22 were installed by DEC in 2006 and 3 were installed by the Department of Agriculture. Field validation at 17 of these sites and an additional 7 sites was conducted. The location of the additional 7 sites was selected in areas where the Landsat imagery indicated that significant in change in vegetation cover since destocking had occurred (Figure 2).

3. Results

A map showing areas of significant vegetation change to 2014 based on a 1988 to 2008 baseline are shown in Figure 2. 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. The location photo point monitoring sites are also shown as are monitoring sites added in 2014.

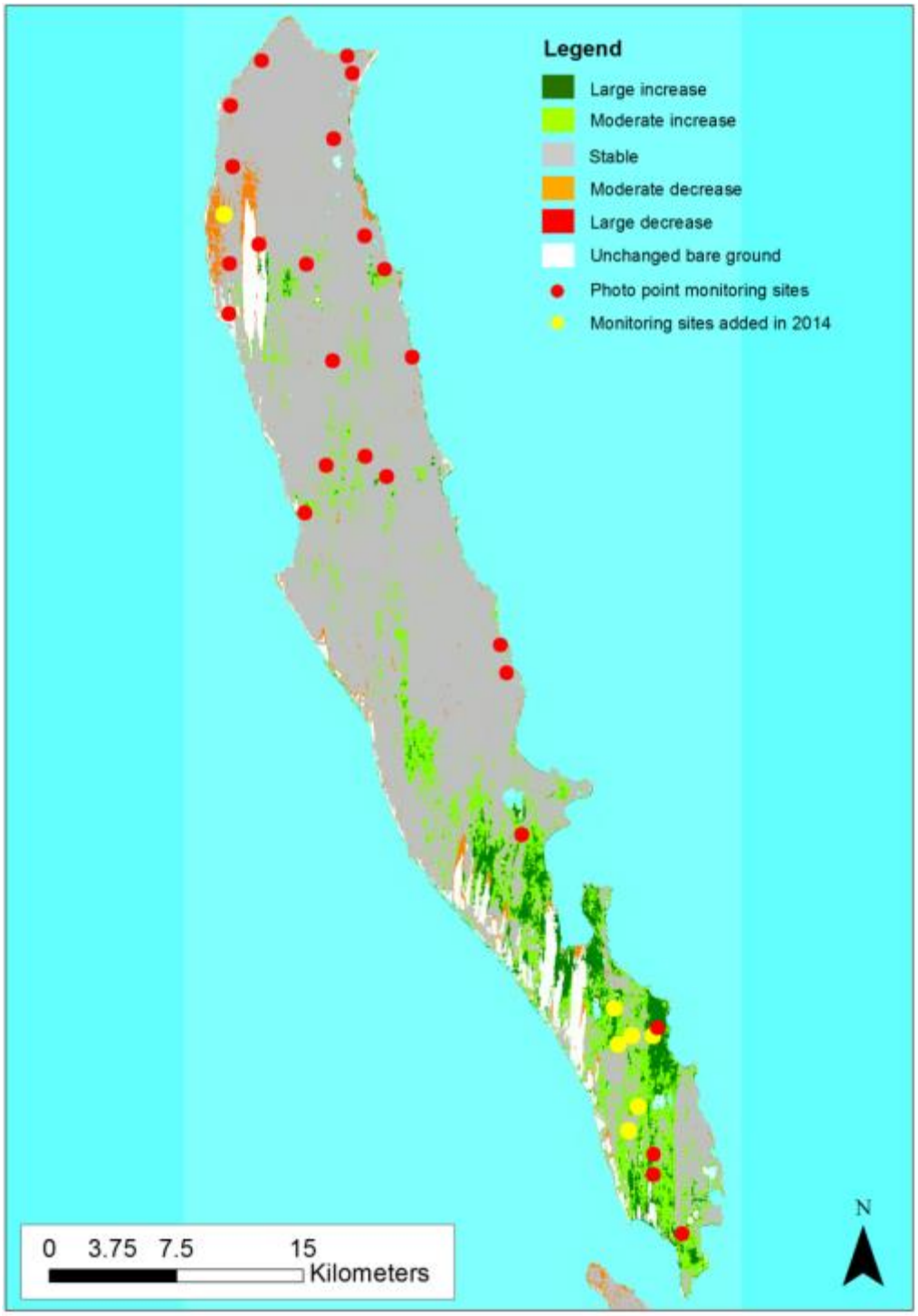


Figure 2: Significant vegetation cover change to 2014 based on 1988 to 2008 baseline, with photo point monitoring sites and sites added in 2014 marked.

Area calculations for the classes in Figure 2 are shown in Table 1. The majority of DHI (74%) recorded no significant increase in vegetation cover since destocking, while 20% recorded either a moderate or significant increase. Only 2% recorded a decrease.

Table 1: Area of change classes.

change class	area (sq km)	%
large increase	33.9255	6%
moderate increase	84.4821	14%
stable	454.7619	74%
moderate decrease	13.3515	2%
large decrease	0	0%
bare	24.7599	4%

Time series plots

Monitoring point 34 is shown below as an example. All other site information is shown in the appendix. Figures 3 and 4 show evidence of recent increases in vegetation cover. Figure 3 shows propagules from a *Triodia* sp. extending into an area which is likely to have been used as a pathway for livestock. Figure 4 shown an acacia seedling.

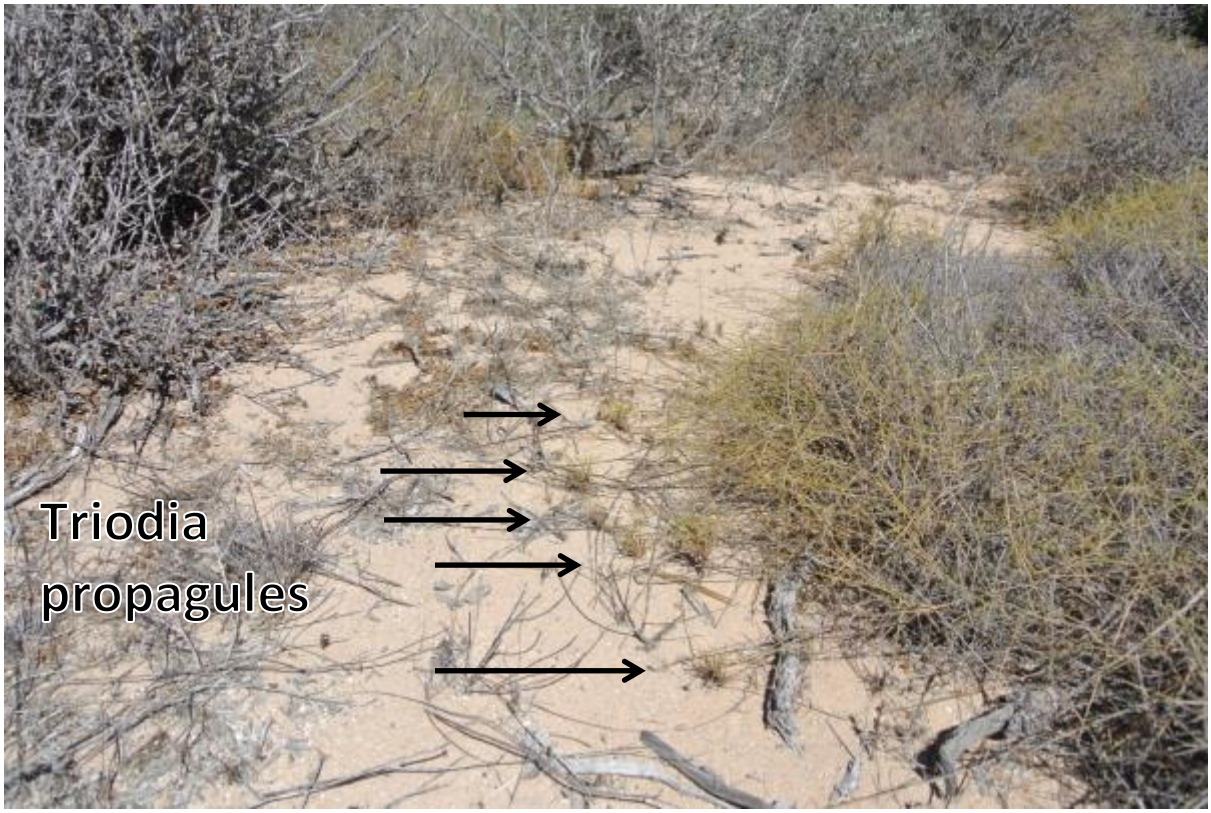


Figure 3: A site photo from monitoring site 34 (April 2014). Propagules can be seen extending from the *triodia* sp.

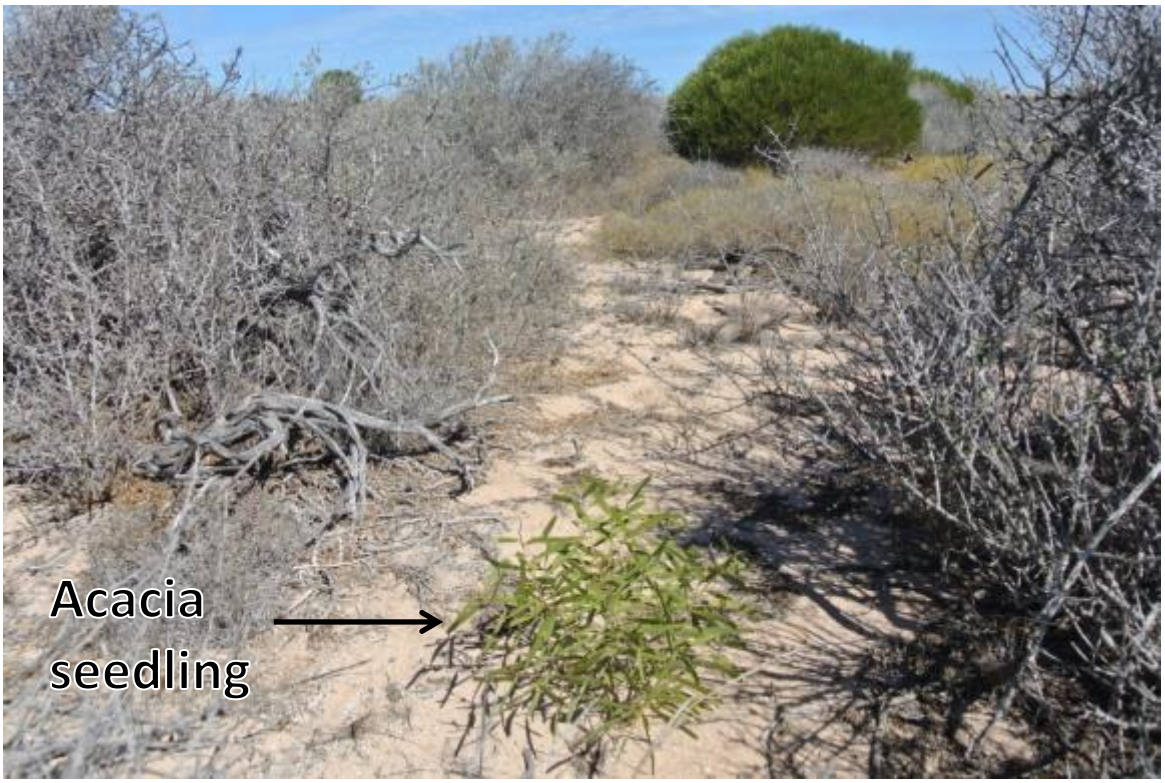


Figure 4: A site photo from monitoring site 34 (April 2014) of an acacia seedling.

The Landsat time series data can be statistically analysed to determine whether an increase in vegetation cover occurred at this site following destocking. Landsat time series data is plotted alongside rainfall data in Figure 5. A model can be fitted to the time series data within the baseline period (1988 to 2008). This modelled baseline is shown in red in Figure 6. Following 2008 the actual cover values move consistently above the modelled baseline values. This consistent deviation causes the cusum values (also Figure 6) to move above the 3 standard deviation control line. This indicates that there has been a significant shift in vegetation cover above the pre-destocking baseline.

In summary, the Landsat data shows a statistically significant increase in vegetation cover at site 34 since destocking and observations from the field indicate that this increase can be attributed to native vegetation.

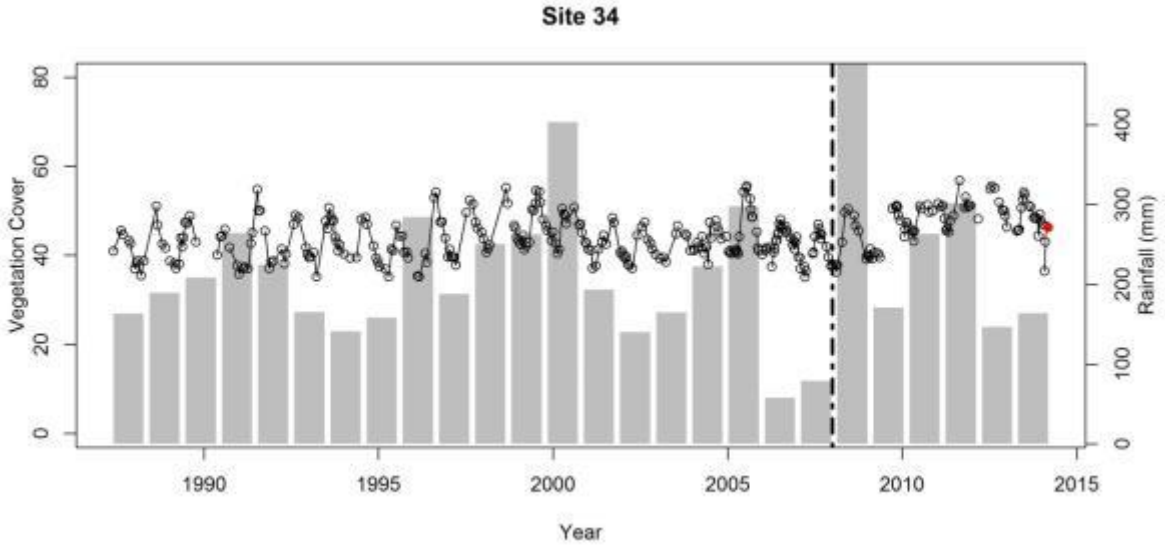


Figure 5: Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and the red point indicated when the field observation was made.

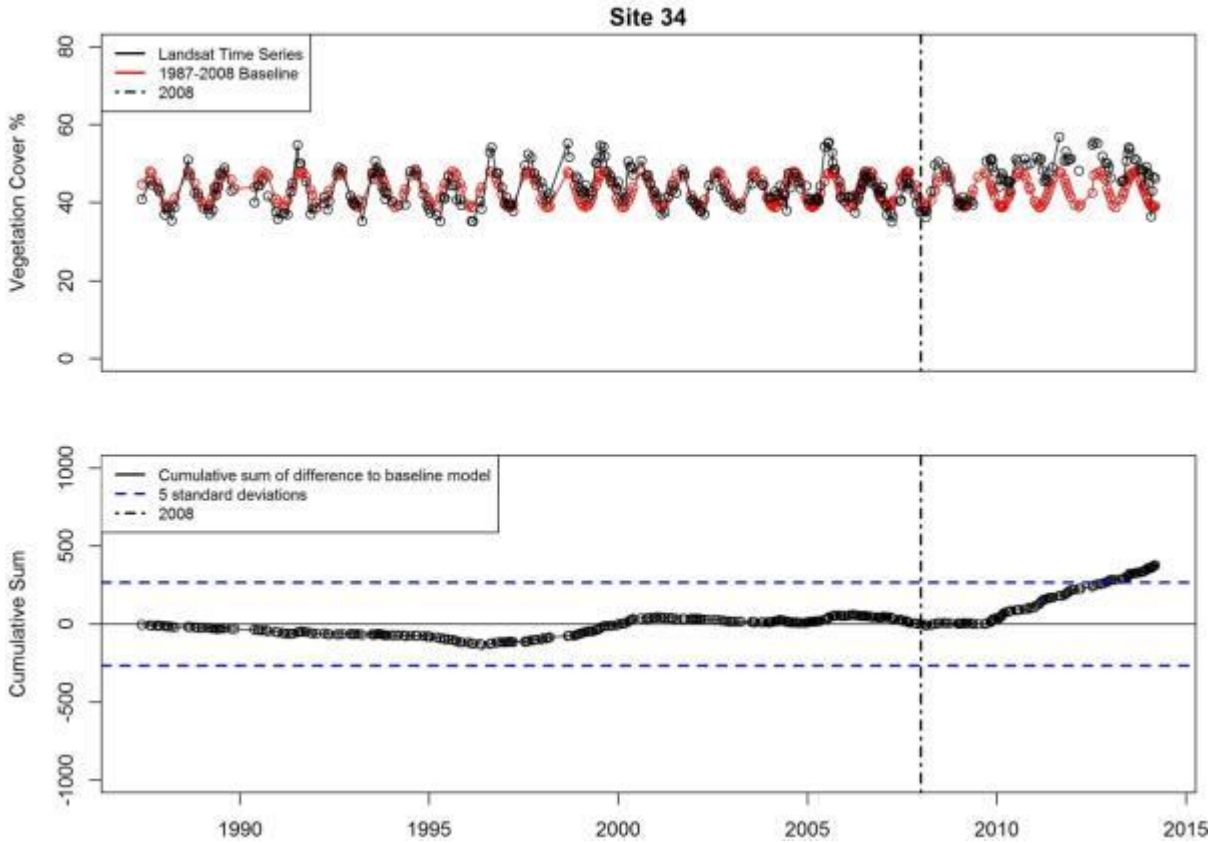


Figure 6: Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom). The dashed vertical line marks the end of the baseline period (2008).

A summary of the time series plots is shown in Table 2.

Table 2: Summary of monitoring point results.

			cross control line	
	number	**no change**	**increase**	**decrease**
photo point established in 2006	22	15	7	0
WARMS monitoring site	3	2	1	0
Monitoring site added 2014	6	1	4	1
total	31	18	12	1
		58%	39%	3%

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, DPaW). Photo point photos are shown. Time series graphs of canopy cover from 1988 to 2014 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.

4. References

Van Dongen, R., and Zdunic, K. (2012). Dirk Hartog Island Aerial Cull and Vegetation Trend Analysis – 2012 (Department of Environment and Conservation).

Gove, A.D., Sadler, R., Matsuki, M., Archibald, R., Pearse, S., and Garkaklis, M. (2013). Control charts for improved decisions in environmental management: a case study of catchment water supply in south-west Western Australia. Ecological Management & Restoration 14, 127–134.

Wu, X., and Danaher, T. (2001). Radiometric Calibration Methods and Software for Landsat MSS and TM Imagery.

Zhu, Z., Woodcock, C.E., and Olofsson, P. (2012). Continuous monitoring of forest disturbance using all available Landsat imagery. Remote Sensing of Environment.

5. Appendix

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 from 2006 to 2014.


May 2006


May 2007


September 2008


October 2009

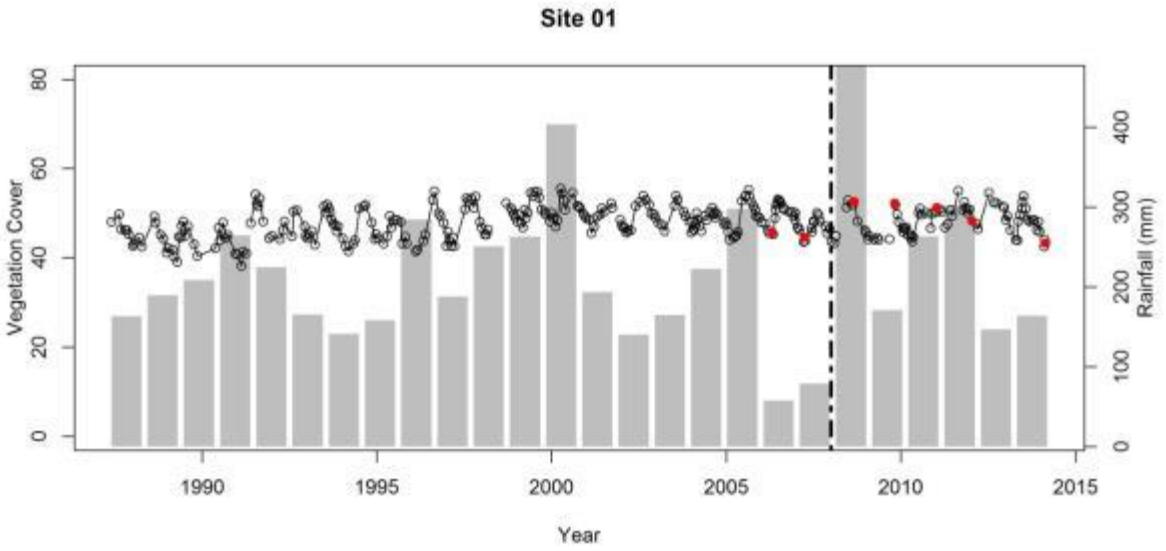

January 2011


January 2012

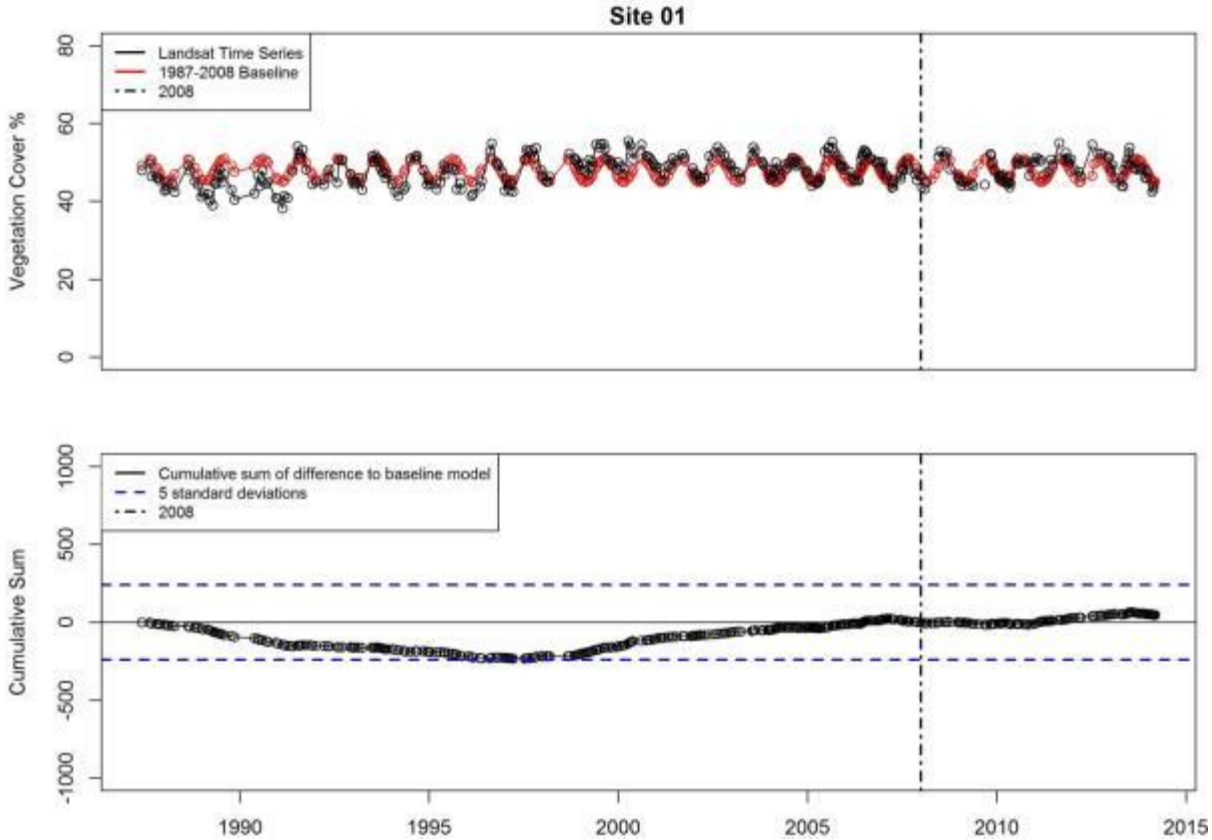

April 2014

Vegetation cover time series analysis:

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



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 5 years or if a significant deviation from baseline vegetation cover are observed (3 standard deviation lines on cusum chart are breached).

Site 2
Description:

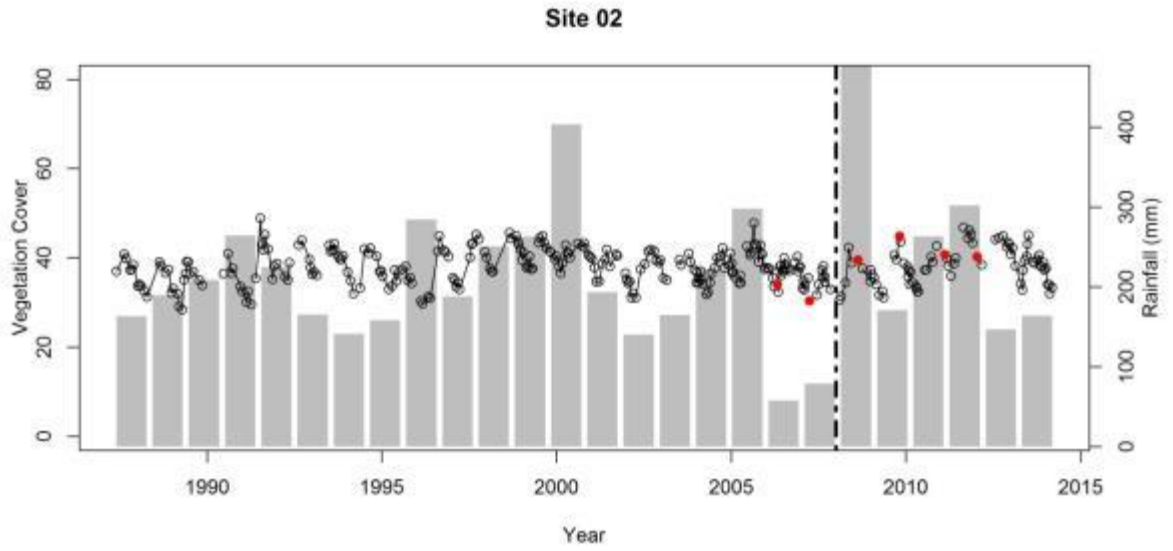
Not visited in 2014

Photo point photographs of site 2 from 2006 to 2012.

