Vegetation Change in Seagroatt Nature Reserve using Land Monitor Data

Department of Agriculture

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June 2003

For the Department of Conservation and Land Management
Narrogin District.

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SUMMARY

This report summarizes the remote sensing component of the Department of Conservation and Land Management (CALM) project to identify change in the condition of vegetation in Seagroatt Reserve. The findings of this report should be considered in association with the vegetation mapping of the Reserve by Mattiske Consulting and the work undertaken by CSIRO on the mineralogy and soil chemistry of the Reserve and its surrounds.

Vegetation death and/or decline have been reported in Seagroatt Reserve since the construction of the Narembeen Drain in 1996. Land Monitor II vegetation products were examined for evidence of change in vegetation in the drainage system, specifically in the Seagroatt Reserve. The data were examined at the Leeuwin Centre with assistance from Jeremy Wallace (CSIRO) and Graeme Behn (CALM). Additional Landsat Thematic Mapper (TM) imagery was used for a 2003 image enhancement.

STUDY AREA

Seagroatt Nature Reserve (25062) is located approximately 22 kilometres south west of the wheatbelt town of Narembeen in south west Western Australia. The Reserve covers 1149 hectares and is managed by CALM. Discharge from the drain flows down a broad waterway through Seagroatt Reserve before entering the Salt River.

FINDINGS

Image and data analysis shows:

- Significant vegetation decline has occurred in the Reserve since February 1998; the decline is limited to that part of the natural drainage line which flows from the east and receives water from the Narembeen drain.
- Vegetation decline or loss since 1998 has occurred in two other remnants within the drainage system to the east of Seagroatt Reserve which also receives water from the Narembeen drain.
- Evidence of some decline in other areas within the Reserve prior to 1998.
- Methods developed by CALM (PFC) show similar trends in canopy health.

Below are change images and graphs to support these conclusions. Brief notes are provided.

LAND MONITOR II IMAGERY AND PRODUCTS

Two Land Monitor II products were used to identify and map vegetation changes in Seagroatt Reserve. They were:

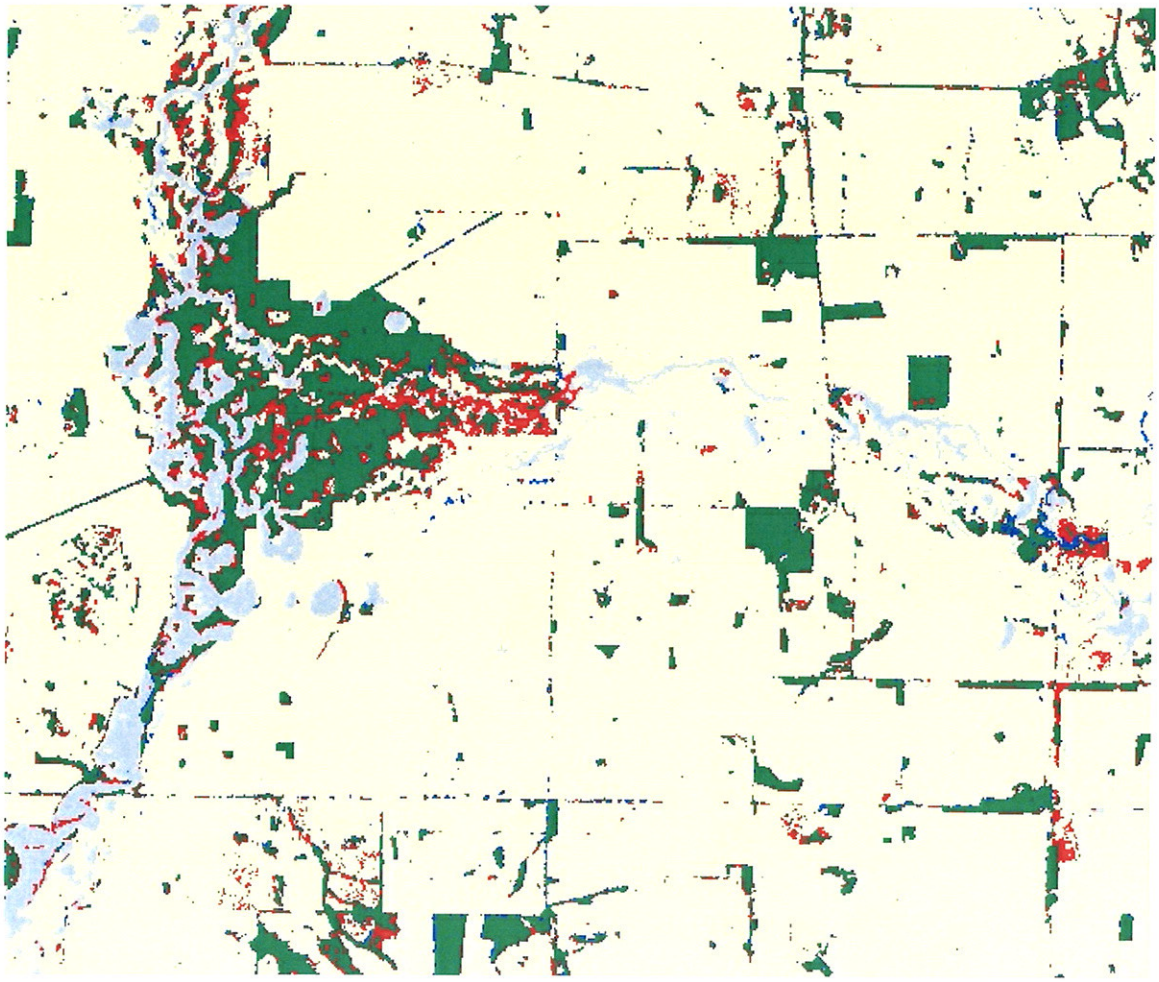
Vegetation Extent and Change 1988 – 2002 and
Vegetation Index Sequence 1988 – 2002

For details on the processing and analysis of all Land Monitor 1 and Land Monitor II products go to *www.landmonitor.wa.gov.au.*

VEGETATION EXTENT AND CHANGE 1988 – 2002

Vegetation Extent and Change 1988 – 2002 is a series of classifications of the extent of vegetation at two-year intervals. An index-threshold is applied to produce measures of confidence of perennial and non-perennial vegetation (Chia and Wallace 2002).