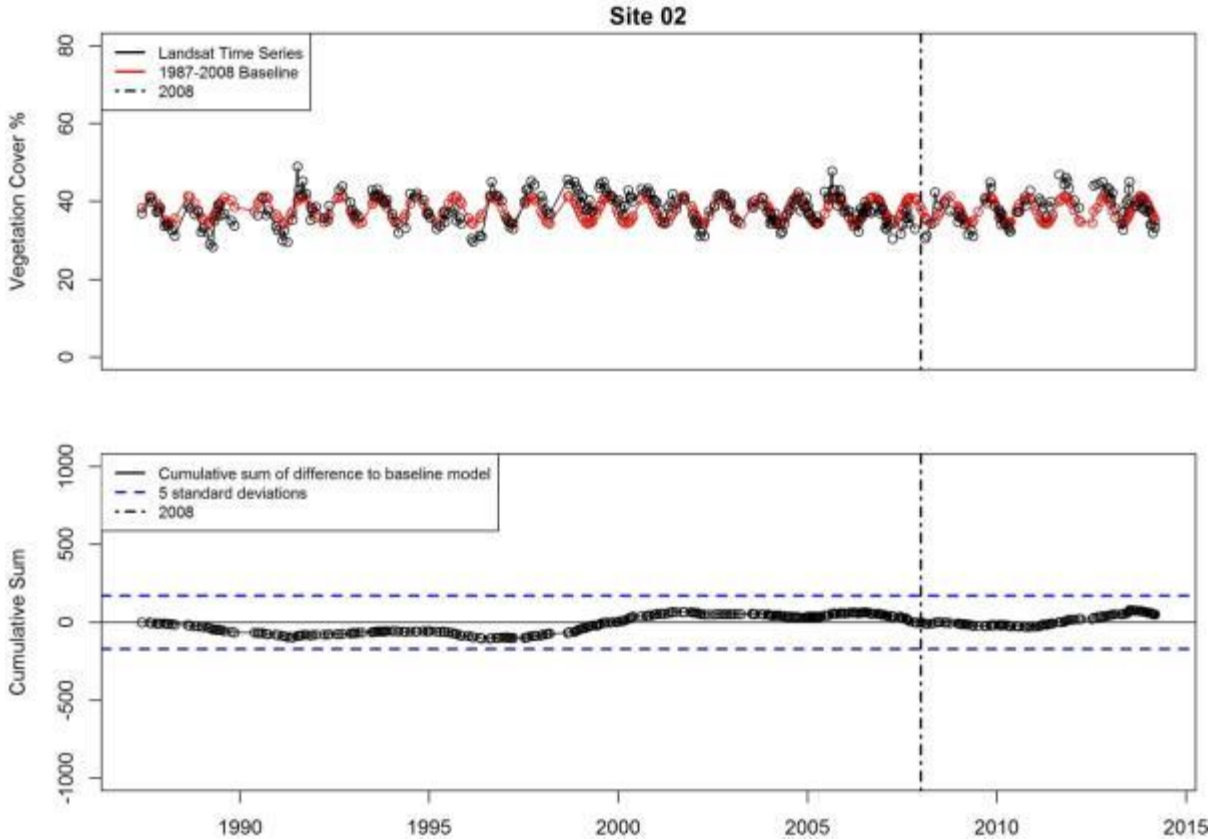
 May 2006	 May 2007	 September 2008
 October 2009	 January 2011	 January 2012

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 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 5 year 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 from 2006 to 2014.


April 2006


May 2007

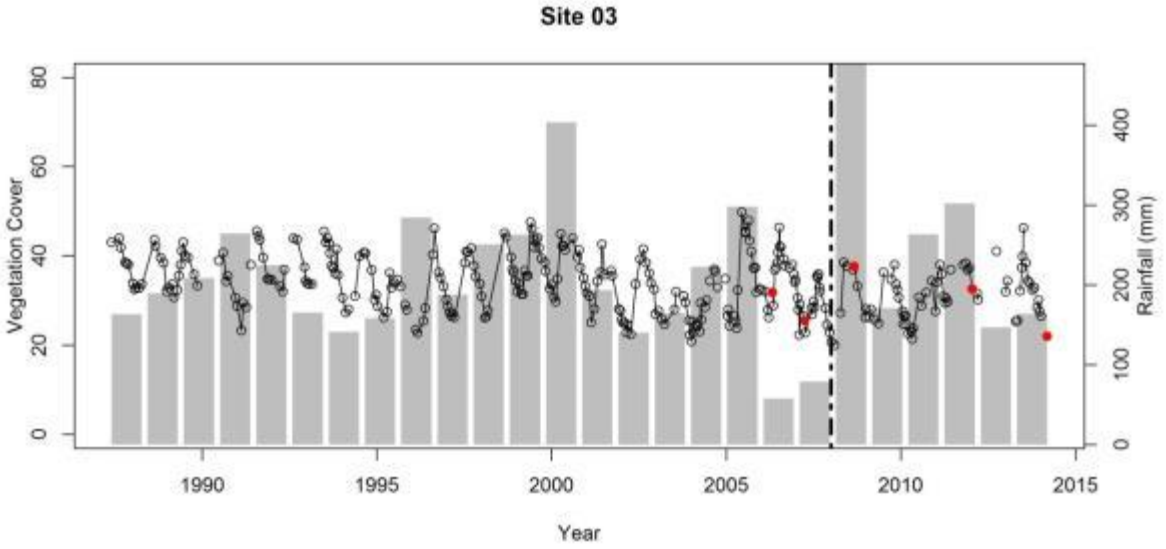

September 2008


January 2012

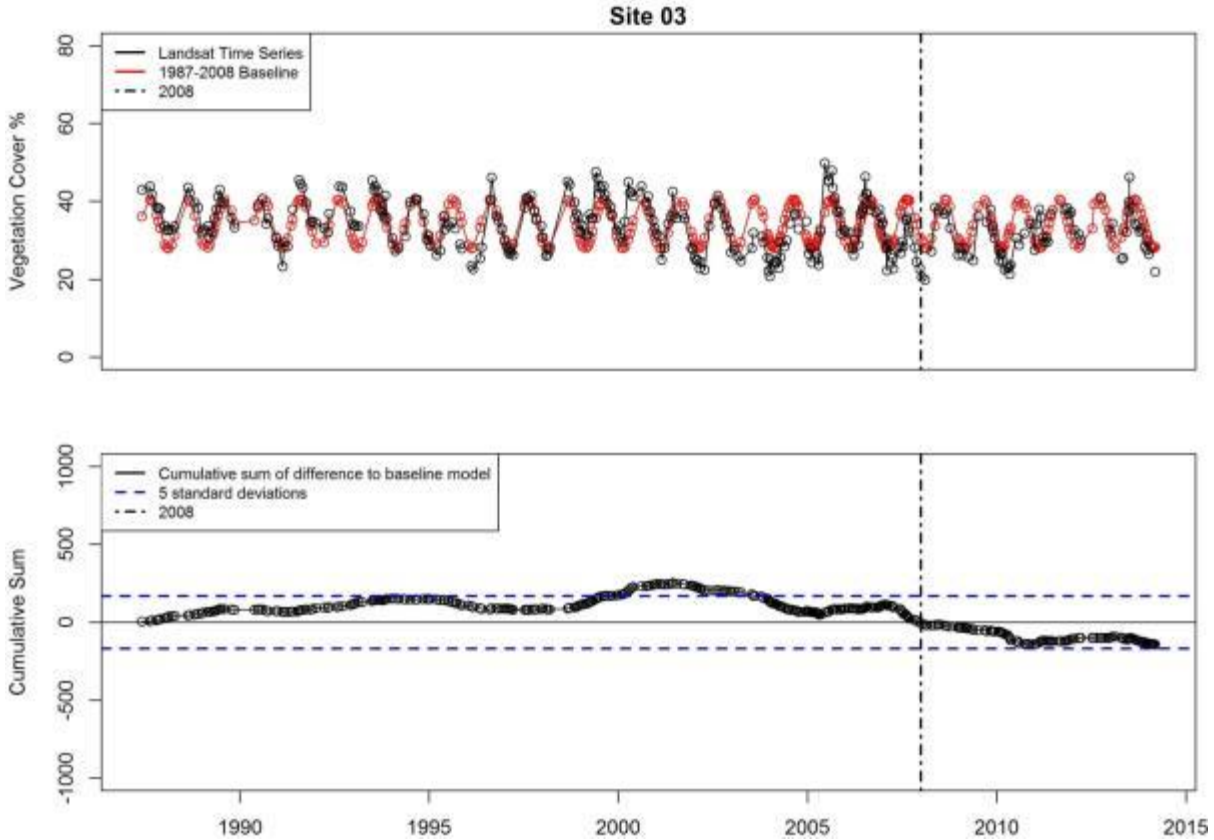

April 2014

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 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 5 year or if a significant deviation from baseline vegetation cover are observed (3 standard deviation lines on cusum chart are breached).

Site 4
Description:
Tall Open Shrubland (2-10% cover) 2-2.5 metres of Diplolaena grandiflora with Acacia ? scxlerosperma(dead), Alectryon oleifolium and Rhagoda sp.

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

Prostrate to decumbent shrubland (10-30%) of Threlkeldia diffusa

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

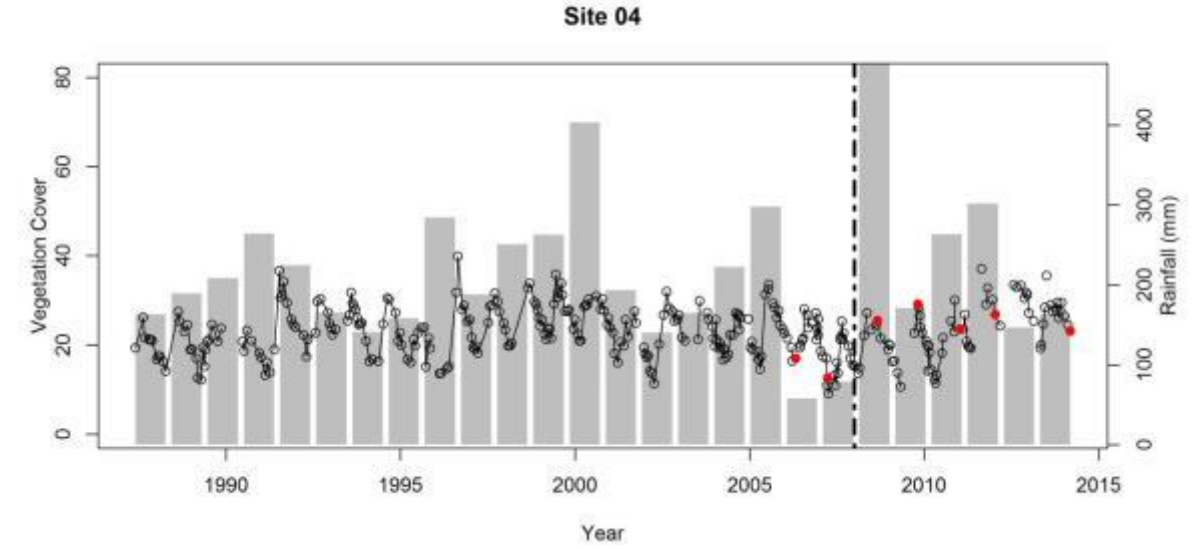
Over scattered herbs and low shrubs (<2% cover) of Angianthus tomerntosus, Podotheca gnaphaloides, *Urospermum picroides and *Brassica tournefortii.

Photo point photographs of plot 4 from 2006 to 2014.

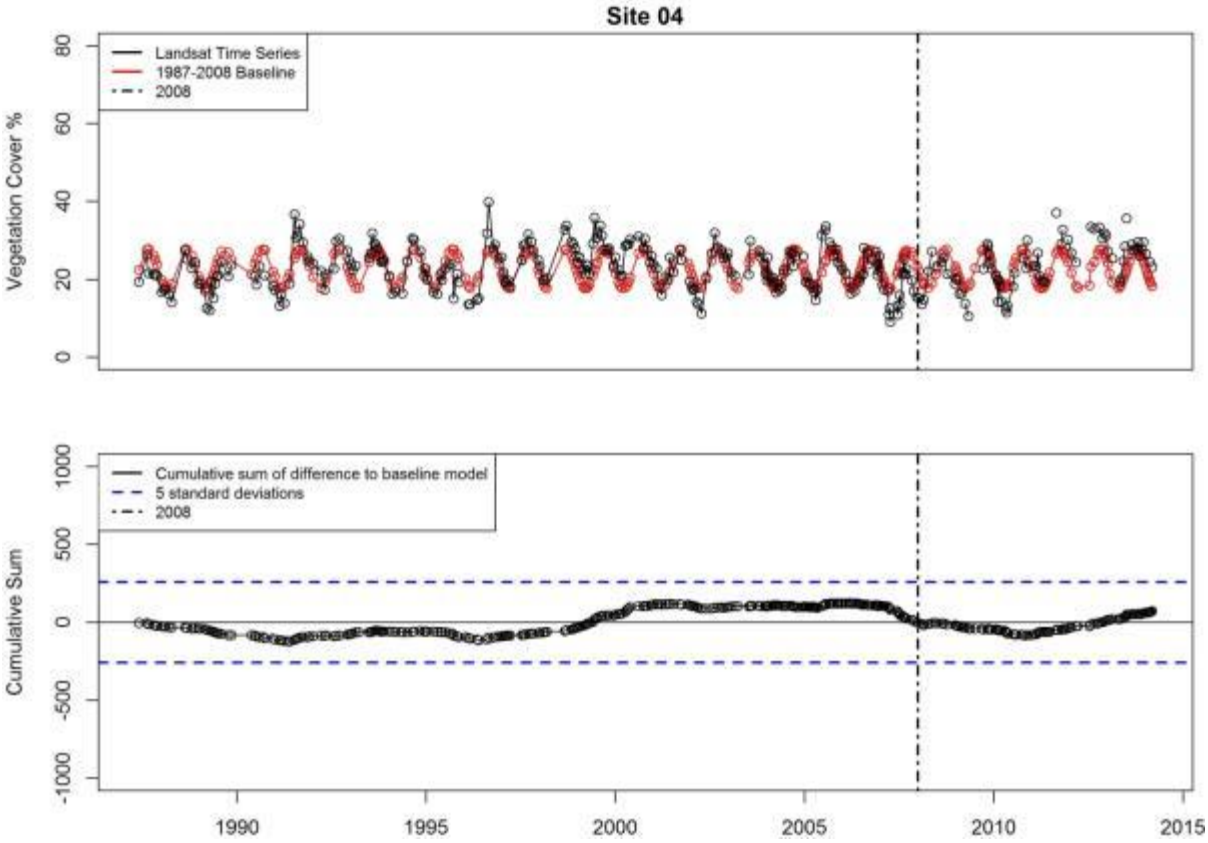
 May 2006	 May 2007	 September 2008
 October 2009	 January 2011	 January 2012
 April 2014		

Vegetation cover time series analysis:

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



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 5 year or if a significant deviation from baseline vegetation cover are observed (3 standard deviation lines on cusum chart are breached).

Site 5
Description:

Site not visited in 2014.

Photo point photographs of plot 5 from 2006 to 2012.


May 2006


May 2007 (peg was reinstalled)


September 2008

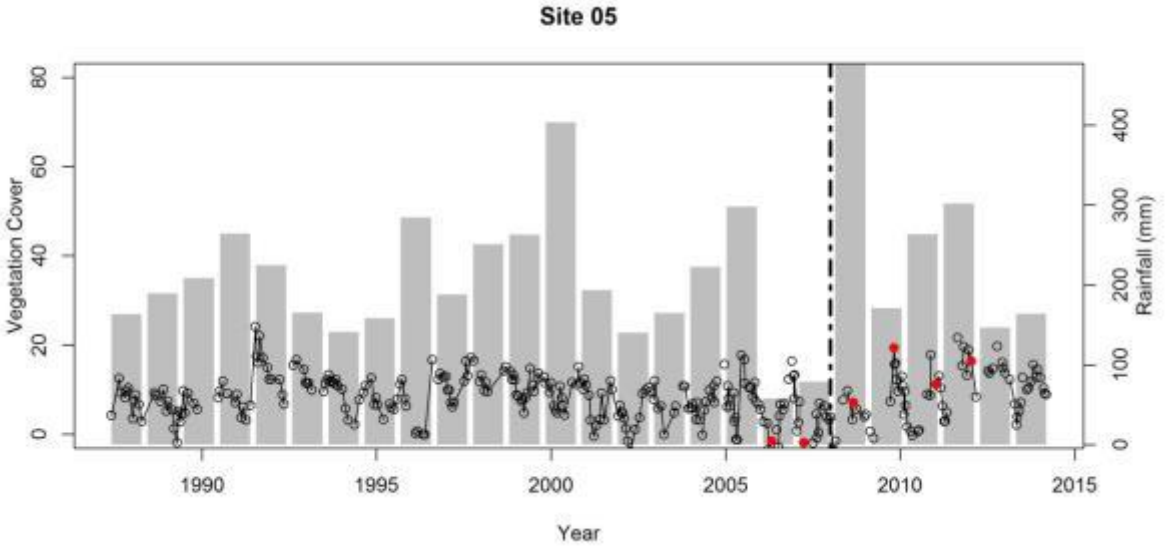

October 2009


January 2011

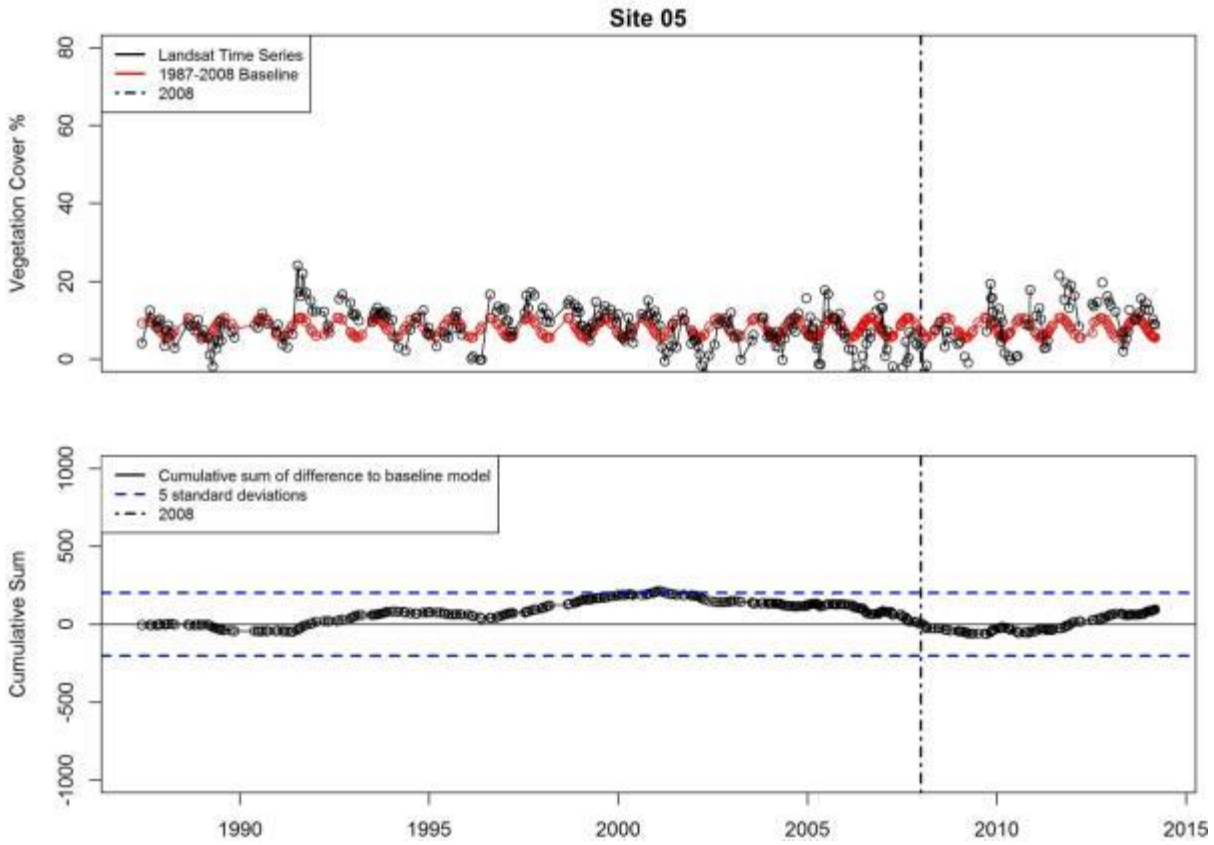

January 2012

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 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 5 year or if a significant deviation from baseline vegetation cover are observed (3 standard deviation lines on cusum chart are breached).

Site 6
Description:

Photo point photographs of plot 6 from 2006 to 2012.


May 2006


May 2007


September 2008

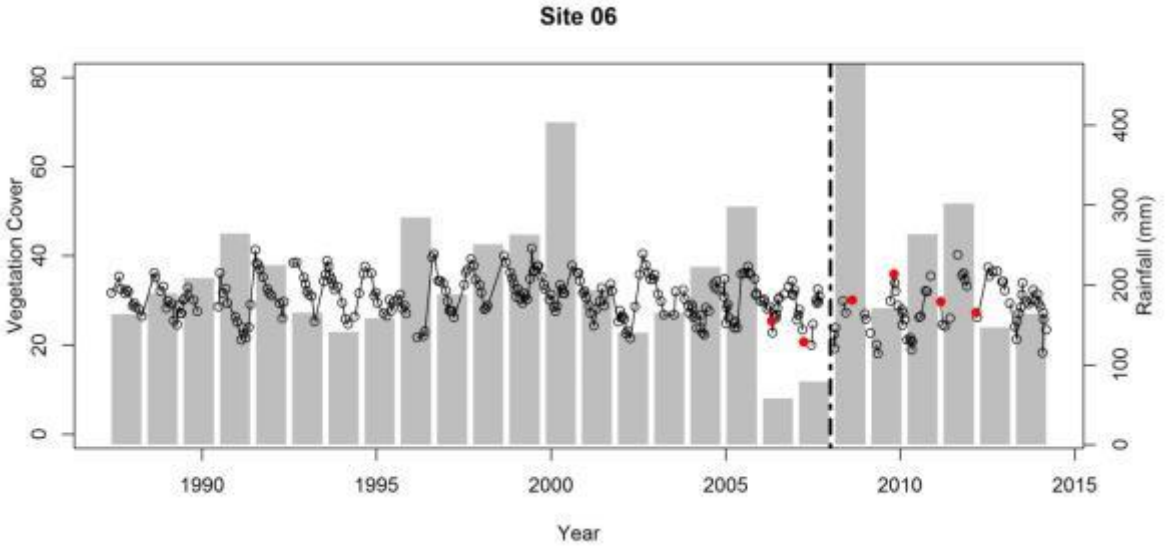

October 2009


January 2011

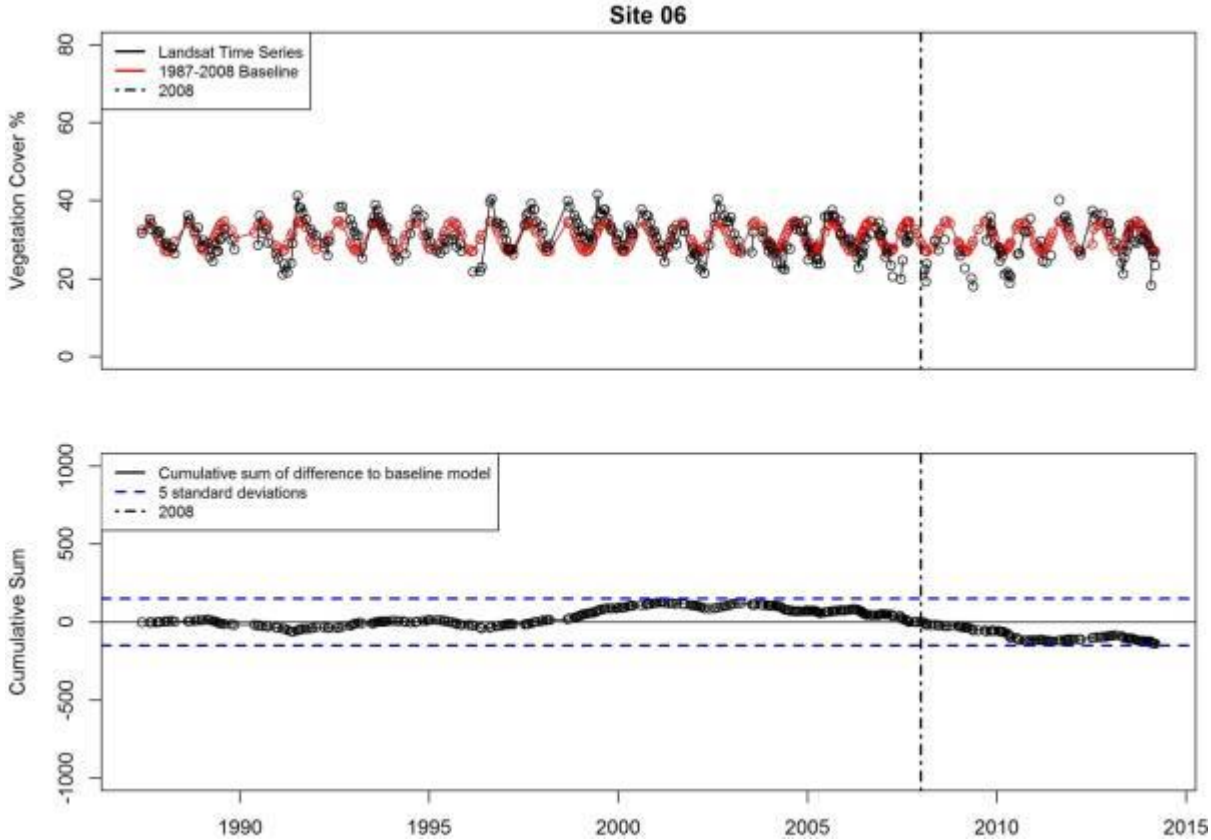

January 2012

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 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 5 year or if a significant deviation from baseline vegetation cover are observed (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 ?crassifolia and Threlkeldia diffusa

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

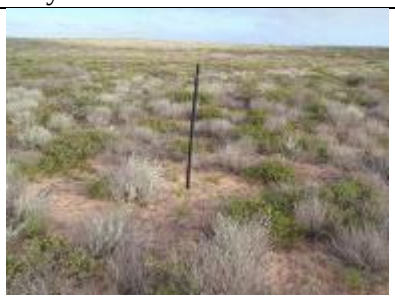
Photo point photographs of plot 7 from 2006 to 2014.