Figure1: Vegetation Change Imagery 1988 - 2002.



Green = Ever Bush, Yellow = Never Bush, Grey = Water, Red = Vegetation Loss 1988 – 2002 and Blue = Vegetation Gain 1988 – 2002.

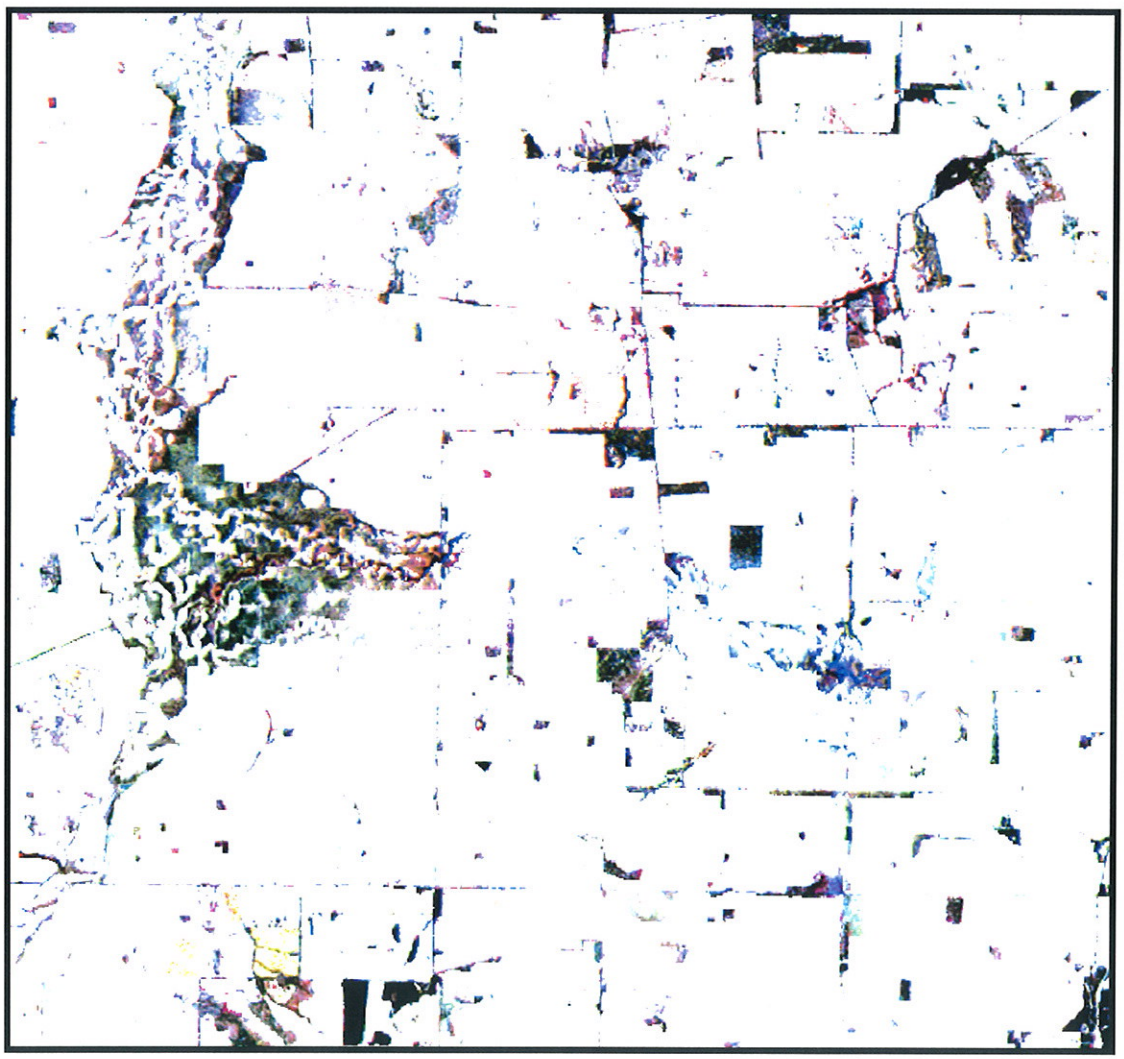
Examination of the change imagery above showed that vegetation loss had occurred along the natural waterway between 1988 and 2002.

VEGETATION INDEX SEQUENCE 1988 – 2002

The Vegetation Index Sequence 1988 – 2002 is used to produce 'time-trend' graphical plots of the index at a range of scales. These can be used in association with the change map products to display and compare the patterns of response for areas of interest (Wallace and Chia 2002).

The index sequence can also be used to produce colour image displays of changes in the vegetation index for selected dates. Figure 2 is an index sequence of vegetation change in the Reserve between 1988 and 1998.

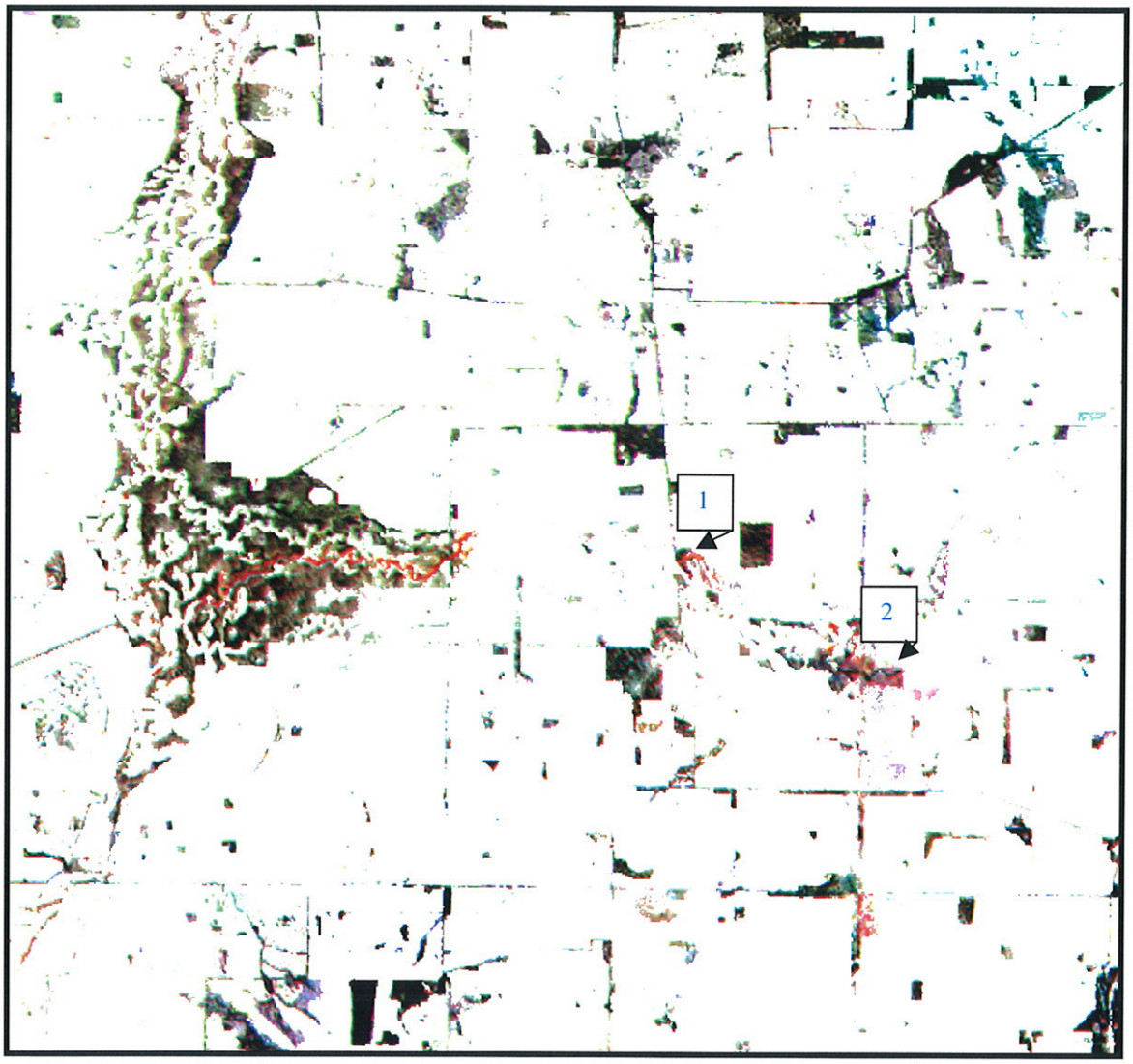
Figure 2: Vegetation Index. Years 1988, 1992 and 1998 displayed in Blue, Green and Red.



The vegetation within the natural waterway appears stable (Black). However there are some areas of vegetation decline around the channel (Red).

An index sequence to display vegetation change for 1996, 1998 and 2002 is presented in Figure 3.

Figure 3: Vegetation Index. Years 1996, 1998 and 2002 displayed in Blue, Green and Red.