May 2006


May 2007


September 2008


October 2009

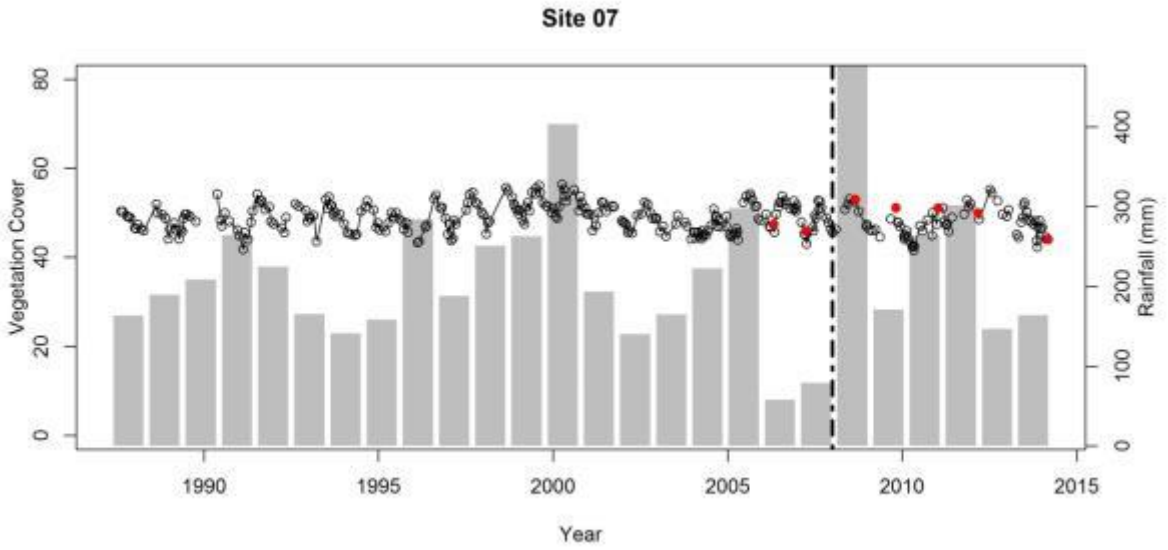

January 2011


January 2012

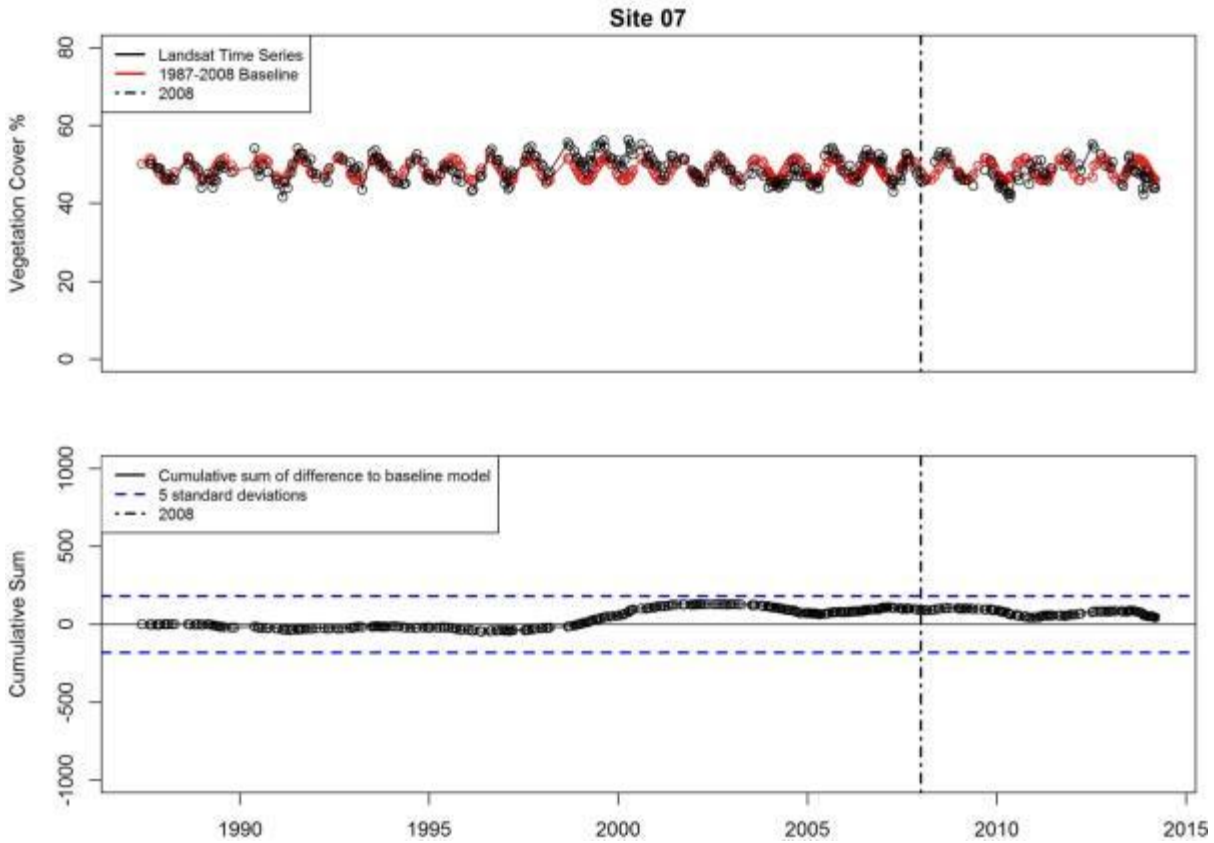

April 2014

Vegetation cover time series analysis:

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



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 5 year or if a significant deviation from baseline vegetation cover are observed (3 standard deviation lines on cusum chart are breached).

Site 8
Description:

Site not visited in 2014.

Photo point photographs of plot 8 from 2006 to 2012.


May 2006


May 2007


September 2008

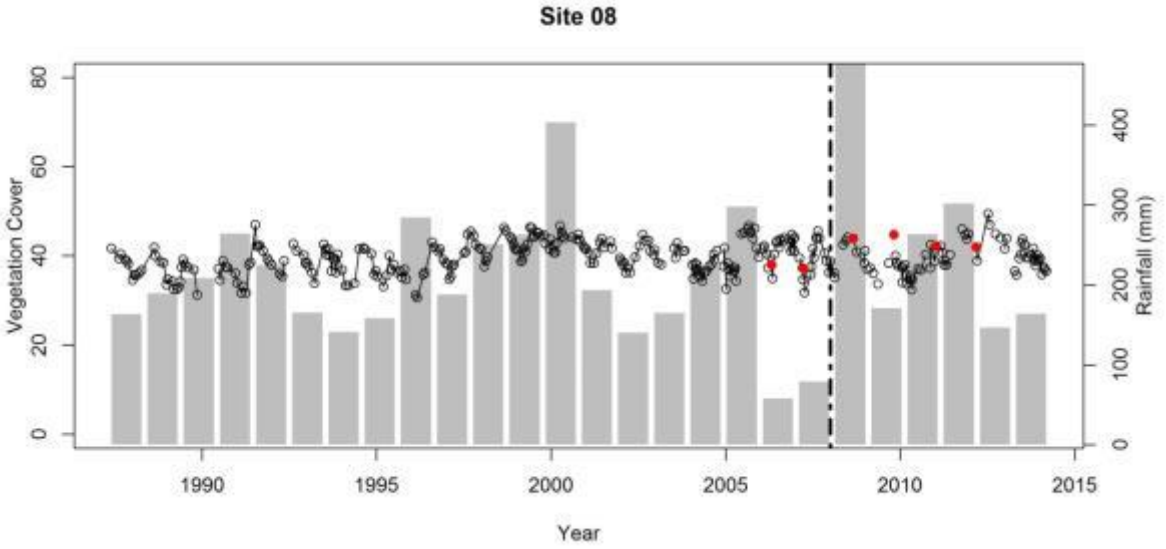

October 2009


January 2011

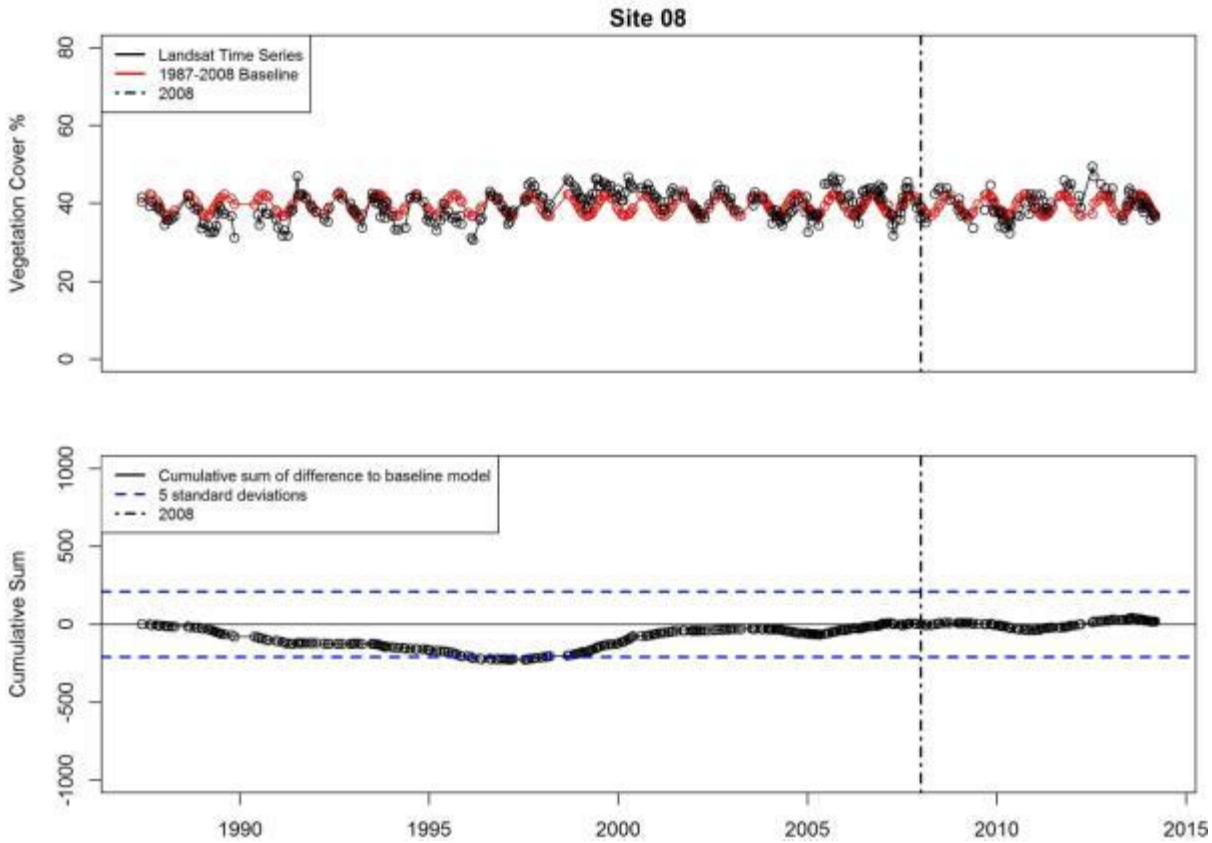

January 2012

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 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 5 year 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, ?fire)

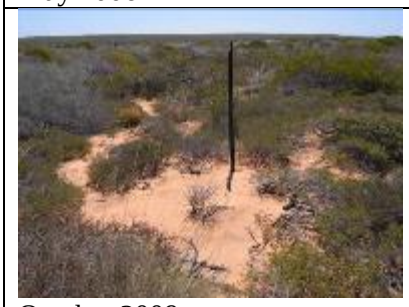
Note: Site of interest for long term monitoring as the upper stratum of Acacia has been lost with little sign of regeneration.

Photo point photographs of plot 9 from 2006 to 2014.


May 2006


May 2007


September 2008


October 2009

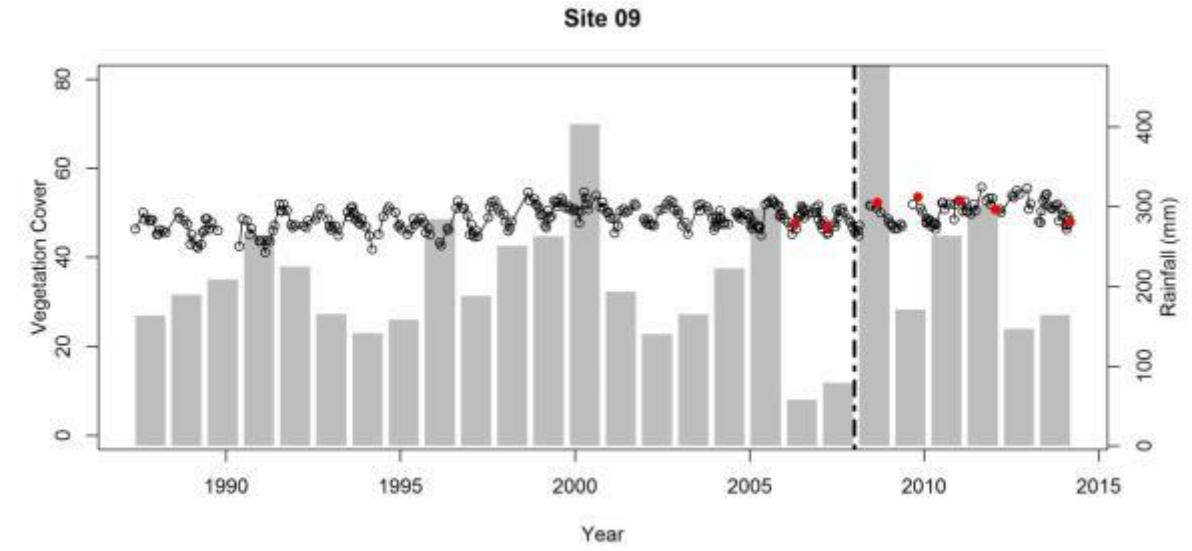

January 2011


January 2012

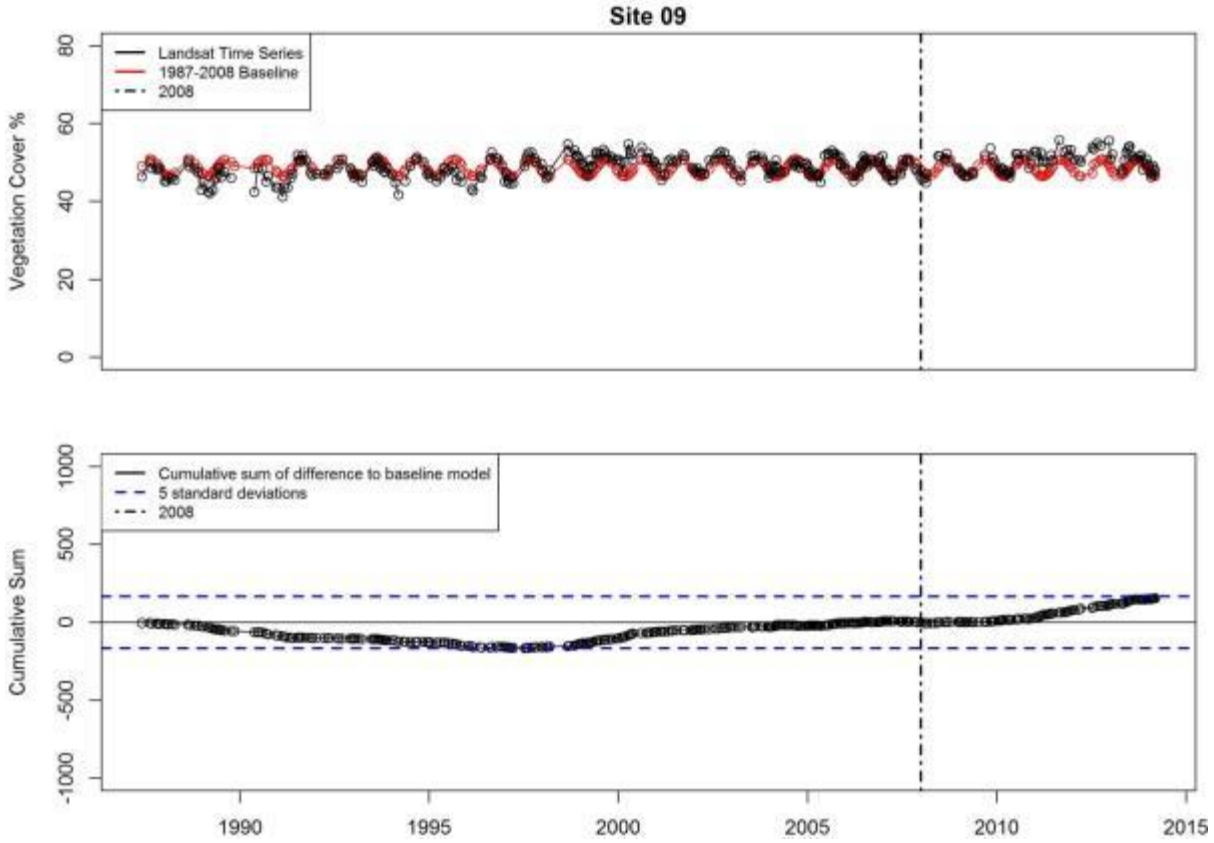

April 2014

Vegetation cover time series analysis:

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



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 5 year 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

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

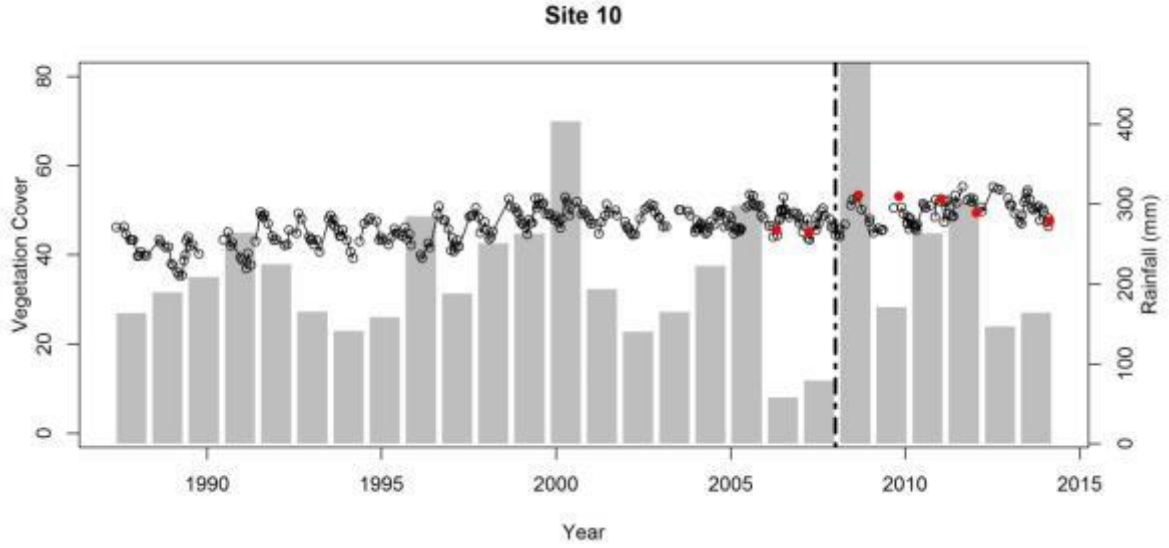
(Note at this site there was a tall layer of Acacia coriacea and Acacia tetragonophylla, now mostly dead, little evidence or regeneration, ?fire)

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

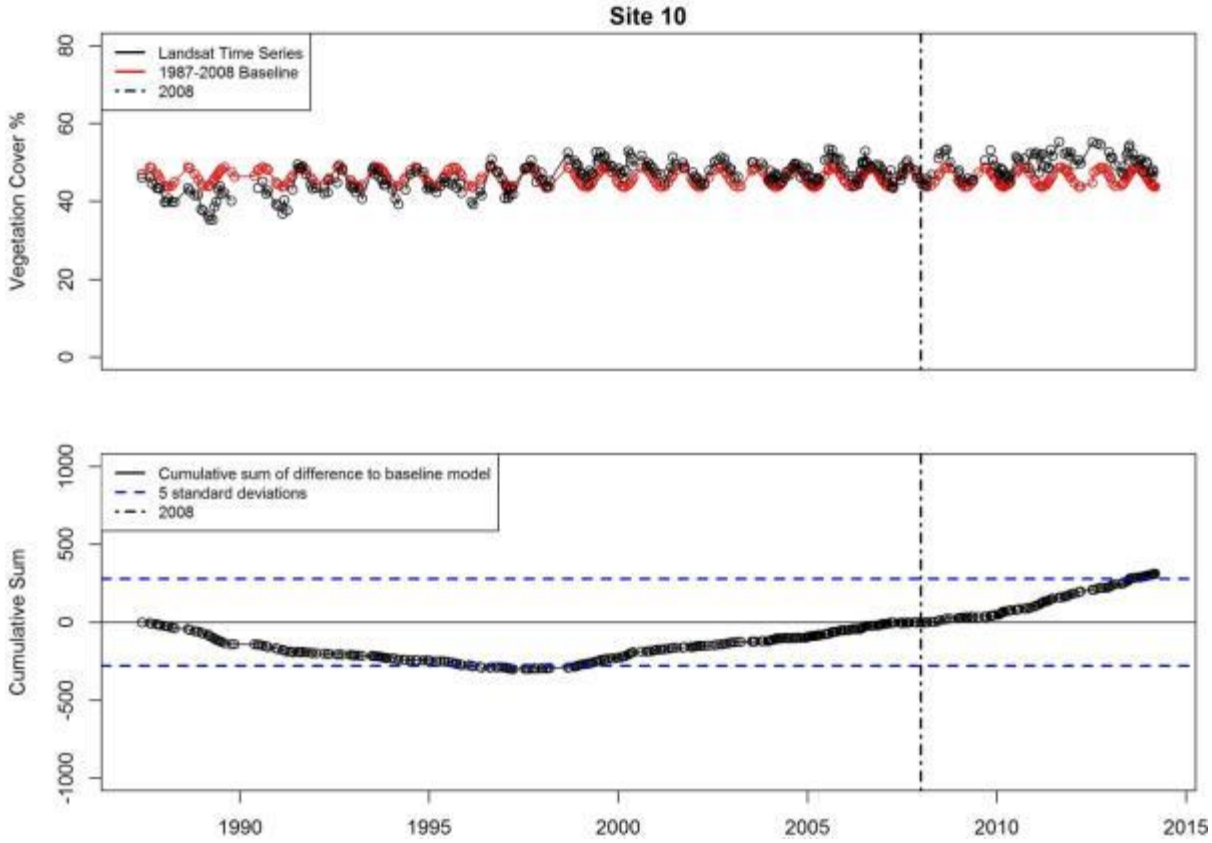
Photo point photographs of plot 10 from 2006 to 2014.

<table>
<tr>
<td> 
May 2006 (view angle inconsistent)</td>
<td> 
May 2007</td>
<td> 
September 2008</td>
</tr>
<tr>
<td> 
October 2009</td>
<td> 
January 2011</td>
<td> 
January 2012</td>
</tr>
<tr>
<td> 
April 2014</td>
<td></td>
<td></td>
</tr>
</table>

Vegetation cover time series analysis:
Control lines in the cusum chart are crossed in 2013. This is due to a continual upward trend in vegetation cover. The highest cover readings in both summer and winter have occurred since 2011. 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.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 2 years if upward trend in vegetation cover continues. Reassess baseline period in 2 years.

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 from 2006 to 2011.