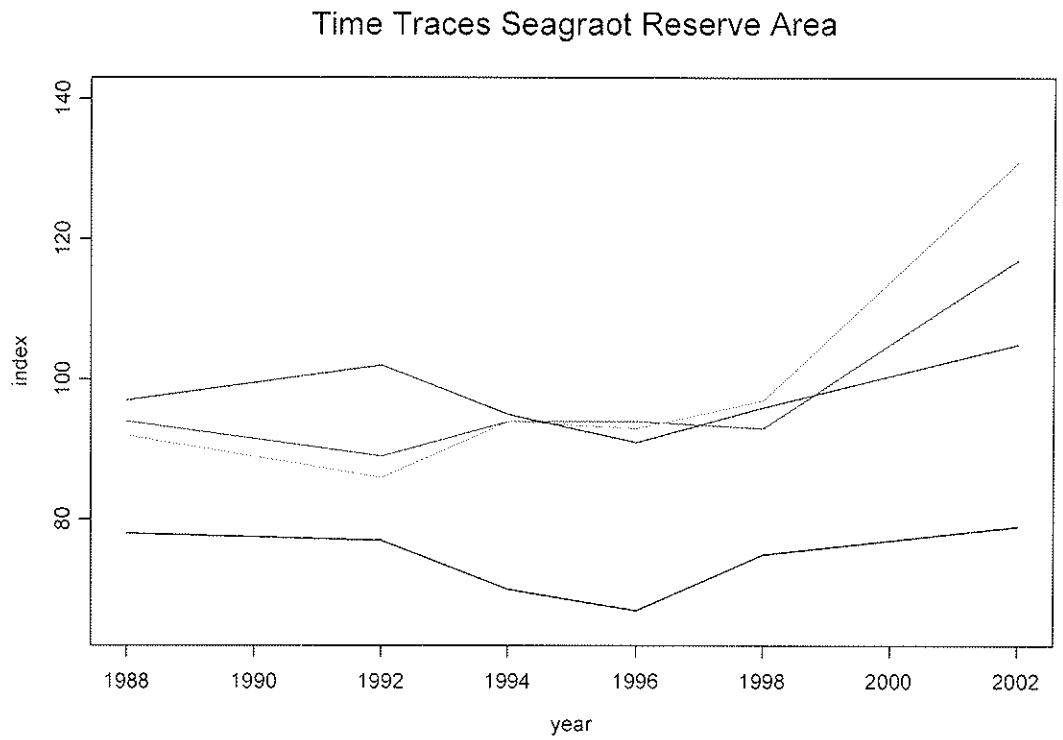


The red indicates vegetation loss has occurred in the main waterway after 1998. Additionally, there are two areas of vegetation loss along the drain line east of the Reserve (1 and 2).

TIME TRACES

The time trace provides mathematical support to the changes displayed in the imagery.

Figure 4: Landsat TM time traces of vegetation sites at Seagroatt Reserve and surrounding areas. An increase in the index brightness indicates loss of vegetation cover.

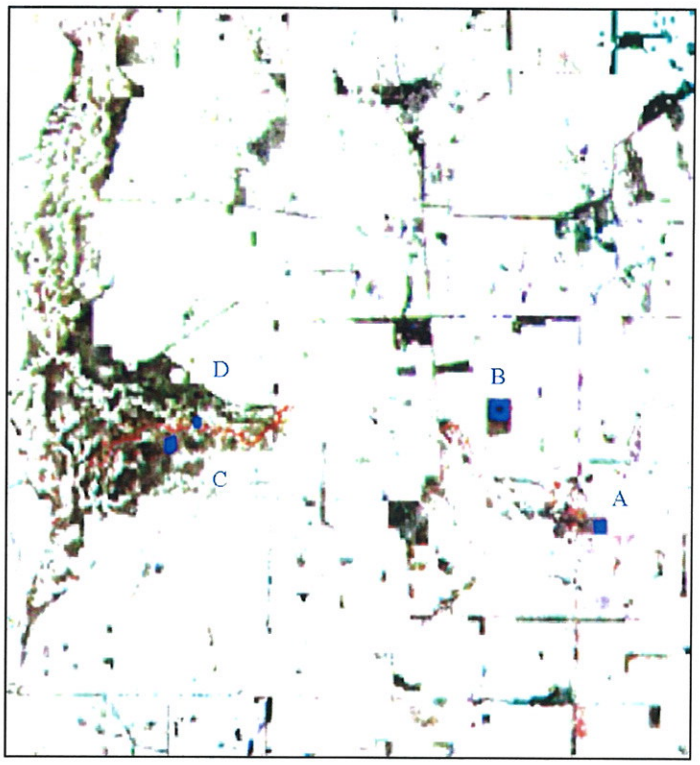


Black – stable vegetation north and east of the drain (B in Figure 5)
Green – stable vegetation in Seagroatt Reserve (Grey in Figure 2; C in Figure 5).
Red – remnant vegetation along the channel east of Seagroatt Reserve
(Red in Figure 2; A in Figure 5).
Orange – remnant vegetation in main waterway of Seagroatt Reserve
(Red in Figure 2; D in Figure 5).

The graph indicates that the Reserve was reasonably stable prior to 1998 though less dense than the remnant vegetation away from the main channel. After 1998, there is a sharp decline in vegetation health along the main waterway in the Reserve and east of the Reserve.

The locations of the training sites used to produce the time traces are shown in Figure 5.

Figure 5. Location of training sites A, B, C and D used to generate the time traces.

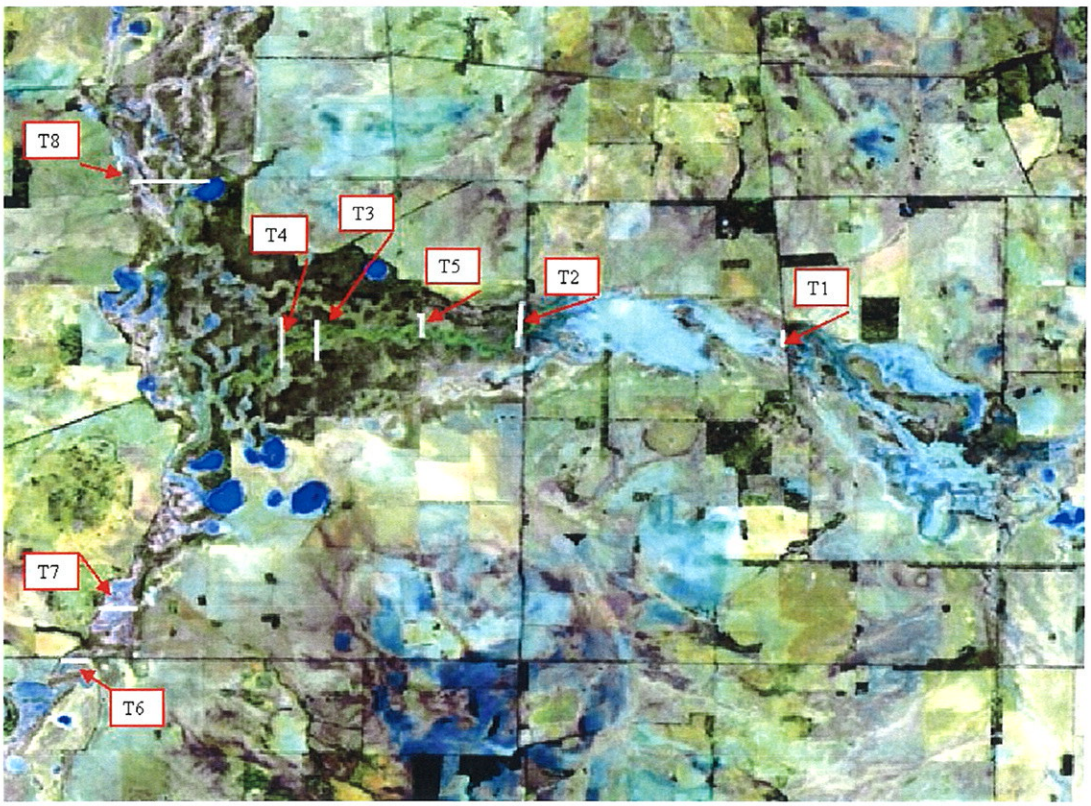


SITE SELECTION FOR SPECTRAL ANALYSIS.

The vegetation index map for 1996, 1998 and 2002 (Figure 3) was used to identify sites for spectral analysis of surface and sub-surface chemistry. Transects were located in the Reserve where vegetation loss had occurred and at strategic points along the main waterway (Figure 6).

A field survey along these transects was undertaken to identify the presence and distribution of minerals associated with drainage. Mineral deposits, precipitating from the drain discharge, are likely to manifest as stream-bed or channel coatings and may impact on the health of the surrounding vegetation. During flood phases, these minerals may be mobilized and transported downstream increasing their area of influence. Ian Tapley and Mark Pirlo (CSIRO) report the findings of the soil and water geochemistry study.

Figure 6: Landsat TM image enhancement from overpass on 3 January 2003. Bands 7, 5 and 4 displayed in Red, Green and Blue.



T1, T2, T3, T4, T5, T6, T7 and T8 show the location of the transects where spectral characteristics (surface mineralogy) were measured by CSIRO using a hand held radiometre.

Transects T3, T4, and T5 are located where vegetation loss had occurred inside Seagroatt Reserve. Transects T1, T2, cross the natural waterway east of the Reserve and downstream from the drains discharge. Transects T6 and T7 cross the natural watercourse south (upstream) of the Reserve and would not be influenced by the Narembeen drain. Transect T8 crosses the natural watercourse north (downstream) of the Reserve which runs west from Lake Ardath.

Photo point locations were set along transects T1, T2, T3, T4, T5 and T8. The GPS derived photo point coordinates (GDA94) are listed in Appendix 1. Thumbnail prints taken at each of the photo points are displayed in Appendix 2. A digital copy of each photo is available on the accompanying CD.

CALM INDEX FOR VEGETATION CHANGE.

Change within Seagroatt Reserve was then investigated using Percentage Foliage Cover (PFC) analysis techniques developed by CALM. PFC is used to map healthy canopy cover in native vegetation. The PFC analysis supports the changes displayed by the Land Monitor imagery.

Three dates of Landsat TM imagery were indexed (1996 1998 and 2002). All three dates were calibrated and rectified using the Land Monitor base imagery. An arbitrary common histogram clip was applied to all three dates. In each image, areas identified as vegetation were assigned a colour. A composite image of vegetation change through time was then produced.

Figure 7: Index of Landsat TM - Seagroatt Reserve 1996. Green indicates 'healthy' vegetation.