May 2006


May 2007


September 2008

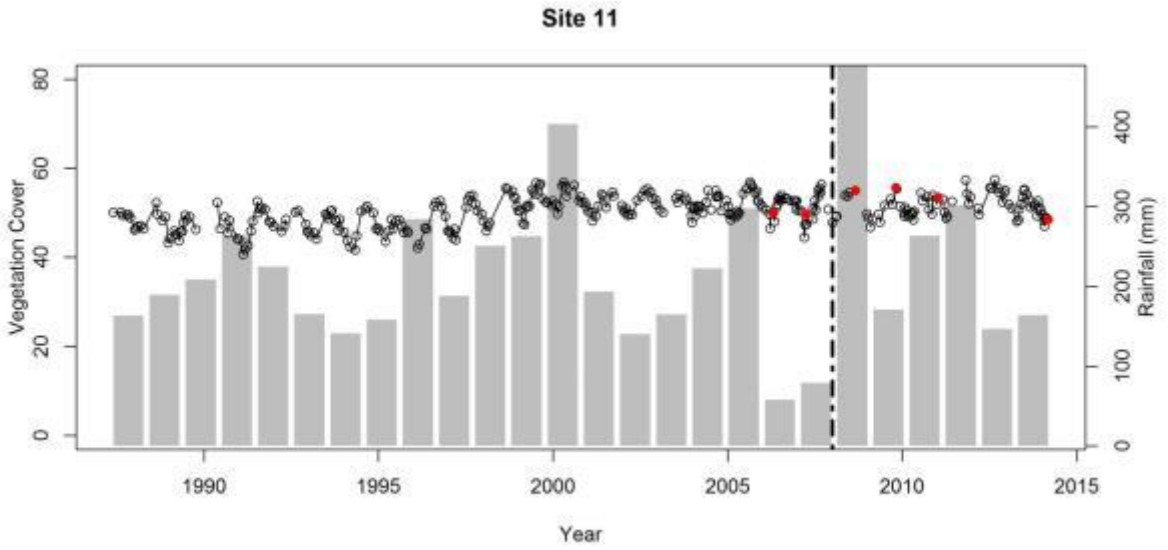

October 2009


January 2011

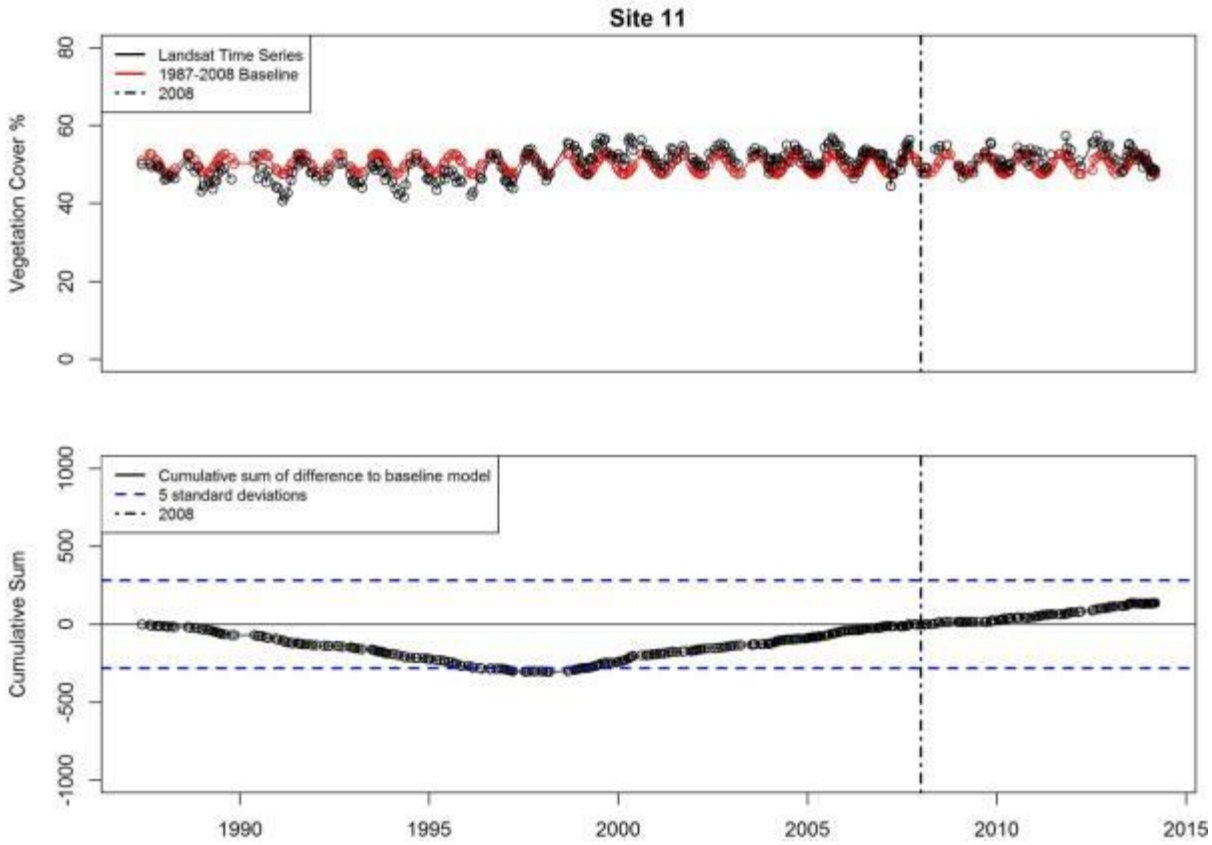

April 2014

Vegetation cover time series analysis:

No significant change in vegetation cover is evident in the time series. However the vegetation cover values appear to have an increasing trend.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 2 years if upward trend in vegetation cover continues. Reassess baseline period in 2 years.

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

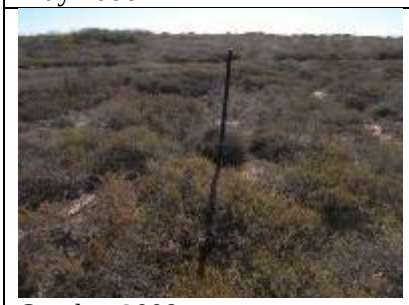
Over low hummock grassland (10-30 % cover) of Triodia plurinervata

Photo point photographs of plot 12 from 2006 to 2014.


May 2006


May 2007


September 2008


October 2009

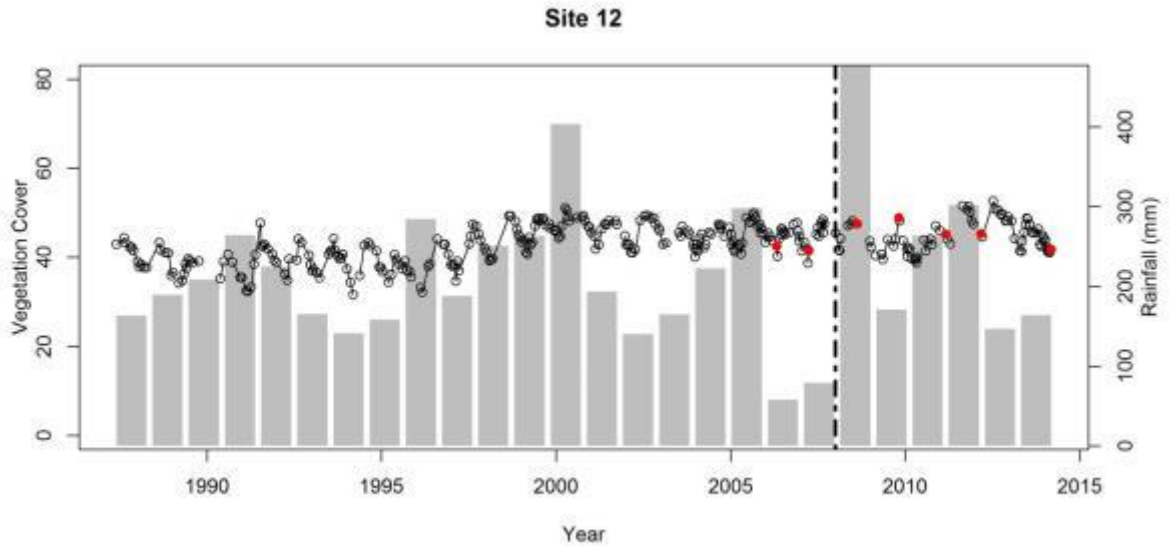

January 2011


January 2012

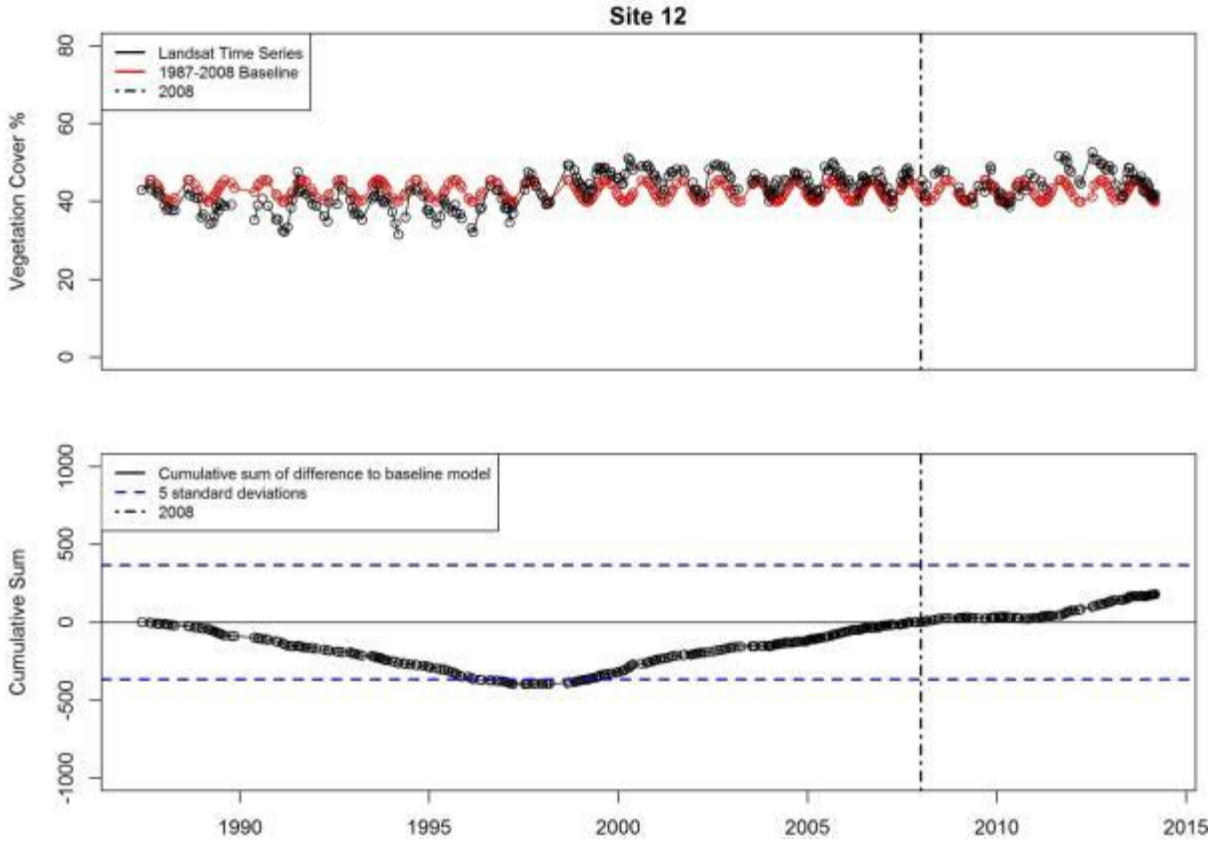

April 2014

Vegetation cover time series analysis:

No significant change in vegetation cover is evident in the time series. However the vegetation cover values appear to have an increasing trend.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 2 years if upward trend in vegetation cover continues. Reassess baseline period in 2 years.

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 from 2006 to 2014.


May 2006


May 2007 (peg reinstalled)


September 2008


October 2009

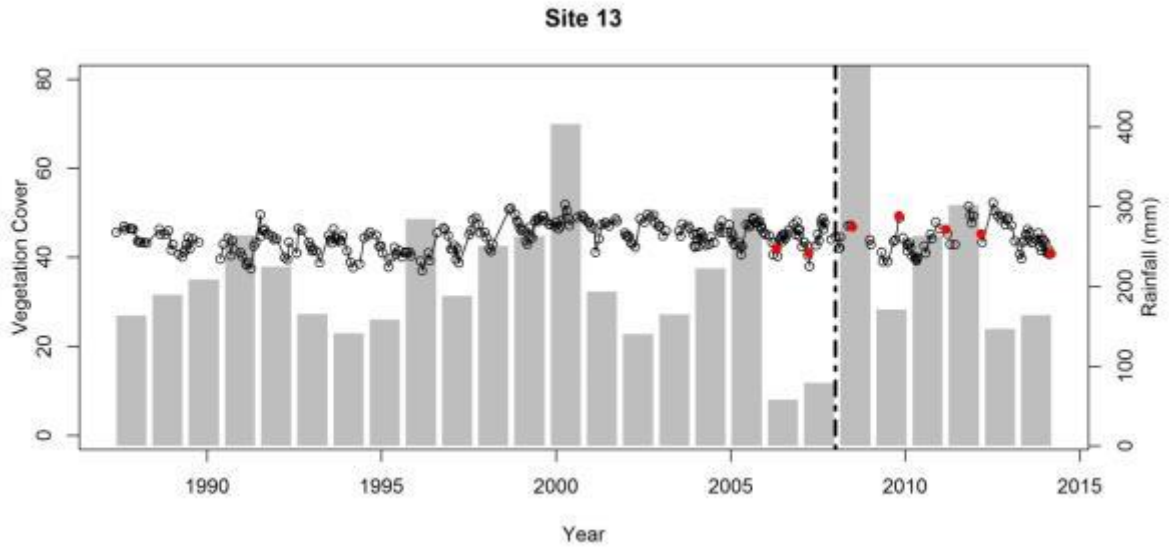

January 2011


January 2012

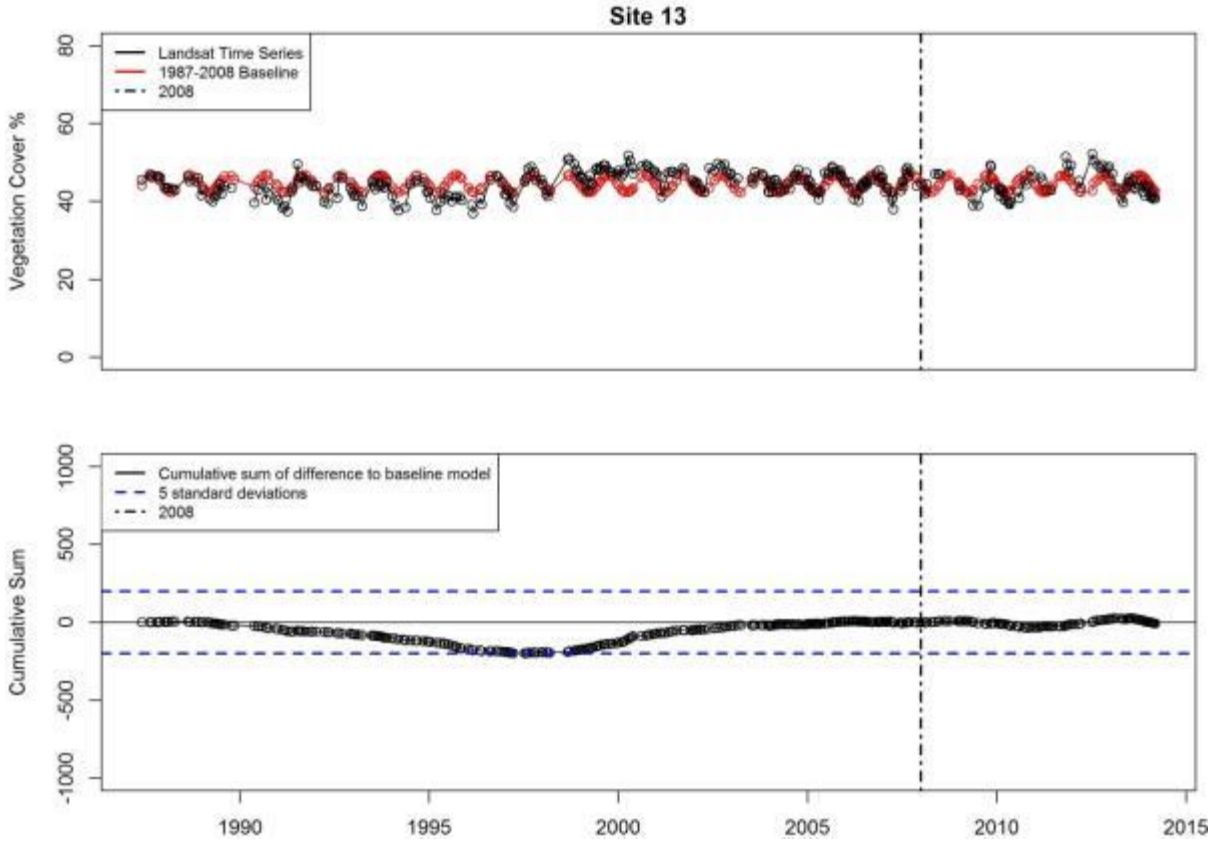

April 2014

Vegetation cover time series analysis:

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



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 5 year 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

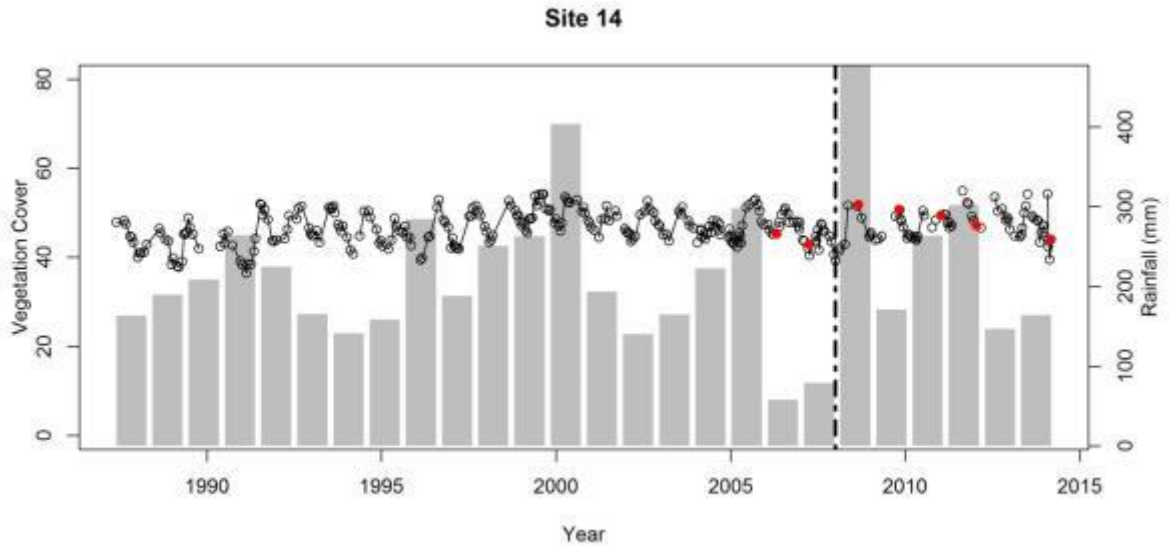
Over scattered herbs of Salsola australis and Angianthus tomentosus

Photo point photographs of plot 14 from 2006 to 2014.

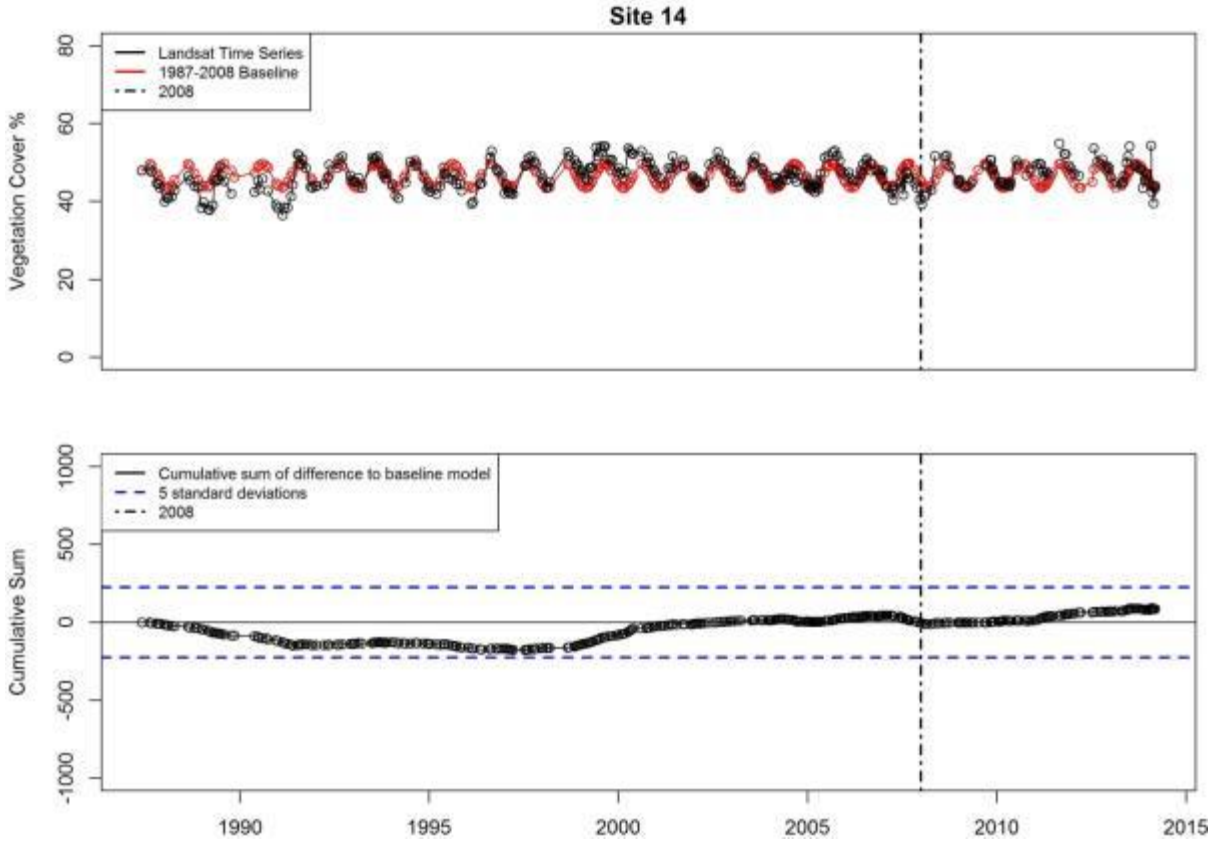
<table>
<tr><td> 
May 2006</td><td> 
May 2007</td><td> 
September 2008</td></tr>
<tr><td> 
October 2009</td><td> 
January 2011</td><td> 
January 2012</td></tr>
<tr><td> 
April 2014</td><td></td><td></td></tr>
</table>

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 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 5 years 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 Atriplex vesicaraia (70%) and Mirbelia viminea, Diplolaena grandiflora, Rhagodia baccata , Enchylaena tomentosa, Acacia tetragonophylla and Thryptomene baeckeacea

Over low grassland (30 % cover) of Triodia plurinervata

Over scattered herbs of Salsola australis and Angianthus tomentosus

Photo point photographs of plot 15 from 2006 to 2014.