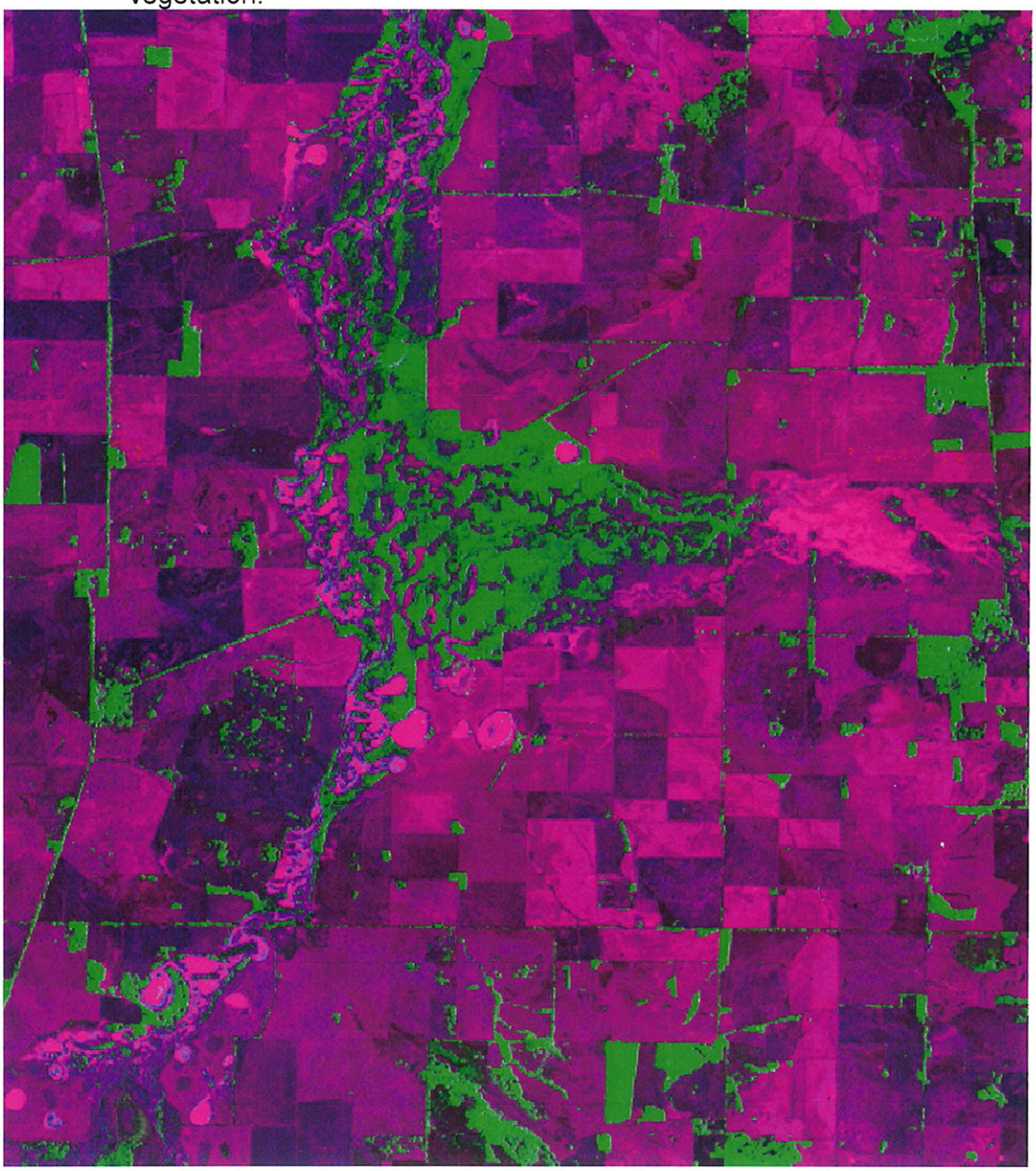


Figure 8: Index of Landsat TM - Seagroatt Reserve 1998. Green indicates vegetation canopy cover.