May 2006

May 2007


September 2008

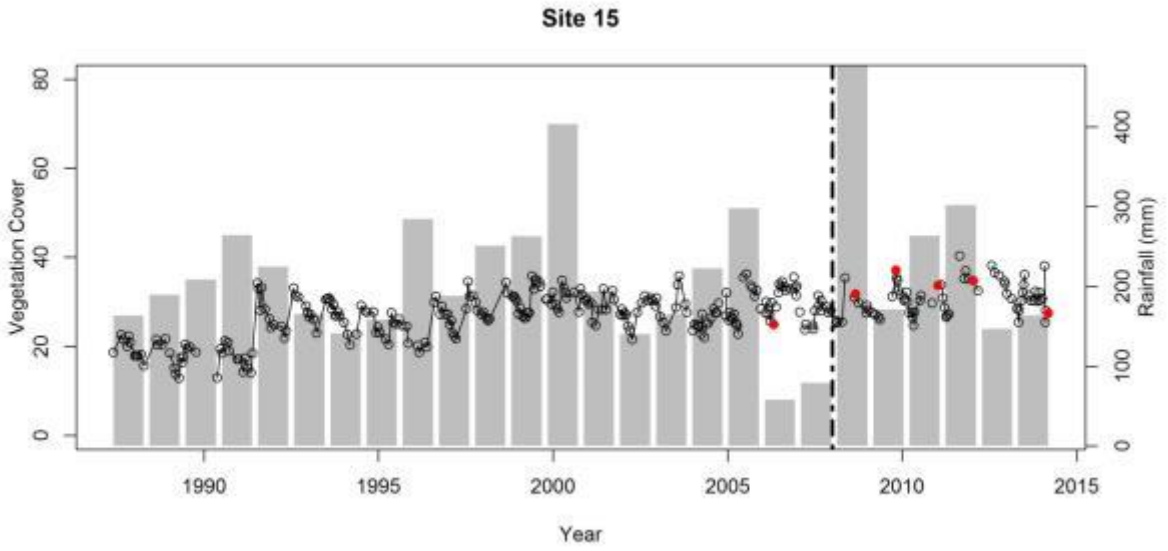

October 2009


January 2011

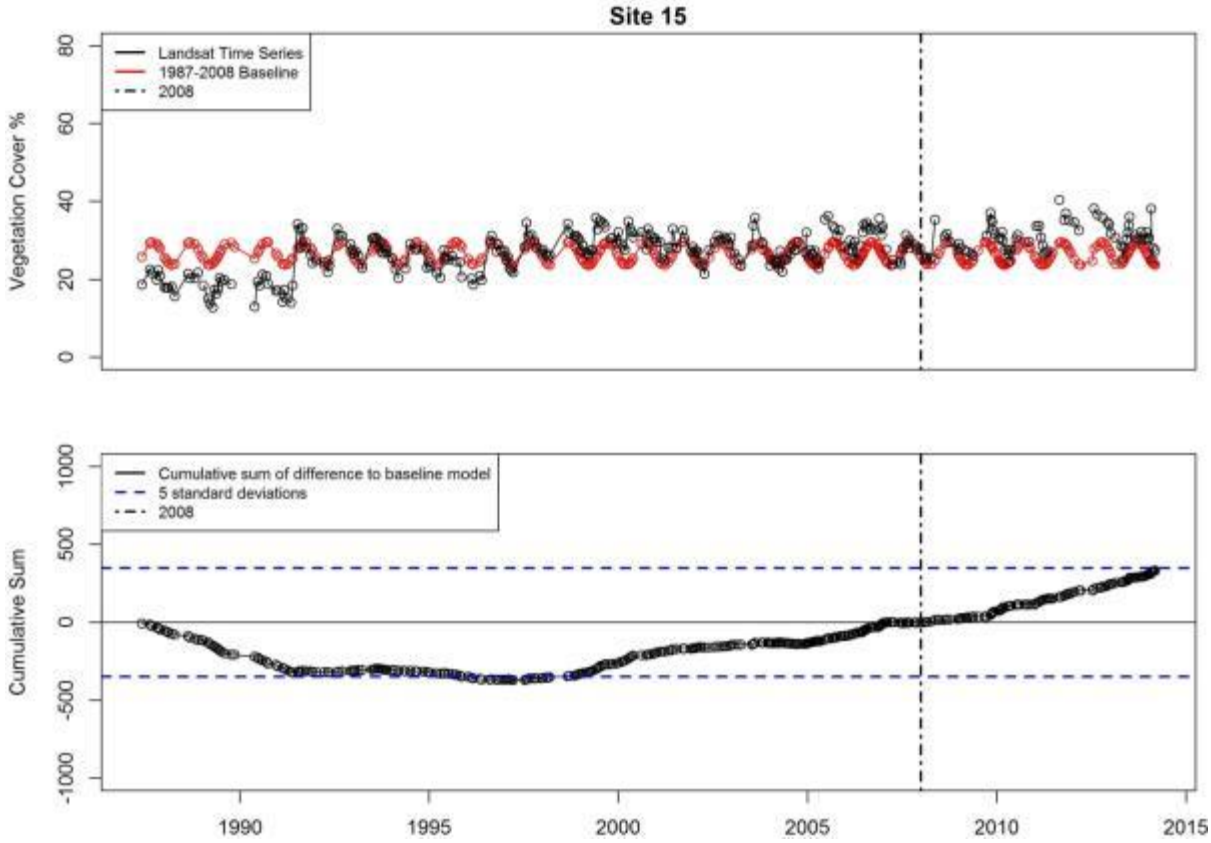

January 2012


April 2014

Vegetation cover time series analysis:
No significant change in vegetation cover is evident the in time series since 2008. However, 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.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 2 years if upward trend in vegetation cover continues. Reassess baseline period in 2 years.

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

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

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


May 2006


May 2007


September 2008


October 2009


January 2011

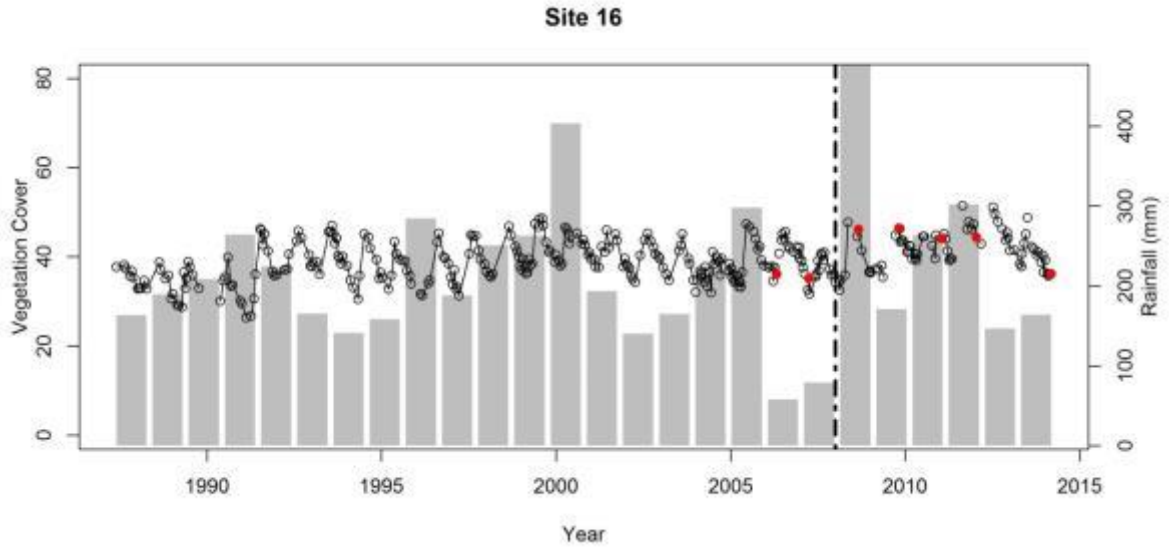

January 2012


April 2014

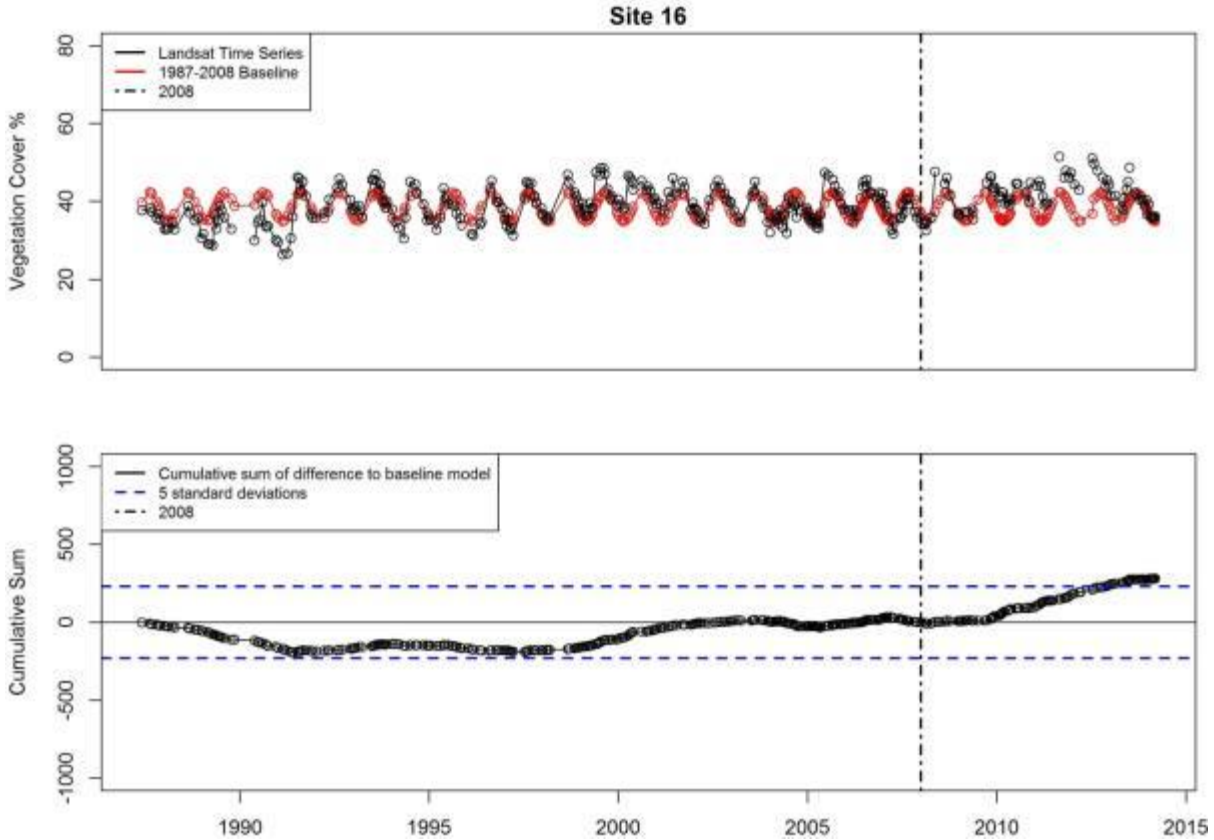
Photo point photographs of plot 16 from 2006 to 2014.

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.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 2 years if upward trend in vegetation cover continues. Reassess baseline period in 2 years.

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 from 2006 to 2014.


May 2006


May 2007


September 2008


October 2009

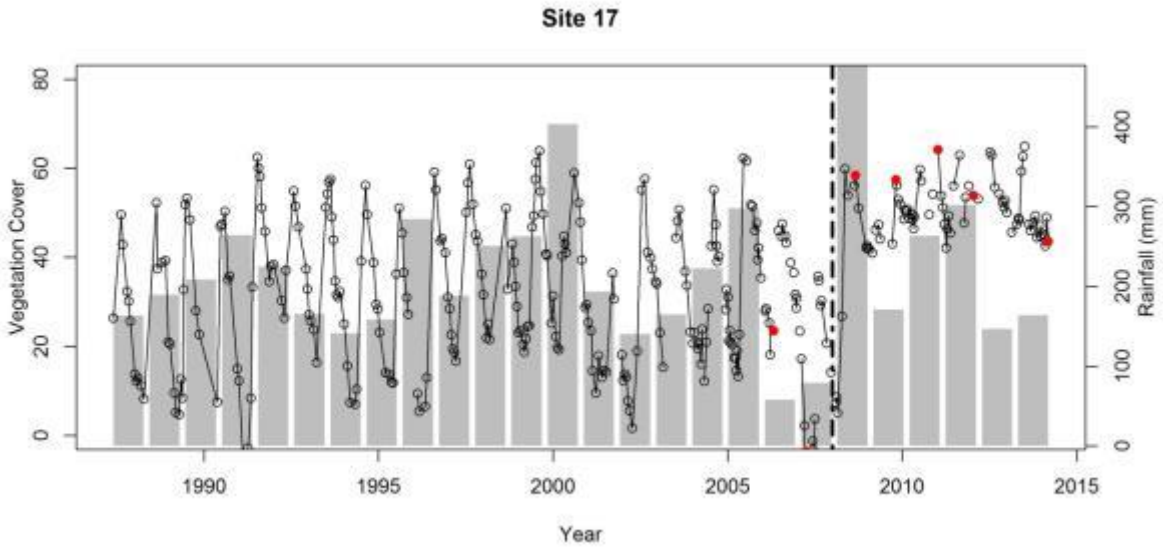

January 2011


January 2012

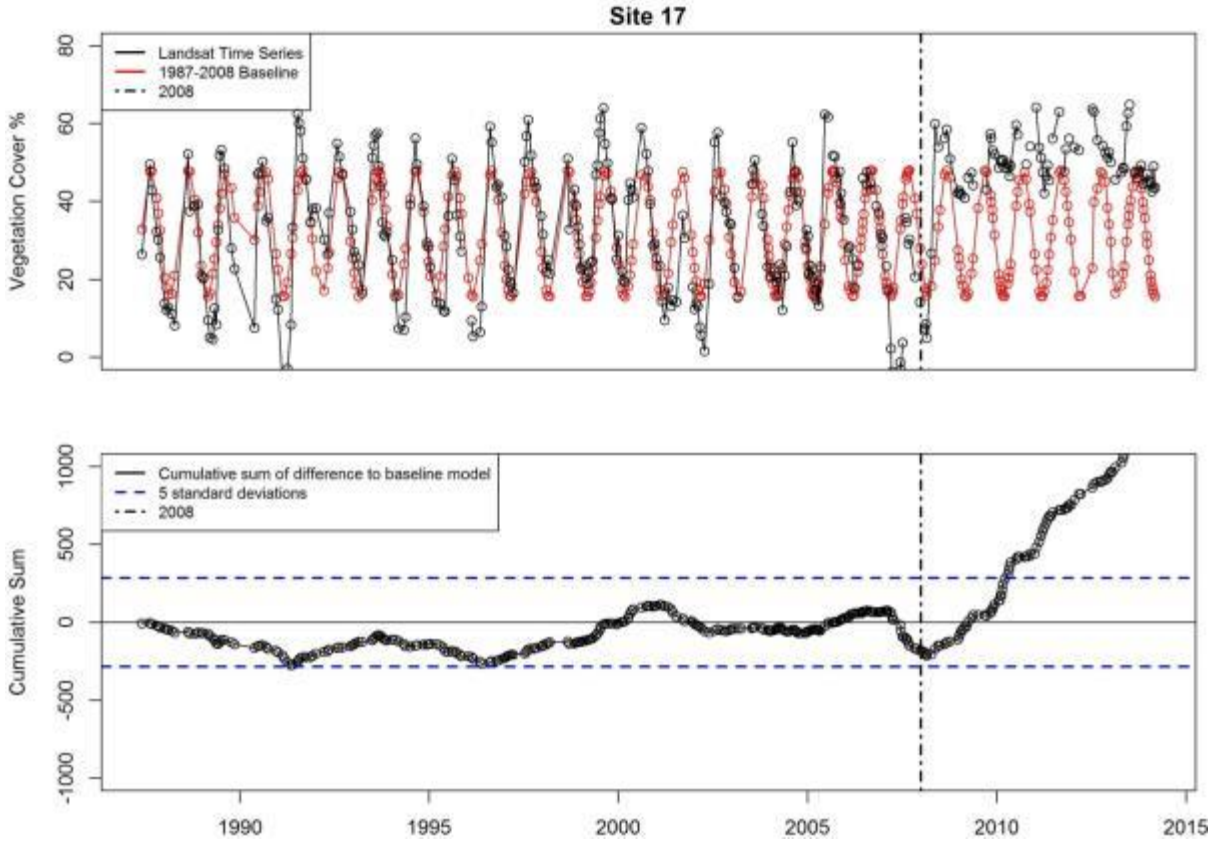

April 2014

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).



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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.

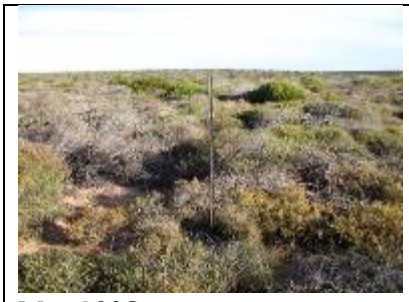
Site 18
Description:
Low Open Shrubland (2-10% cover) 1-2 metres of Acacia ligulata

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 from 2006 to 2014.


May 2006


May 2007


September 2008


October 2009

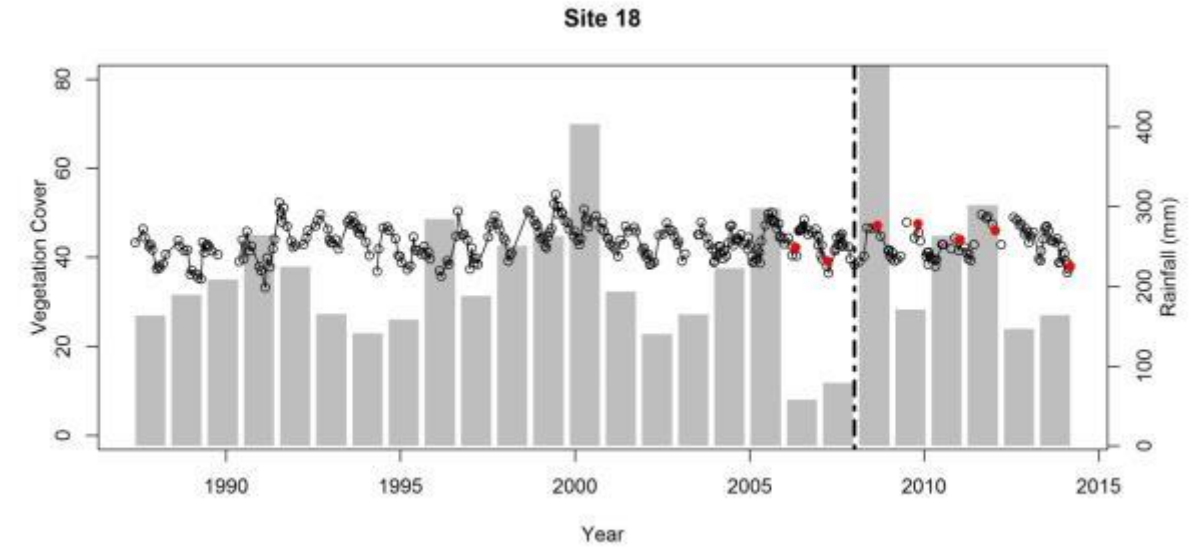

January 2011


January 2012

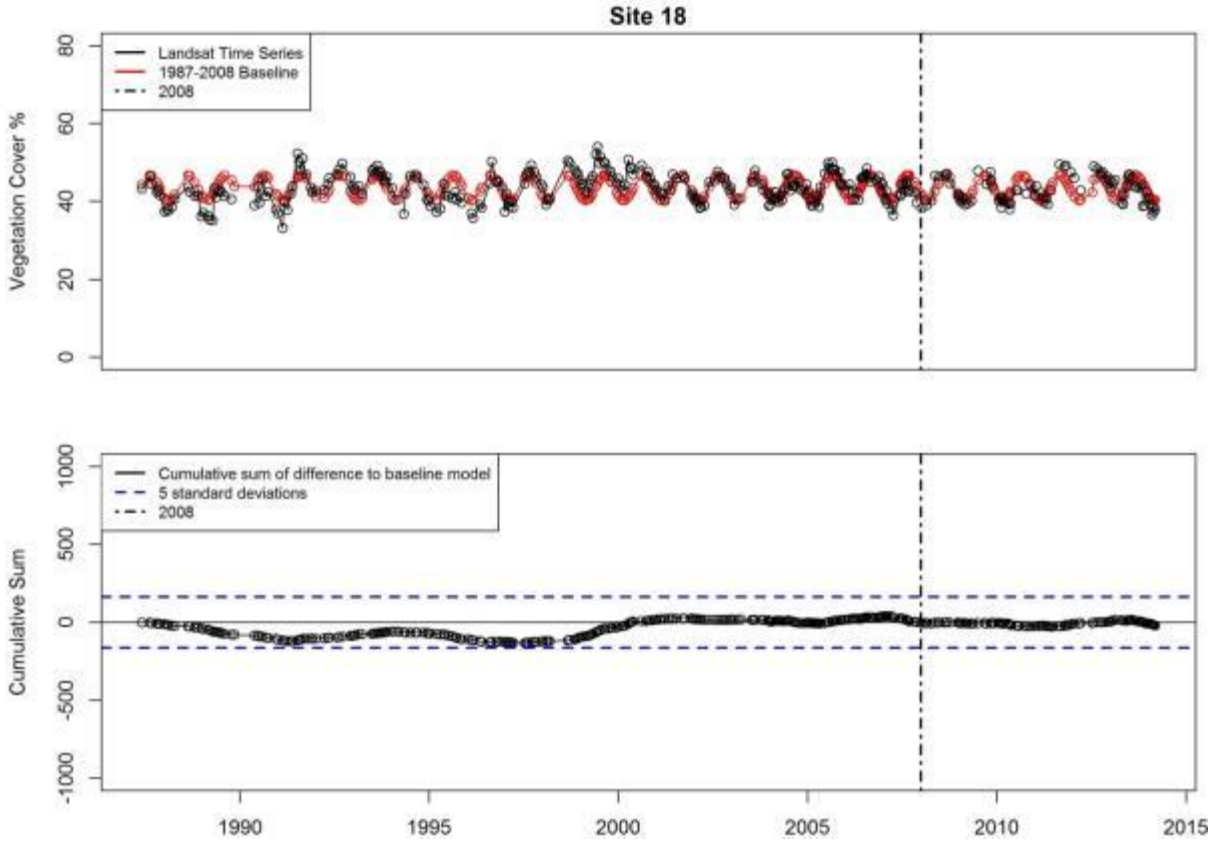

April 2014

Vegetation cover time series analysis:

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



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 5 year or if a significant deviation from baseline vegetation cover are observed (3 standard deviation lines on cusum chart are breached).

Site 19
Description:

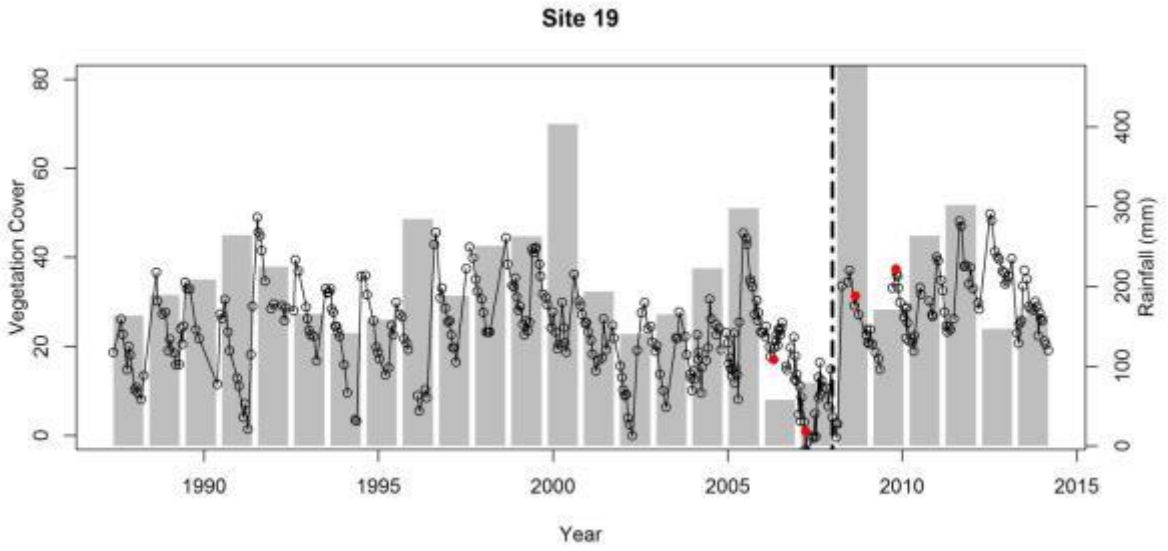
Site not visited in 2014

Photo point photographs of plot 19 from 2006 to 2009.

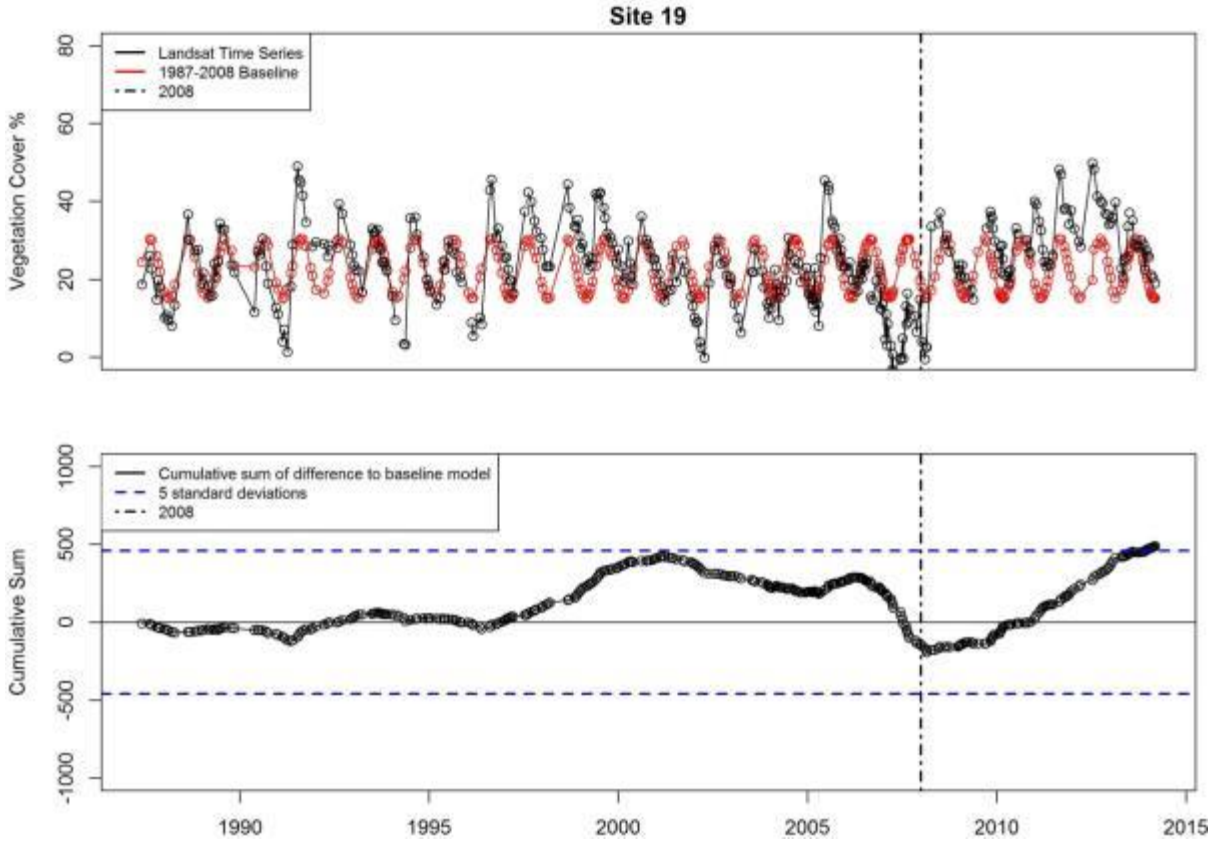
<table>
<tr><td> 
May2006</td><td> 
May 2007</td><td> 
September 2008</td></tr>
<tr><td> 
October 2009</td><td></td><td></td></tr>
</table>

Vegetation cover time series analysis:

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



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 and modelled (1987 to 2008) baseline (top). CUSUM chart with 3 standard deviation control line (bottom).

Recommendations:

Field validation is required in 2015 to investigate the cause of the significant increase in vegetation cover.

Site 20
Description:
Low Open Shrubland (10-30% cover) 1-2 metres Acacia ligulata, Atriplex vesicaria, Alectryon oleifolius, Exocarpus aphyllus and ?? Scaevola tomentose

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

Bare ground (30 % cover)

Site 21
Description:
Low Open Shrubland (10-30% cover) 1-2 metres Acacia ligulata, Atriplex vesicaria, Alectryon oleifolius, Exocarpus aphyllus and ?? Scaevola tomentose

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

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

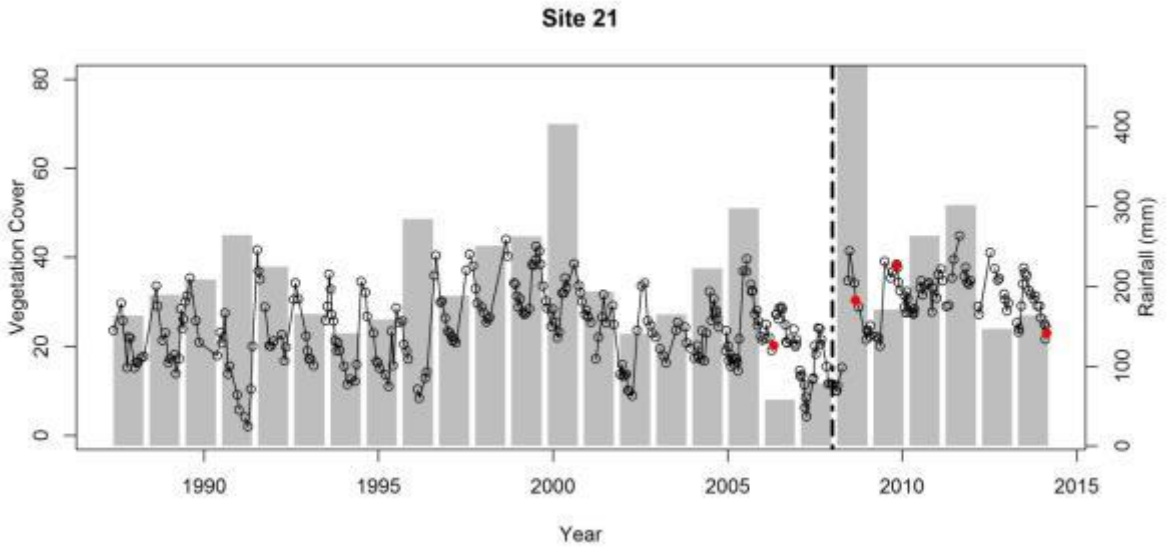
Herbs (2-10%) Chenopdium melanocarpum, Angianthus tomentosus, Calotis hispidula, Brachyscome iberiidifolia, Maireana georgei and Ptilotus gaudichaudii

Photo point photographs of plot 21 from 2006 to 2009.

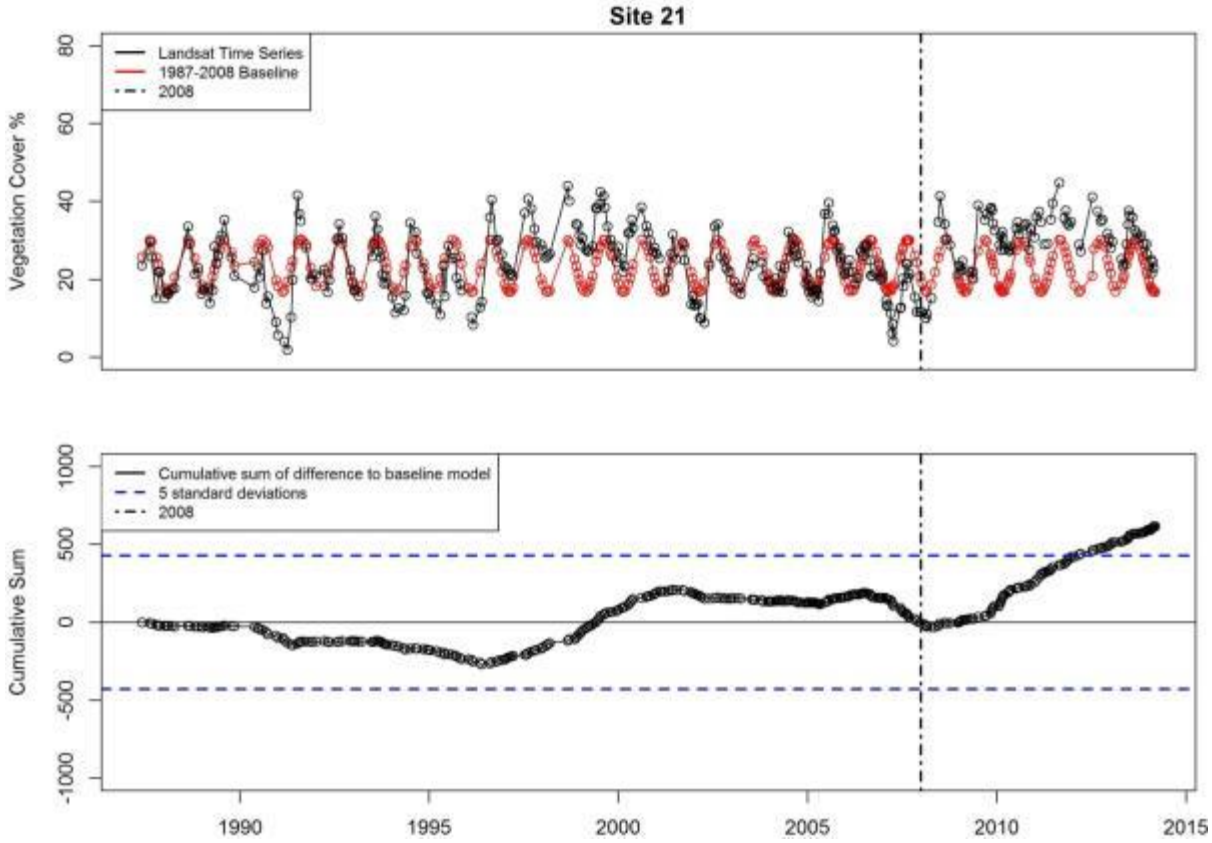
<table>
<tr>
<td> 
May 2006</td>
<td>May 2007</td>
<td> 
September 2008</td>
</tr>
<tr>
<td> 
October 2009</td>
<td> 
April 2014</td>
<td></td>
</tr>
</table>

Vegetation cover time series analysis:

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



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 2 years if upward trend in vegetation cover continues. Reassess baseline period in 2 years.

Site 22
Description:
Low Open Shrubland (2-10% cover) 1-2 metres Acacia rostellifera

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

Low open shrubland (2-10 % cover) of less than 0.5 metres of Pimelea gilgiana and Threlkeldia diffusa

Over dense hummock grassland (50-70 % cover) of Triodia ?plurinervata/pungens

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 from 2006 to 2009.


May 2006

May 2007

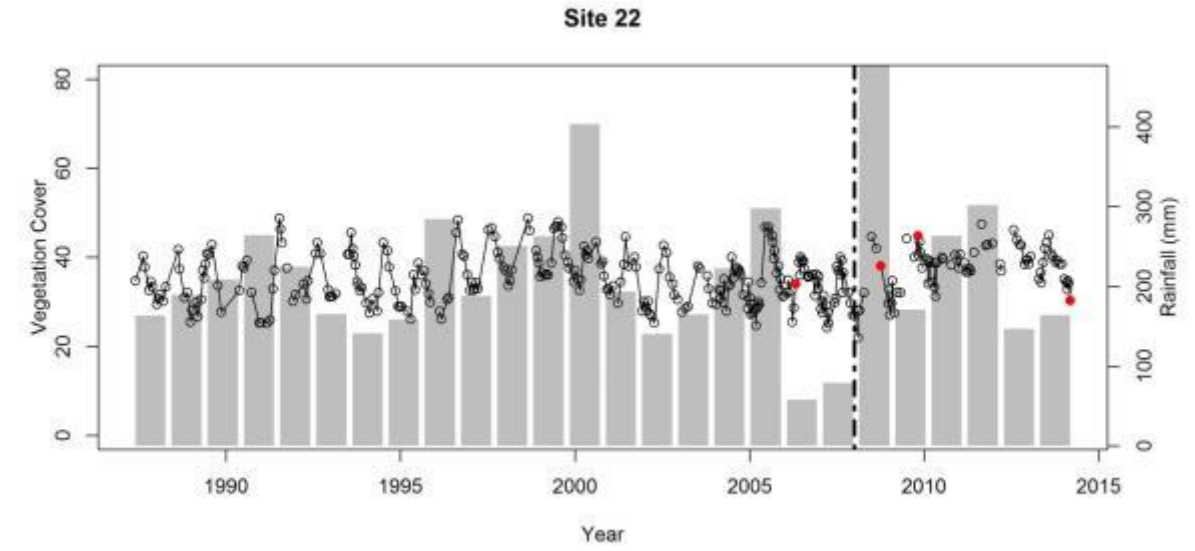

September 2008


October 2009

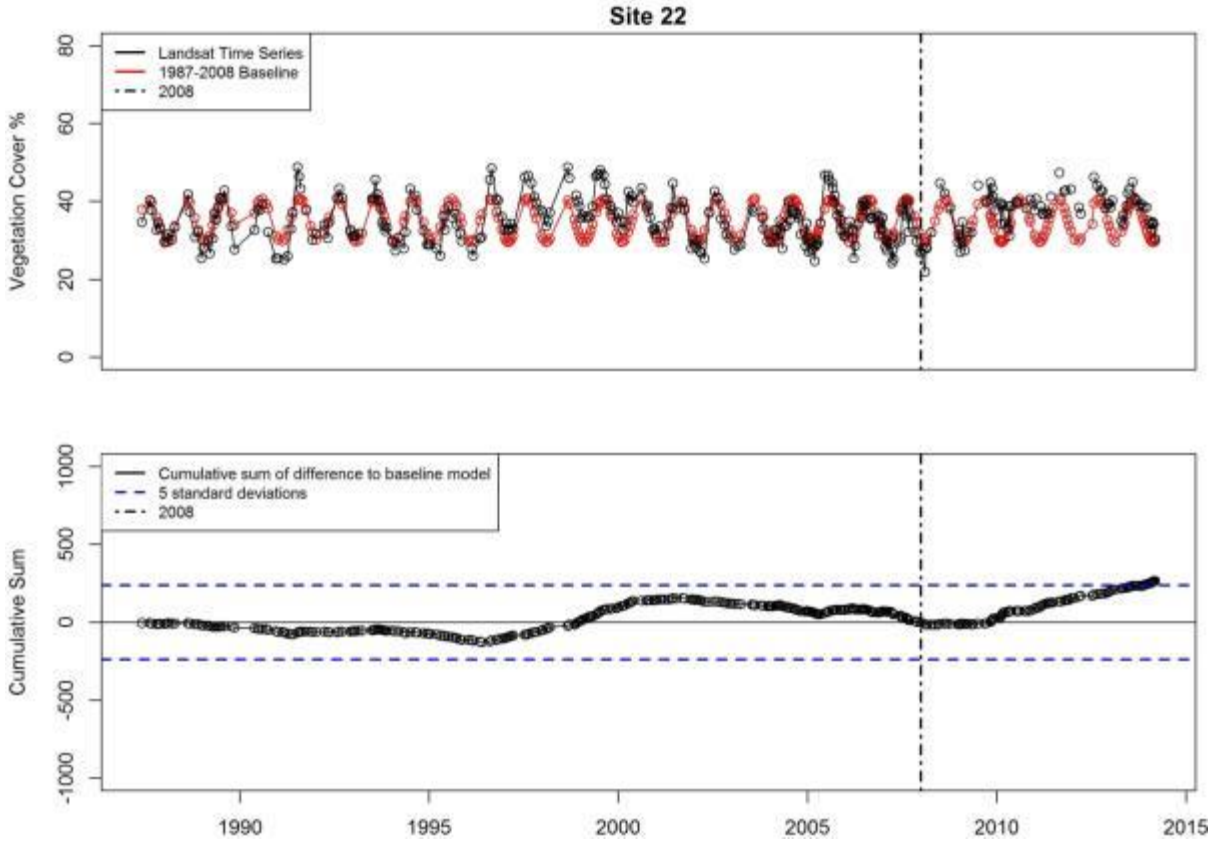

April 2014

Vegetation cover time series analysis:

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



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 2 years if upward trend in vegetation cover continues. Reassess baseline period in 2 years.

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 and Ptilotus obovatus

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

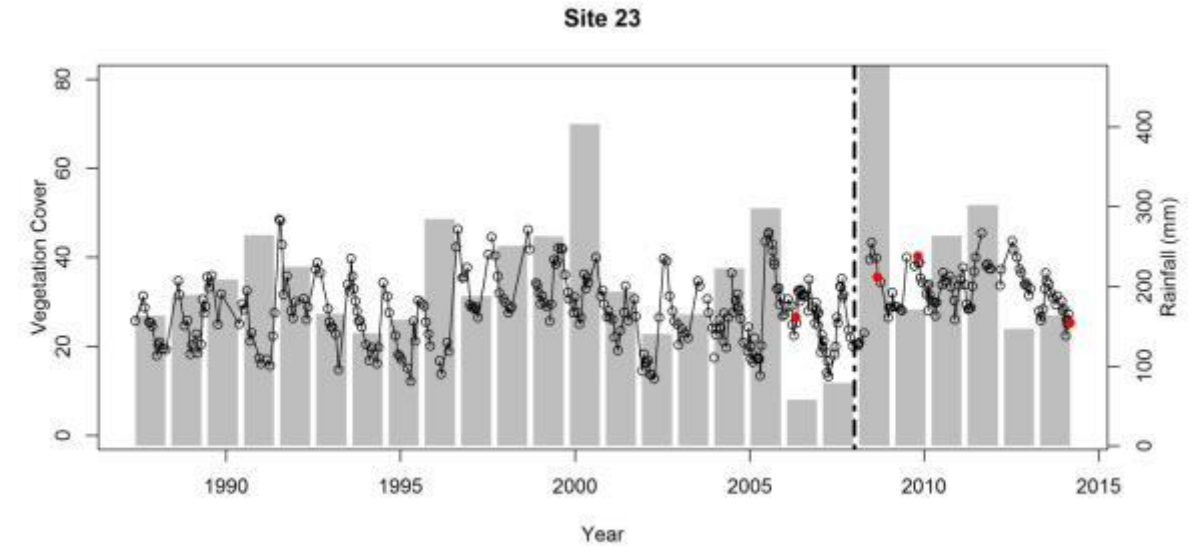
Over herbs, grasses and low shrubs (2-10 % cover) of Senecio pinnatifolius, Maireana sp., Austrostipa sp., *Brassica tournefortii, Acanthocarpus robustus, Gnephosis arachnoidea and Dianella revoluta.

Photo point photographs of plot 23 from 2006 to 2014.

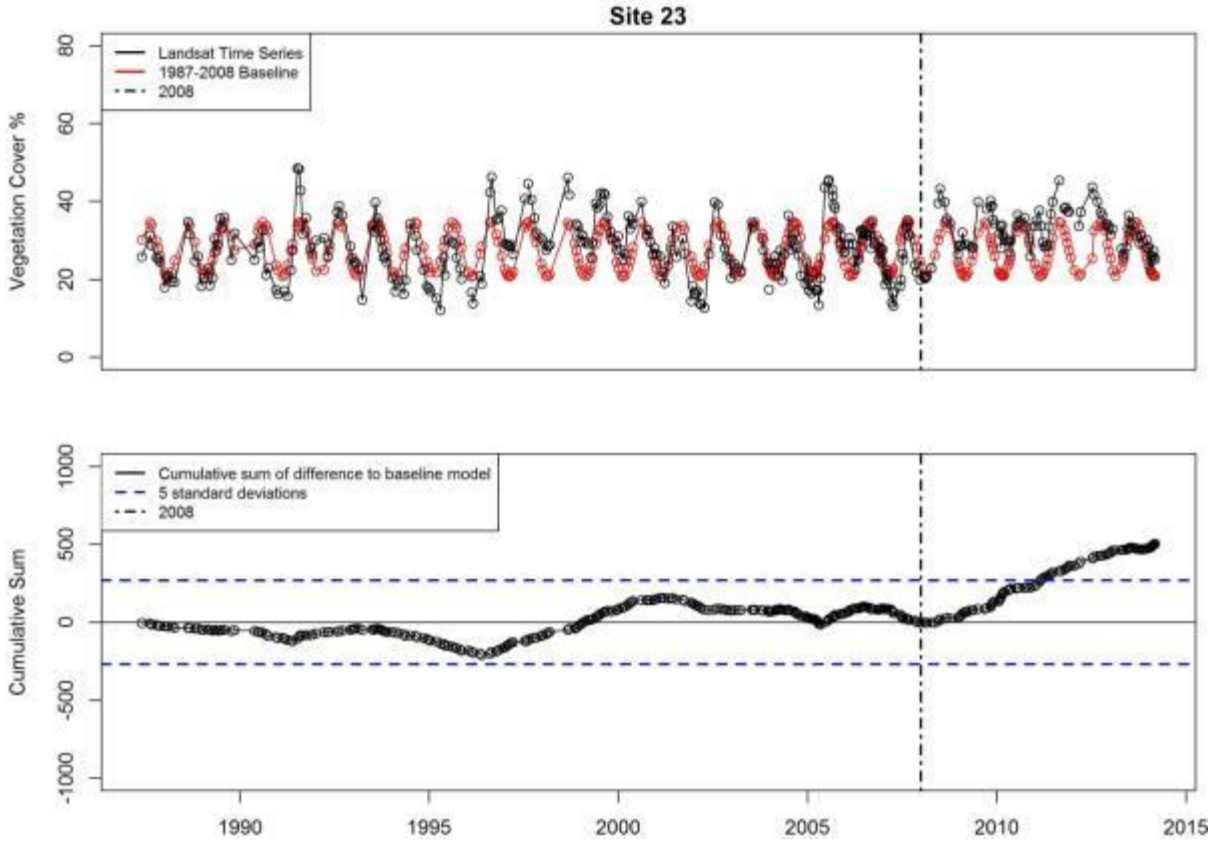
<table>
<tr>
<td> 
May 2006</td>
<td>May 2007</td>
<td> 
September 2008</td>
</tr>
<tr>
<td> 
October 2009</td>
<td> 
April 2014</td>
<td></td>
</tr>
</table>

Vegetation cover time series analysis:

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



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 2 years if upward trend in vegetation cover continues. Reassess baseline period in 2 years.

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

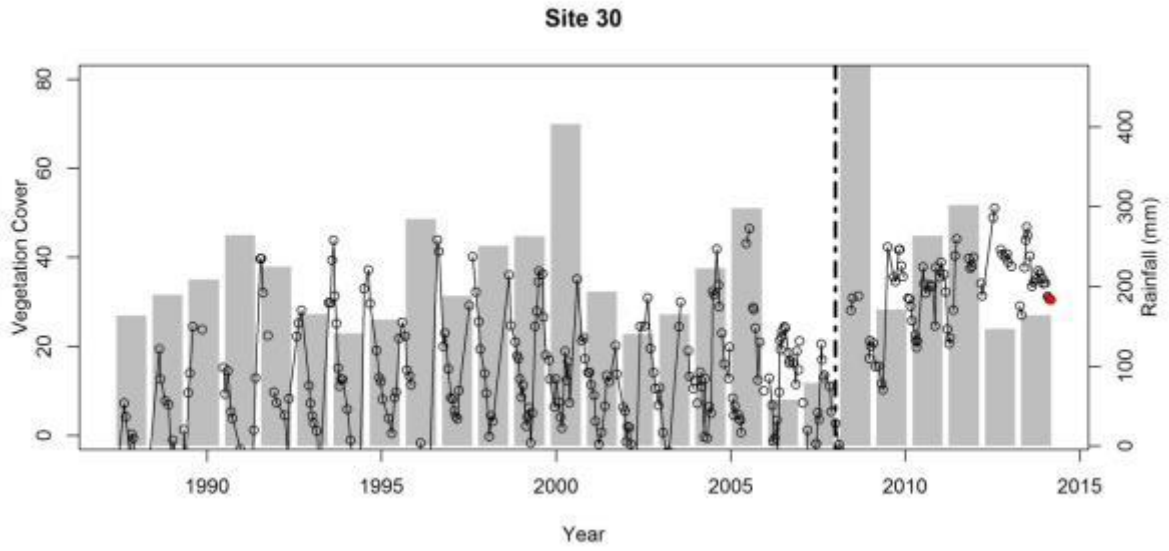
Over low bunch grassland (10-30 % cover) of *Cenchrus ciliaris and *Cenchrus setiger

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.

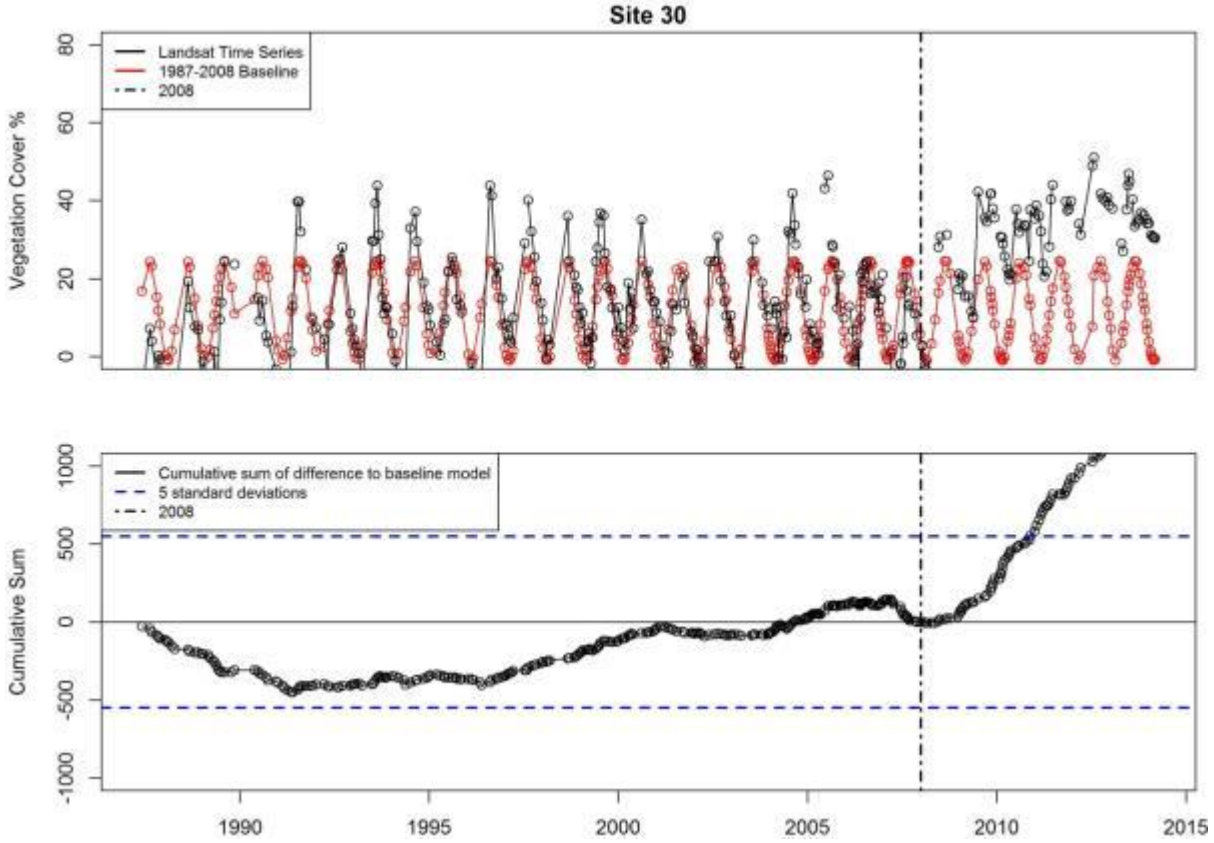
Site photograph, April 2014

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.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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.