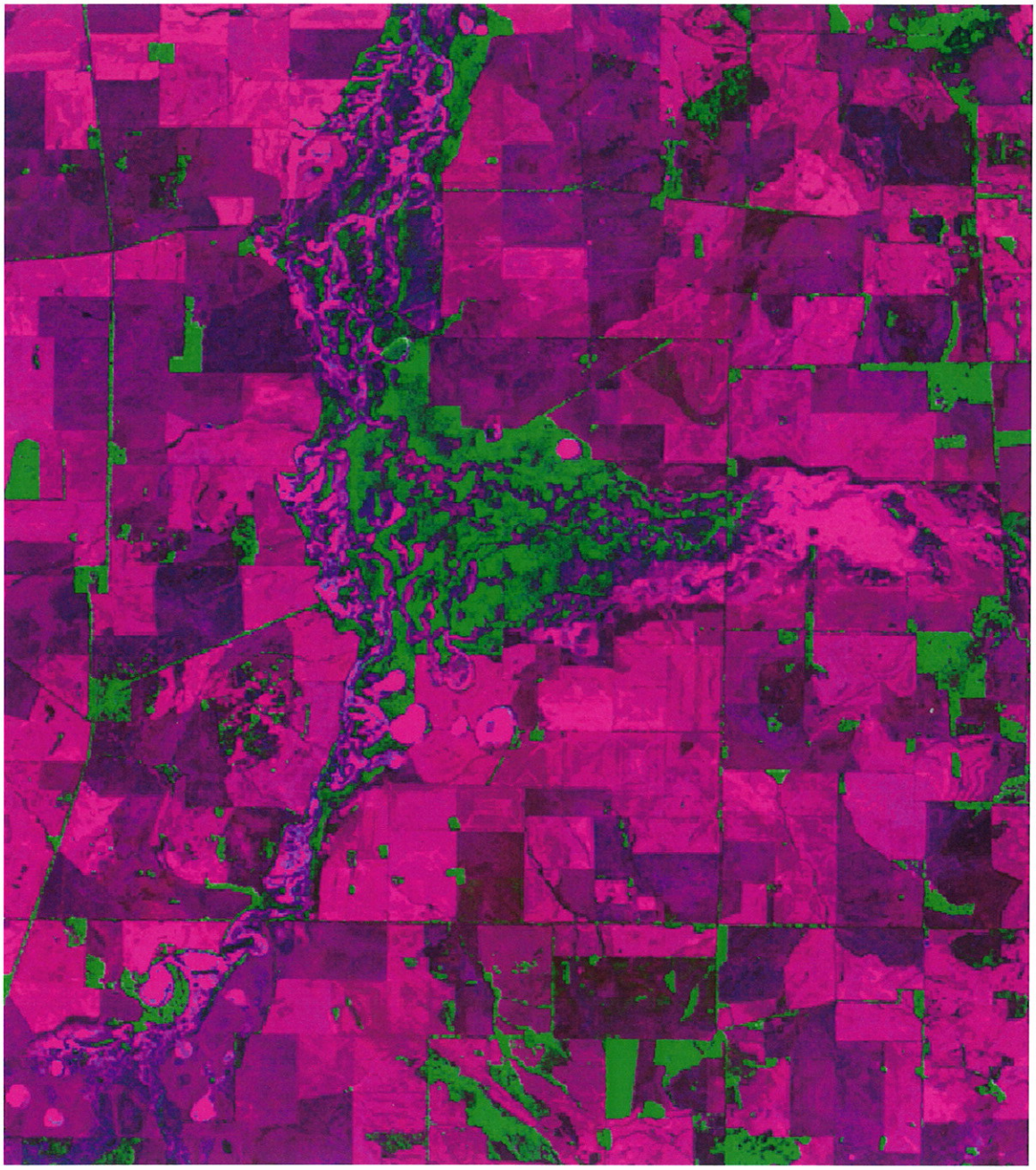


Figure 9: Index of Landsat TM - Seagroatt Reserve 2002. Green indicates vegetation canopy cover.

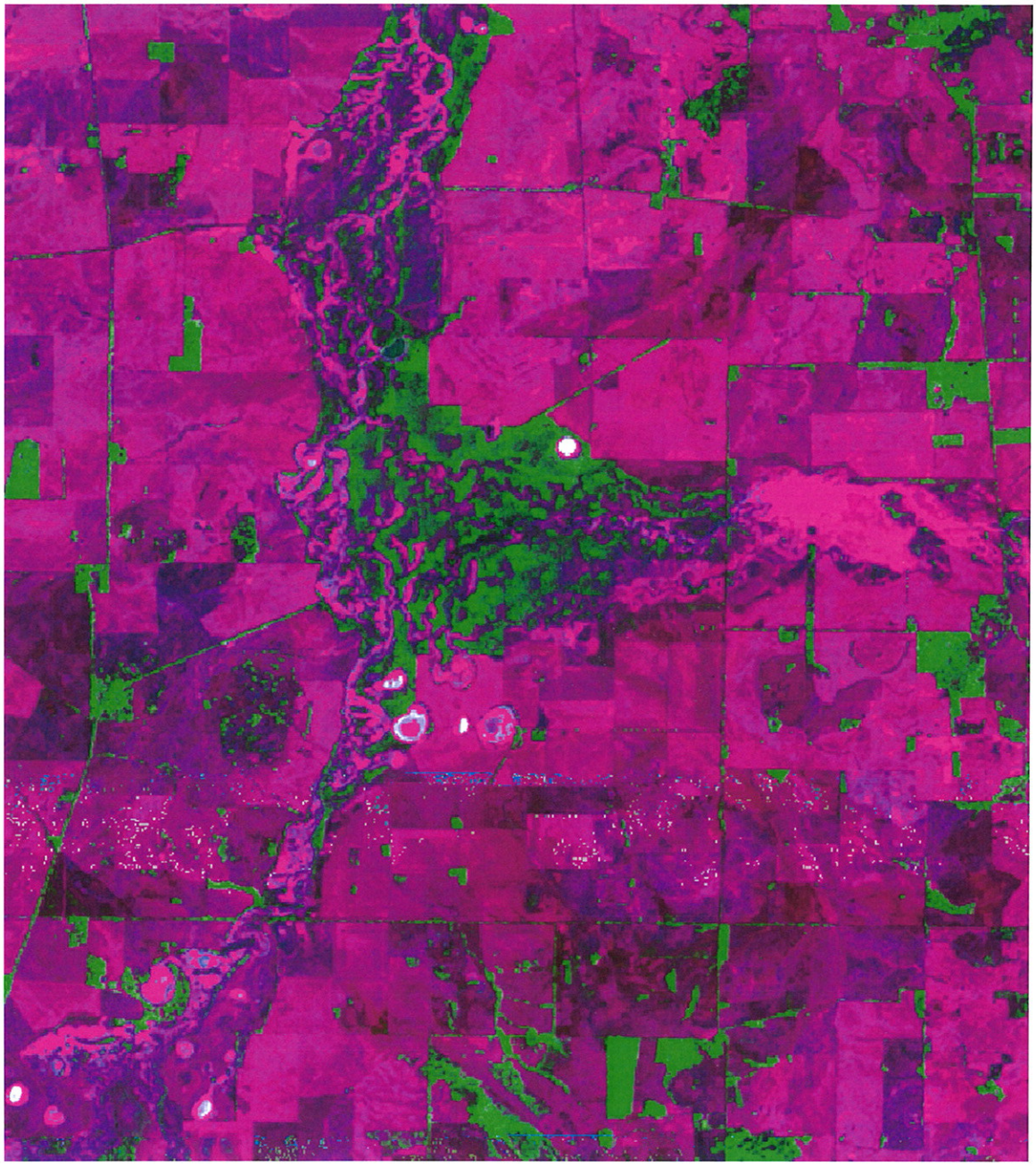
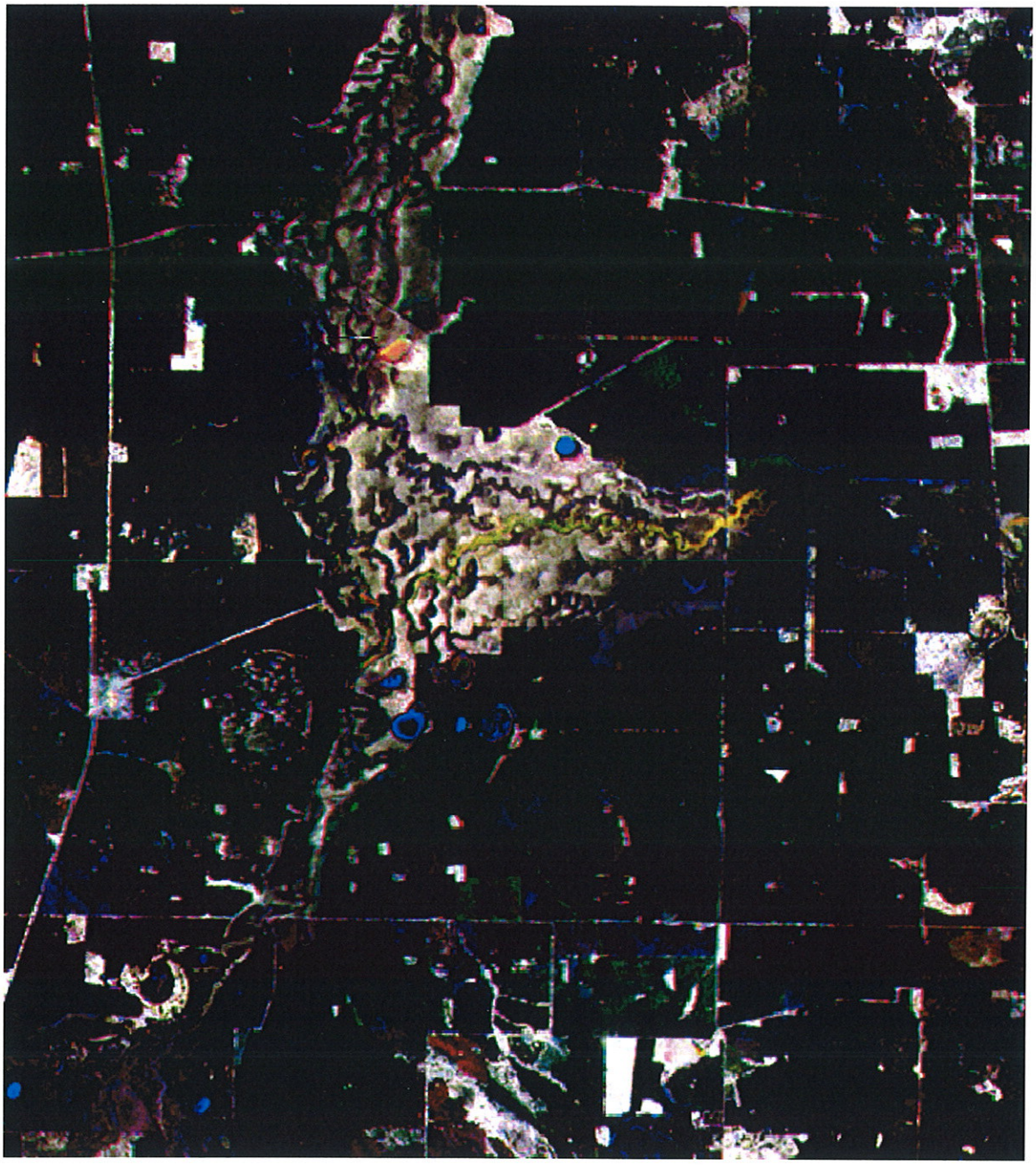