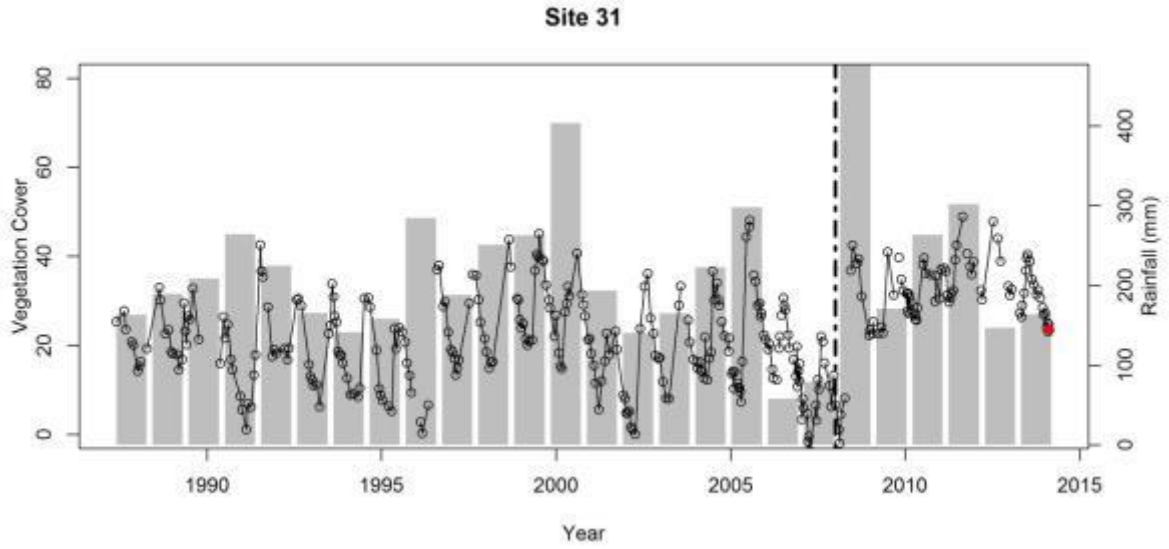
Site 31
Description:
Open Shrubland (2-10% cover) 1-2 metres Diplolaena grandiflora (mostly dead)

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

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.

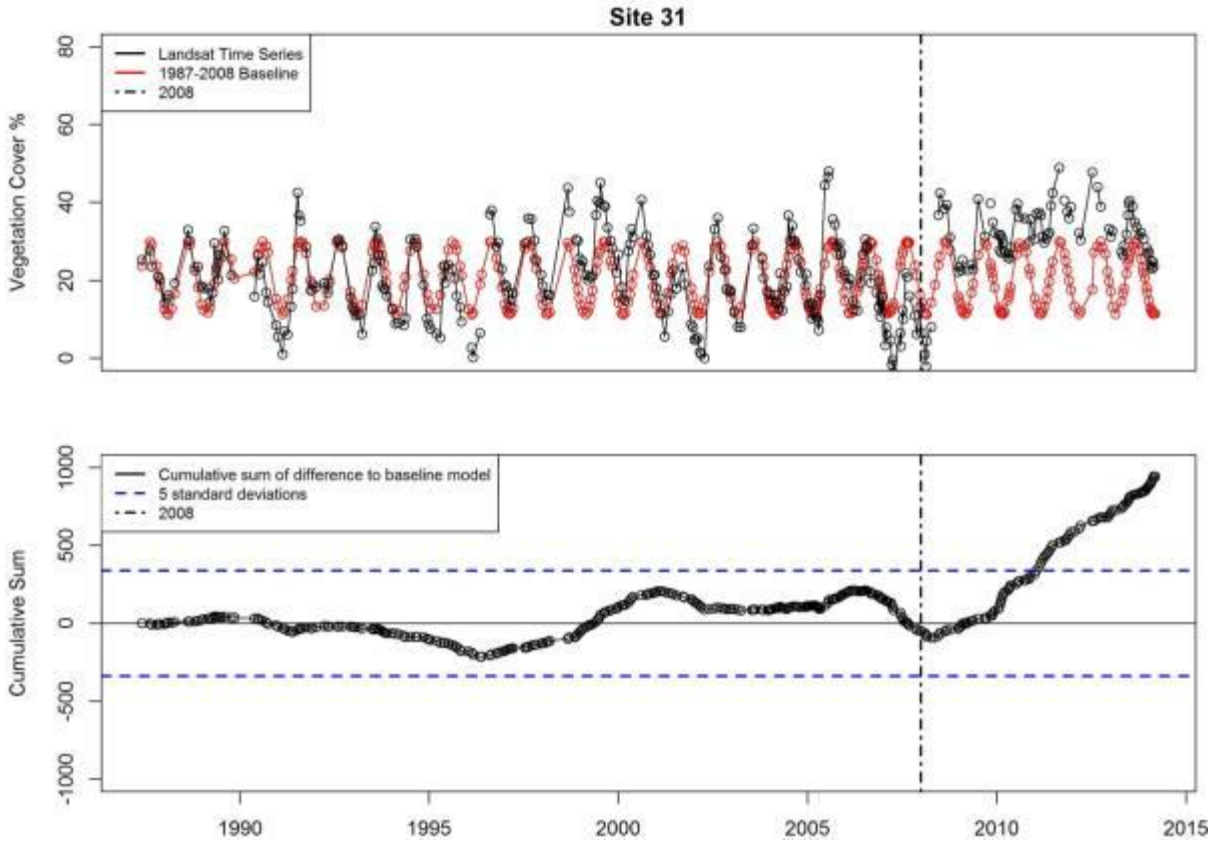
Note: Here the upper shrub Diplolaena grandiflora has largely died, however, this species (on Bernier and Dorre) appears en masse after fire or heavy storms grows and eventually dies out. This would be a very interesting site to monitor long term for natural cycles.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.

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.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 ? isatidea, Rhagodia baccata

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

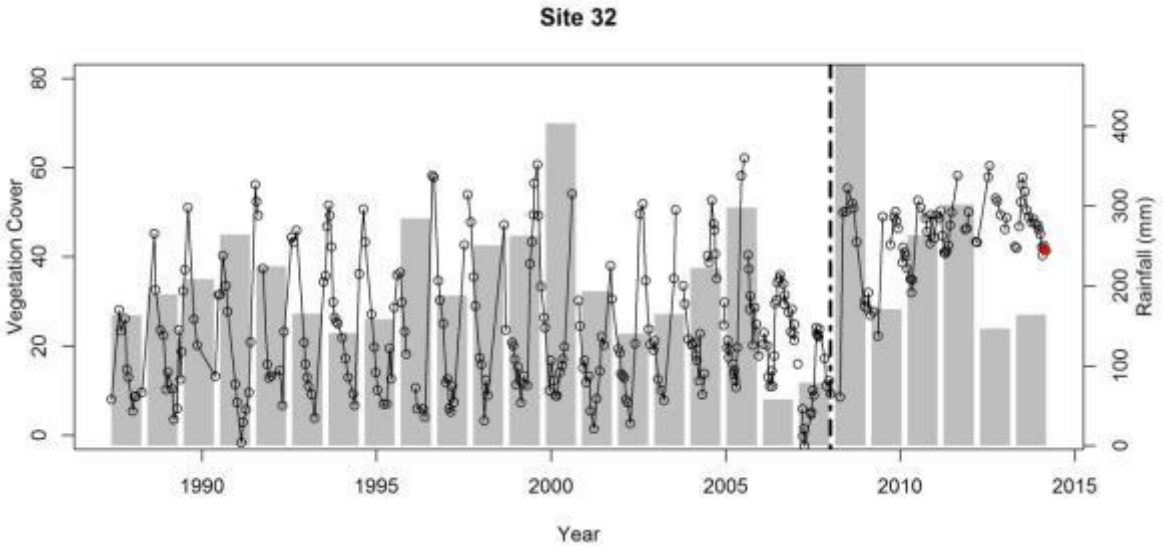
Over low bunch grassland (2-10 % cover) of *Cenchrus ciliaris

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.

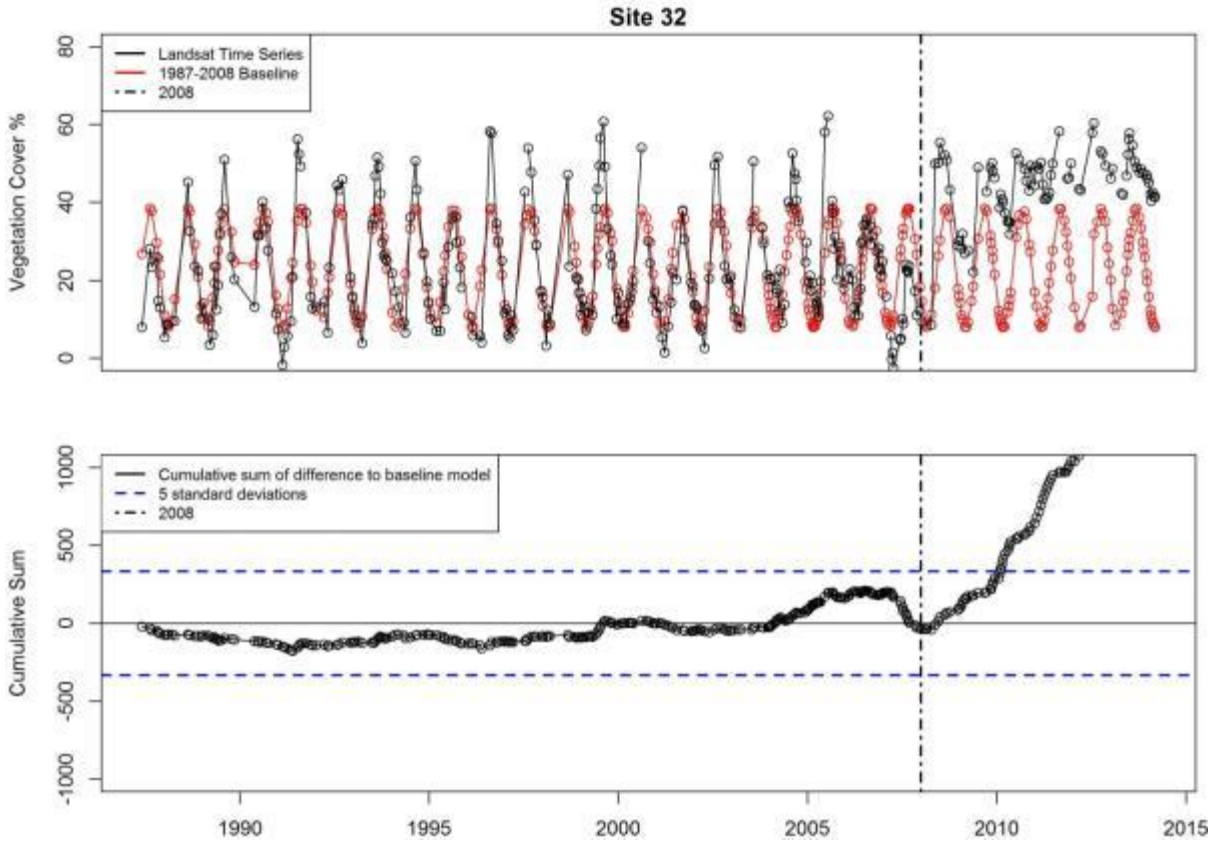
Note: Site of interest for long term monitoring for changes in buffel grass cover.

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.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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

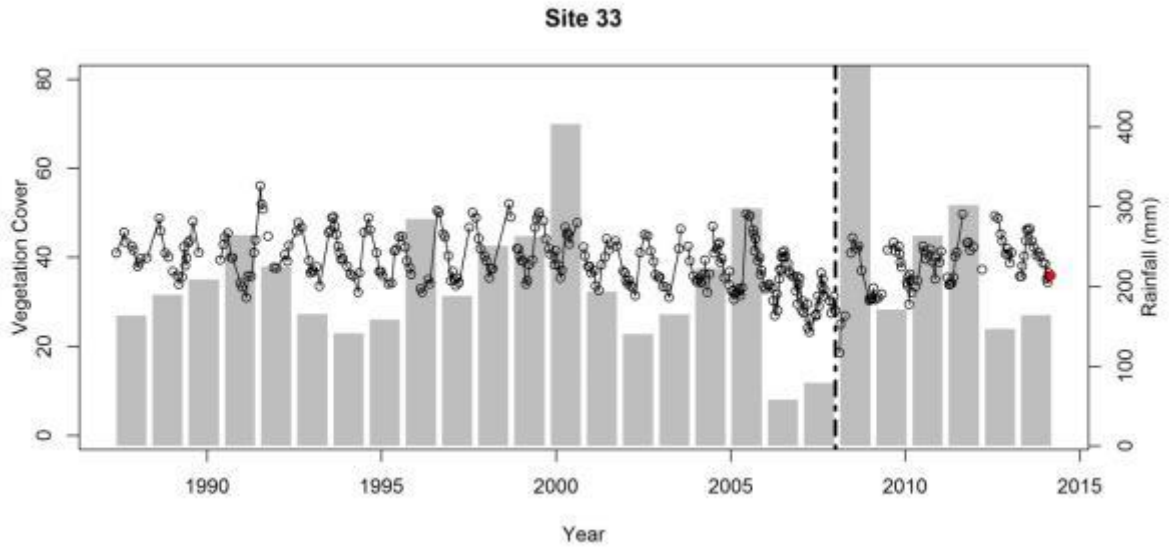
Over low very open bunch grassland (2-10 % cover) of Austrostipa nitida, Austrostipa elegantissima, Amphipogon sp. and *Cenchrus ciliaris

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.

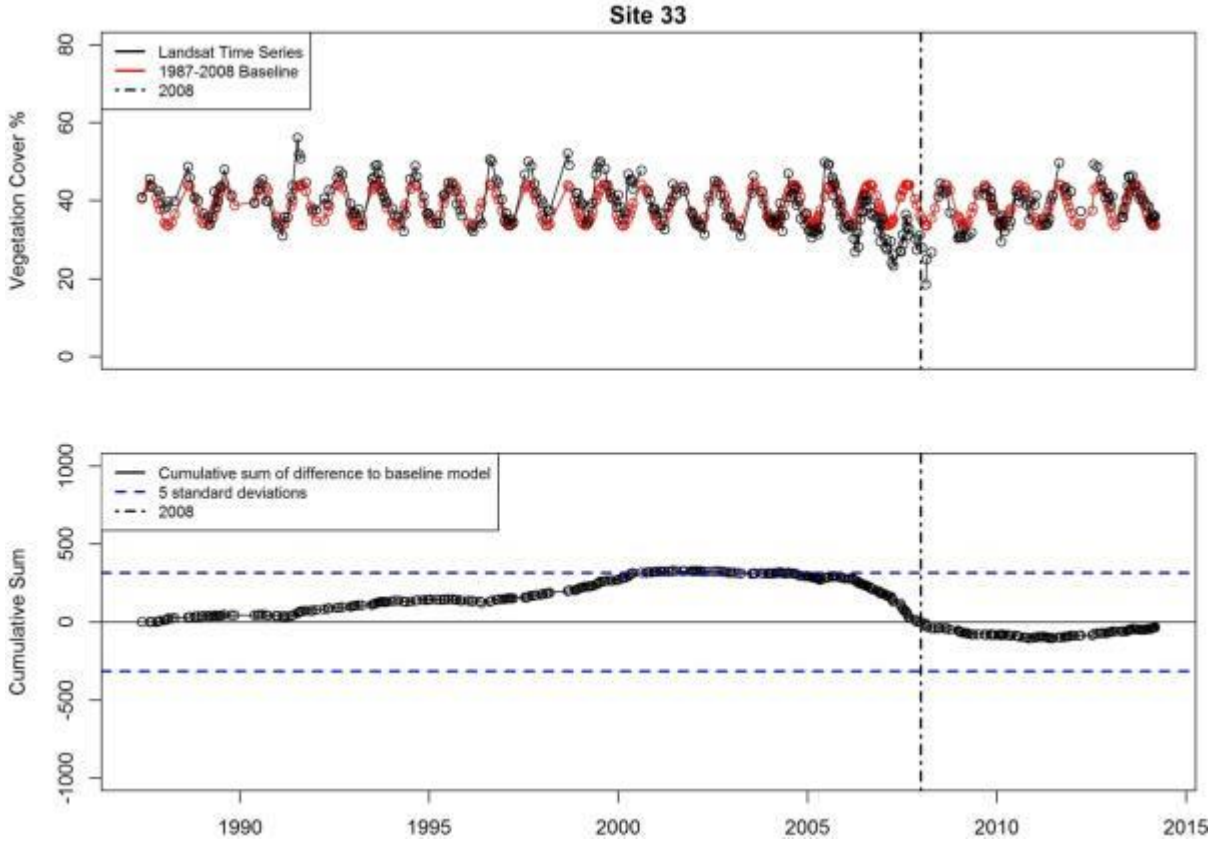
Site photograph, April 2014

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.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 5 year 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

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

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

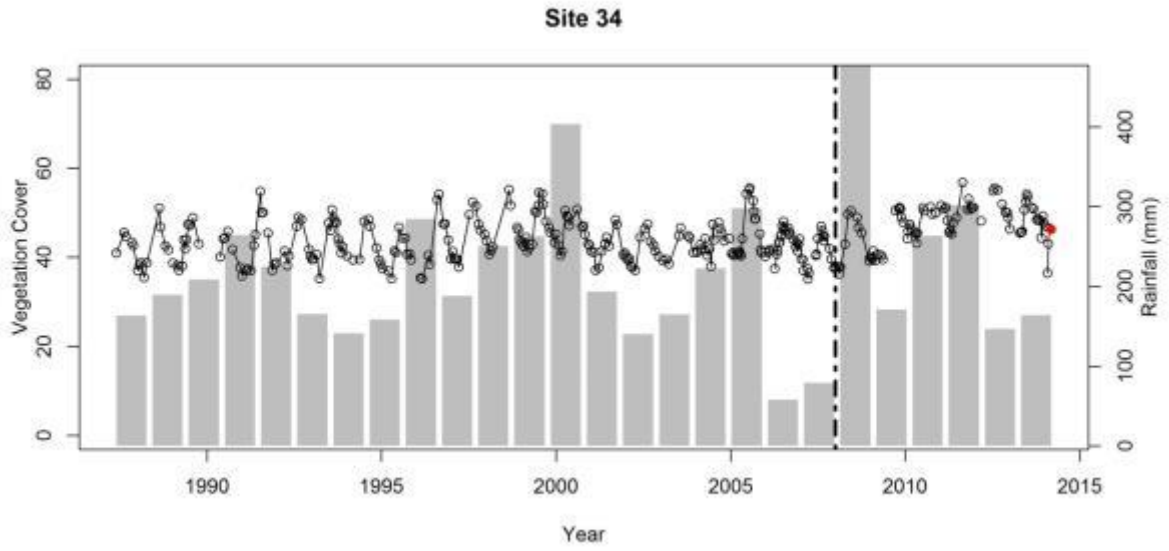
Over low bunch grassland (2-10 % cover) of Austrostipa nitida and Austrostipa elegantissima

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.

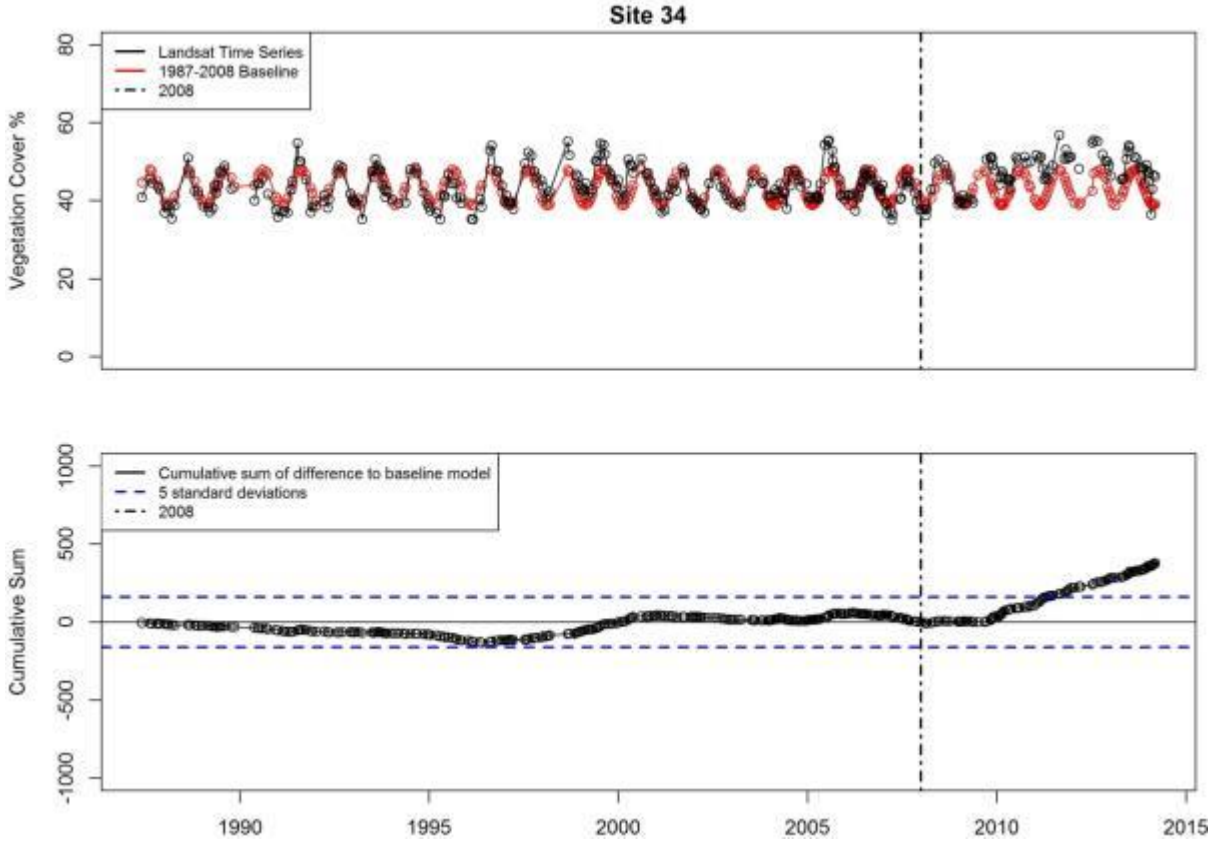
Site photograph April 2014

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.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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

Low shrubland (30% cover) 0.3- 0.5 metres of Atriplex vesicaria, Threlkeldia diffusa and Frankenia pauciflora

Over low hummock grassland (10-30 % cover) of Triodia plurinervataand Triodia schinzii
Over low bunch grassland (2-10 % cover) of *Cenchrus ciliaris, Austrostipa nitida and Austrostipa elegantissima

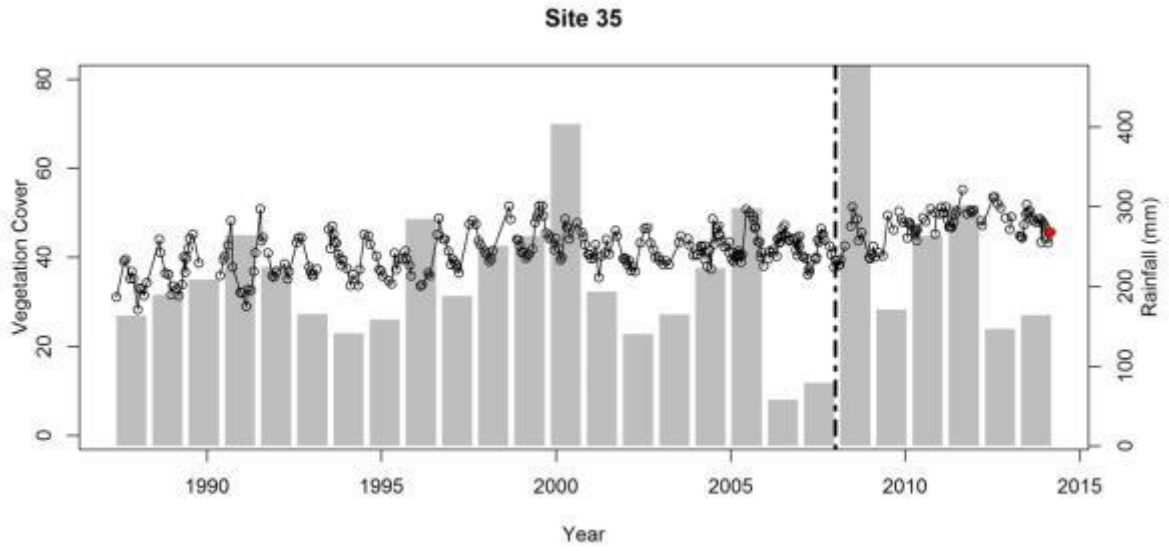
Over herbs, grasses and low shrubs (10 % cover) of Bromus arenarius, *Bromus diandrus, Angianthus tomentosus, Angianthus sp., *Brassica tournefortii, Chenopdium melanocarpum, Goodenia sp. ,

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

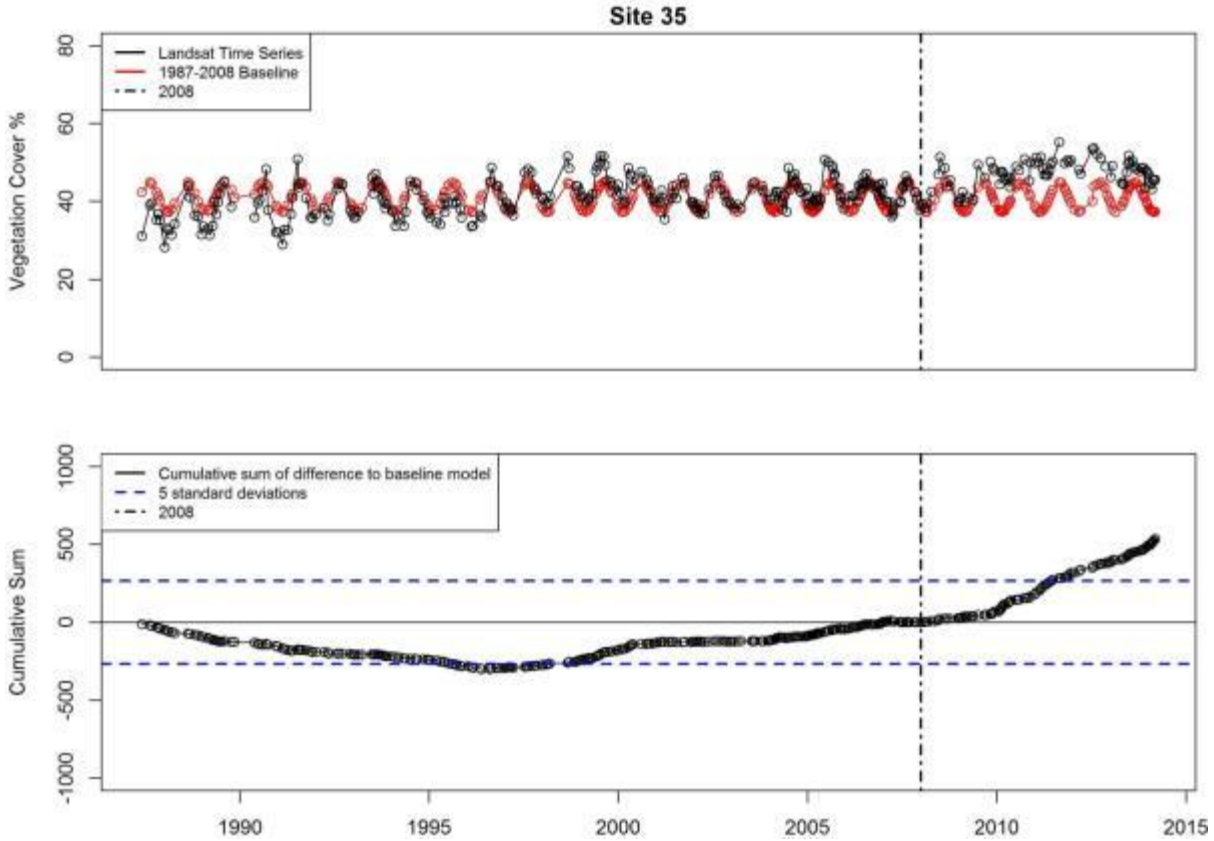
Site photograph April 2014

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.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 Cymbypogon obtectus, *Cenchrus ciliaris, *Bromus japonicas

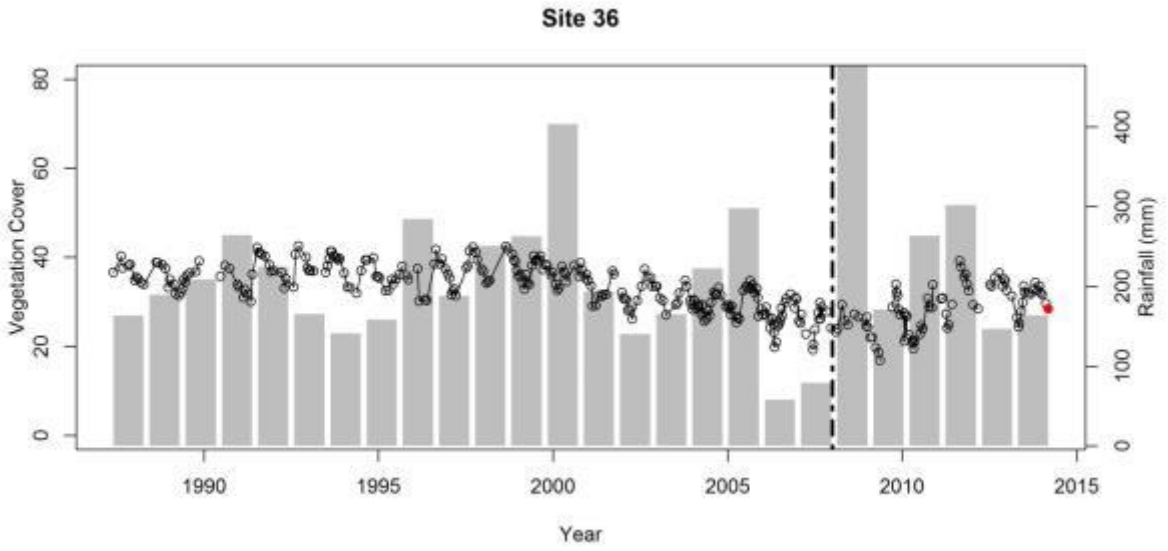
Over herbs and low shrubs (2-10% cover) of *Urospermum picroides, *Bidens bipinnata, *Solanum nigrum , *Sonchus oleraceus, *Centaurium eryhthraea, Conostylis stylidioides, Acanthocarpus preissii, *Hypochaeris glabra, Euphorbia boopthona, *Brassica tournefortii, mHalgania cynea, Cassytha sp., Logania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

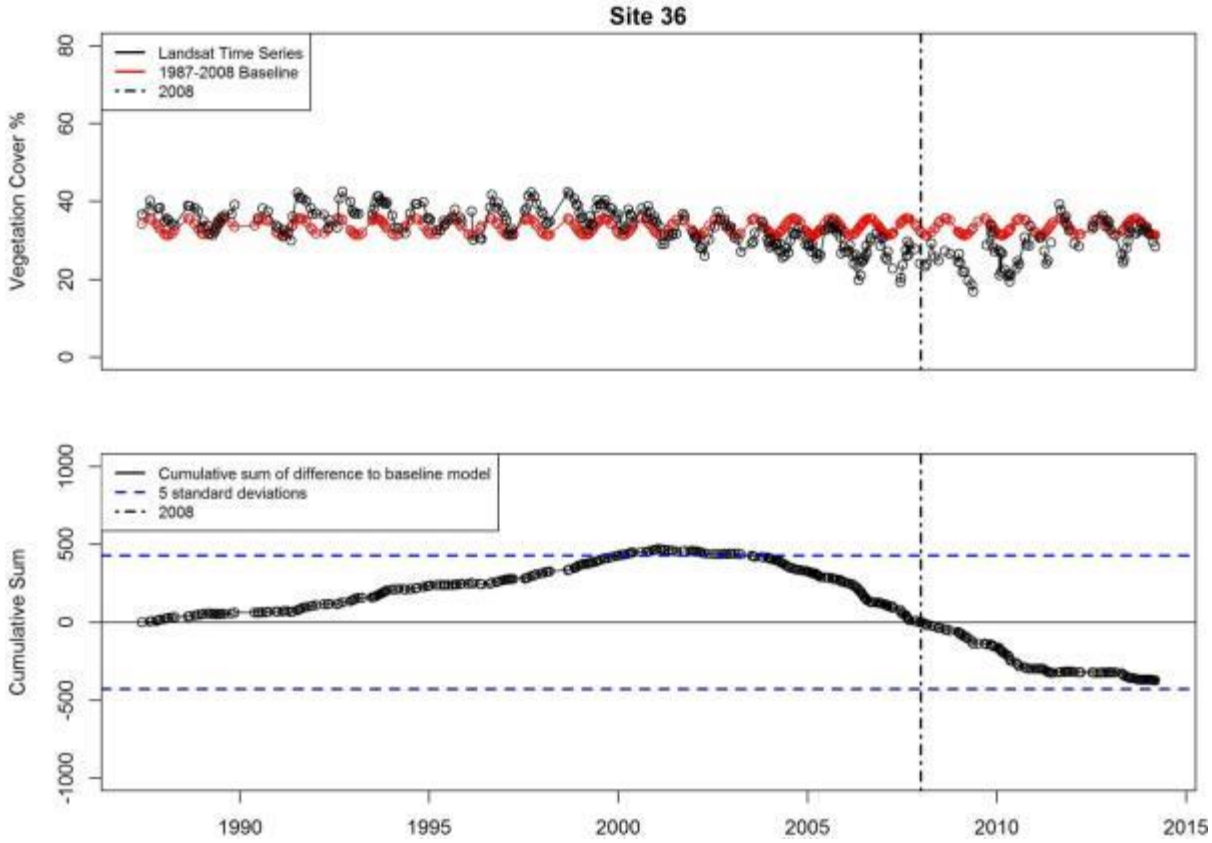
Site photo, April 2014

Vegetation cover time series analysis:

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



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 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 Grey Spiny Shrub

Low shrubland (10-20% cover) 0.5-1 metres of Atriplex vesicaria, Scaevola nitida, Teragonia implexicoma

Low shrubland 2-10% cover) 0.3- 0.5 metres of Pembertonia latisquamea, Ptilotus obovatus, Frankenia pauciflora, Rhagodia crassifolia, Threlkeldia diffusa, Clematidium and Pimelia gilgiana

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.

Photo point photographs of plot AGWA657 from 2007 to 2014.


May 2007


September 2008


October 2009

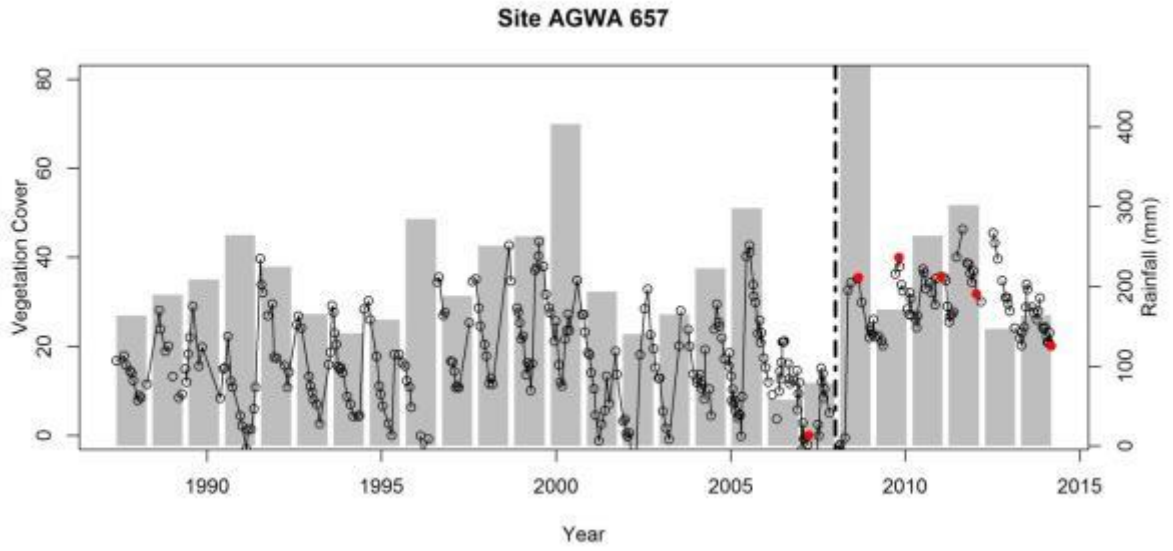

January 2011


January 2012

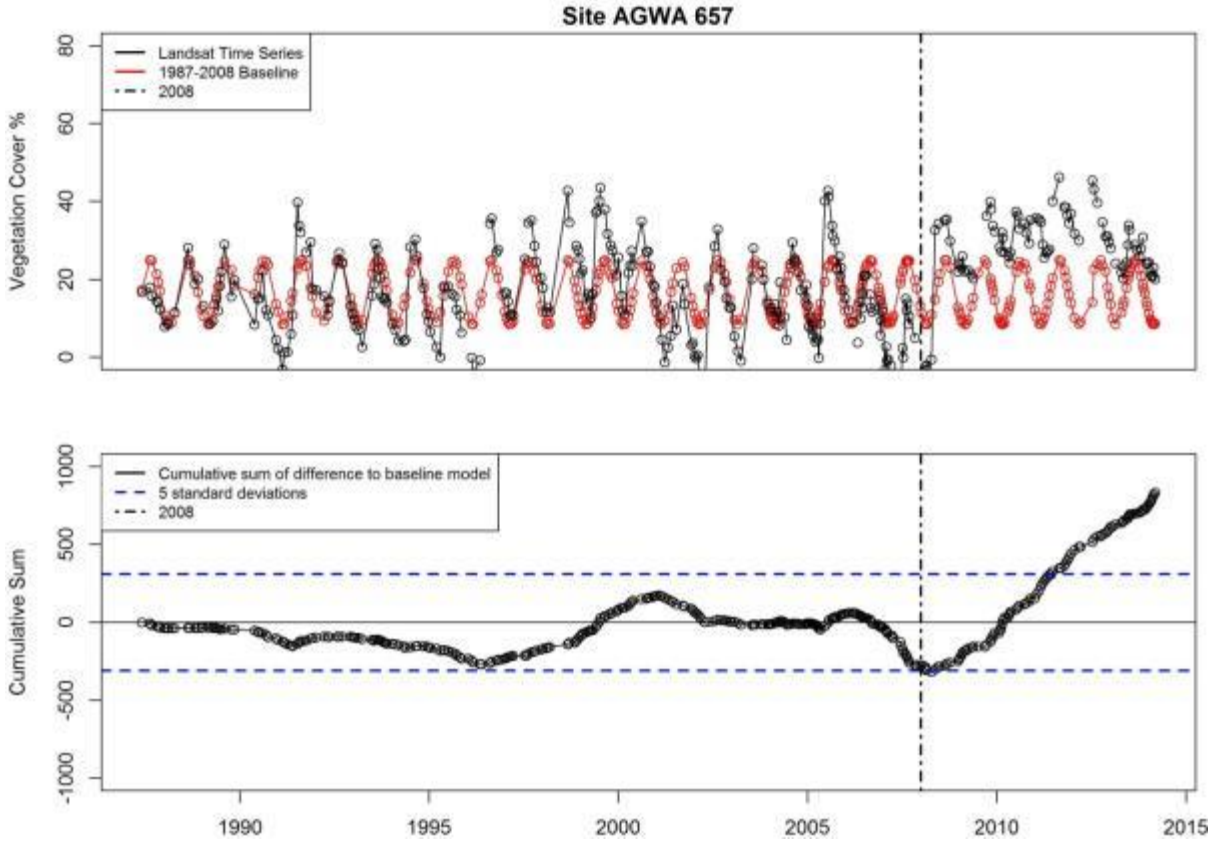

April 2014

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 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 2 years. Reassess baseline period in 2 years.

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

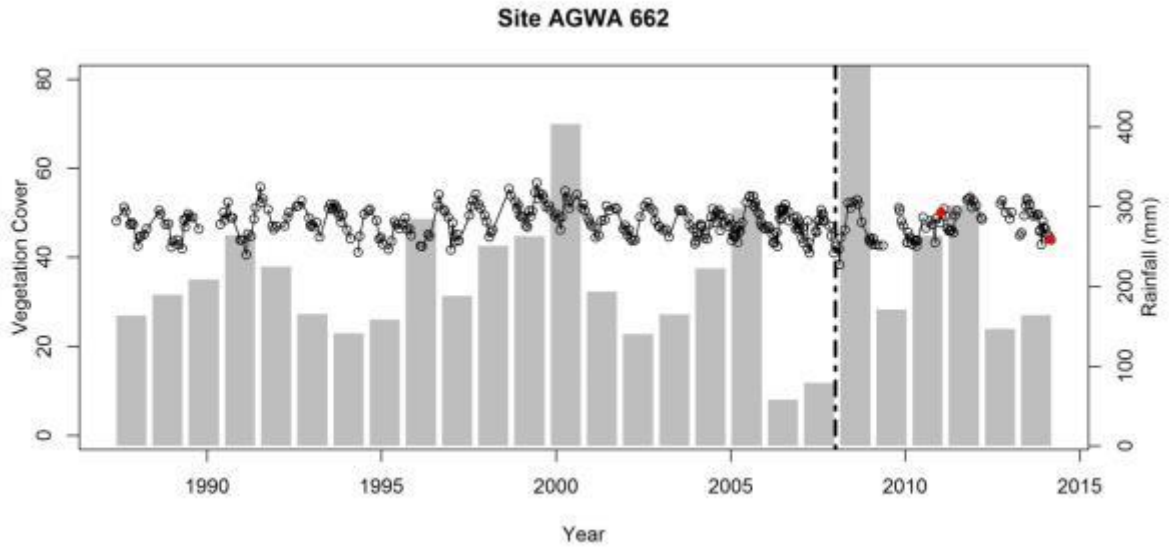
Over scattered herbs of Salsola australis

Photo point photographs of plot RHR633 from 2011 to 2014.

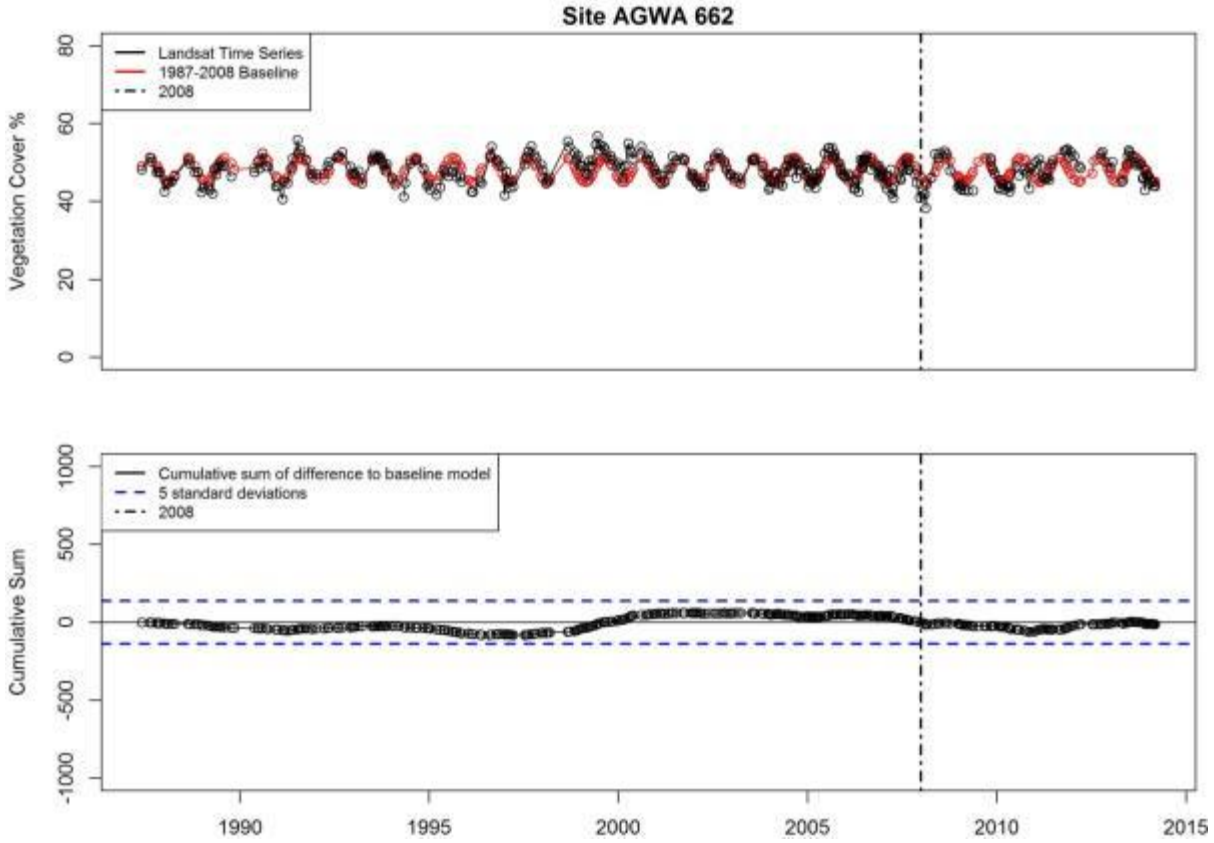
 January 2011	 April 2014	

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 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 5 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 from 2006 to 2014.


May 2006


May 2007


September 2008

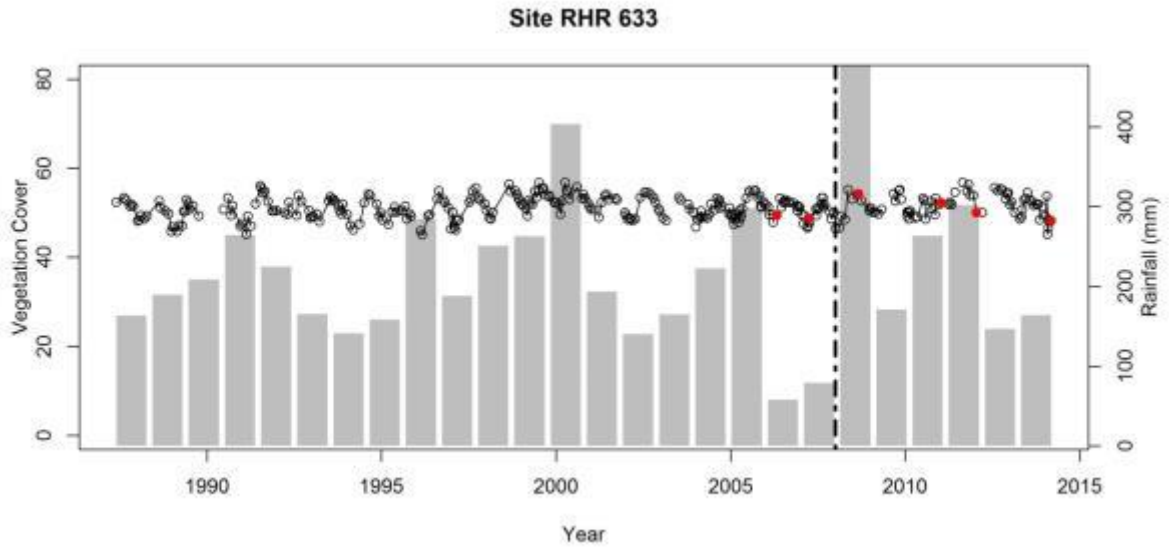

January 2011


January 2012

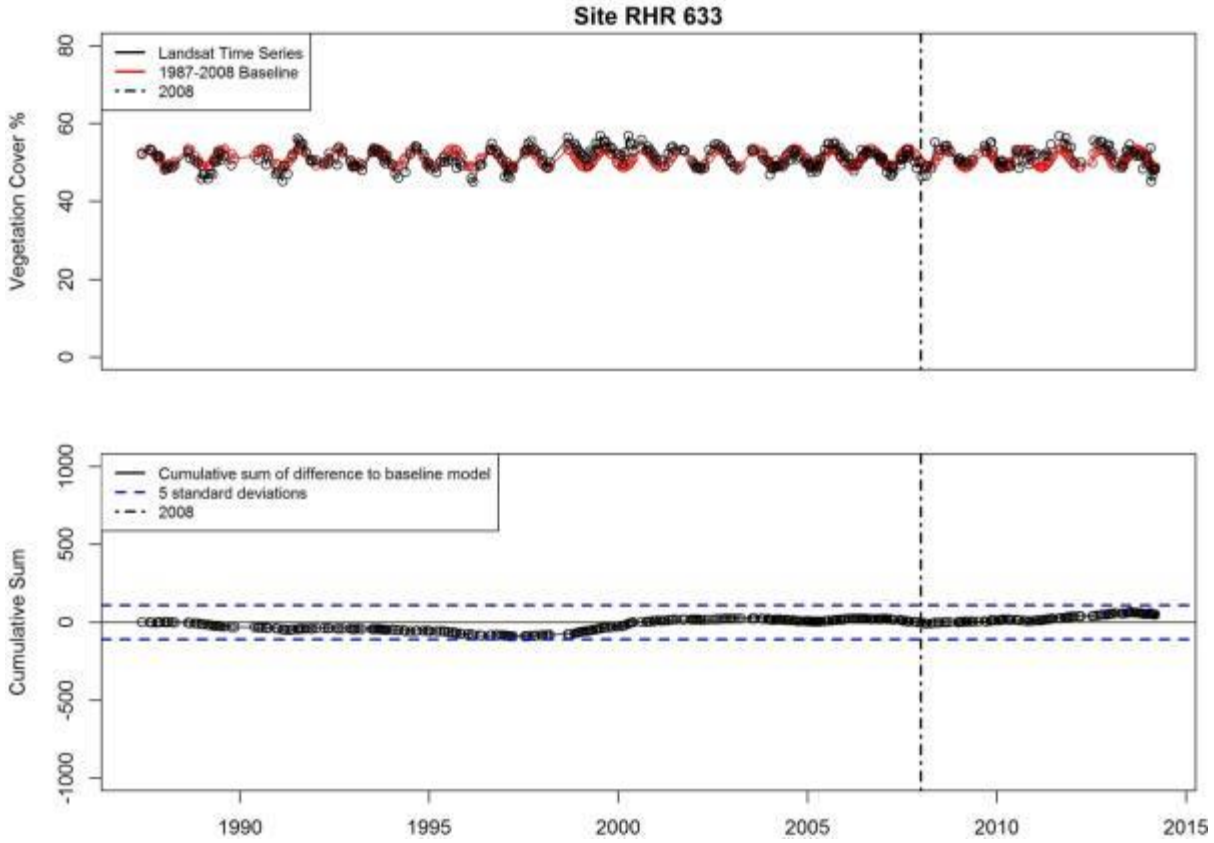

April 2014

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 2014 with rainfall from Useless Loop meteorological station. The dashed vertical line marks the end of the baseline period (2008) and photo point dates are marked in red.



Time series graph of vegetation cover derived from Landsat satellite data from 1987 to 2014 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 5 year or if a significant deviation from baseline vegetation cover are observed (3 standard deviation lines on cusum chart are breached).