Figure 10: Composite image of Seagroatt Reserve 1996, 1998 and 2002.



Red (and reddish tones) indicates recent increase in canopy cover (2002).
Yellow (and yellowish tones) indicates decline in canopy cover in 1998 and no recovery in 2002.
White indicates 'constant' remnant vegetation.
Black is pasture.

References.

Chia J.L.C. and Wallace J.F. (2002), Vegetation extent and change 1988 – 2002 south west agricultural region of Western Australia. An update to 2002 of the Land Monitor Project Vegetation Project #1. CSIRO Mathematical and Information Science.

Wallace J.F. and Chia J.L.C. (2002), Vegetation index sequence 1988 – 2002 south west agricultural region of Western Australia. Land Monitor II Project Vegetation Final Product #4. CSIRO Mathematical and Information Science.

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Jim Dixon (Department of Agriculture)

APPENDIX 1: Easting and Northing (GDA94) coordinates of photo points.

TRANSECT & PHOTO NUMBER		EASTING & NORTHING
T1-01	north	E617863
T1-02	south	N6445420
T1-03	north	E617860
T1-04	south	N6445566
T2-01	north	E613798
T2-02	south	N6445282
T2-03	north	E613798
T2-04	south	N6445762
T2-05	north	E613848
T2-06	south	N6445540
T2-07	east	E613845
T2-08	west	N6445625
T3-01	north	E610575
T3-02	south	N6445455
T3-03	north	E610575
T3-04	south	N6445686
T3-05	north	E610575
T3-06	south	N6445802
T3-07	north	E610576
T3-08	south	N6445567
T4-01	north	E610018
T4-02	south	N6444952
T4-03	north	E610018
T4-04	south	N6445205
T4-05	north	E610020
T4-06	south	N6445313
T4-07	north	E610022
T4-08	south	N6445875
T5-01	north	E612215
T5-02	south	N6445076
T5-03	north	E612220
T5-04	south	N6445505
T5-05	north	E612223
T5-06	south	N6445649
T5-07	north	E612220
T5-08	south	N6445862
T8-01	east	E608585
T8-02	west	N6448329
T8-03	east	E608104
T8-04	west	N6448333
T8-05	south	