MALLEE CATCHMENT
TECHNICAL BULLETIN

Technical Bulletin # 20.

Trends in native vegetation condition in the Victorian Mallee

Above: Photopoint photograph of Koonda Reserve site KR05 in October 1999. Photo: Ian Sluiter.

Left: Photopoint photograph of Koonda Reserve site KR05 in November 2011. Photo: Ian Sluiter.

At a glance

- A vegetation survey was undertaken in spring 2011 to investigate changes in vegetation condition over time;
- The survey revealed that changes in vegetation condition at studied sites were related to a number of environmental variables, including grazing, cumulative rainfall and soil salinity; and
- Information collected from these sites has the potential to inform land managers on the catchment condition and change.

This technical bulletin summarises the findings of a survey undertaken in spring 2011 to investigate changes in vegetation condition and composition over time in the Victorian Mallee.

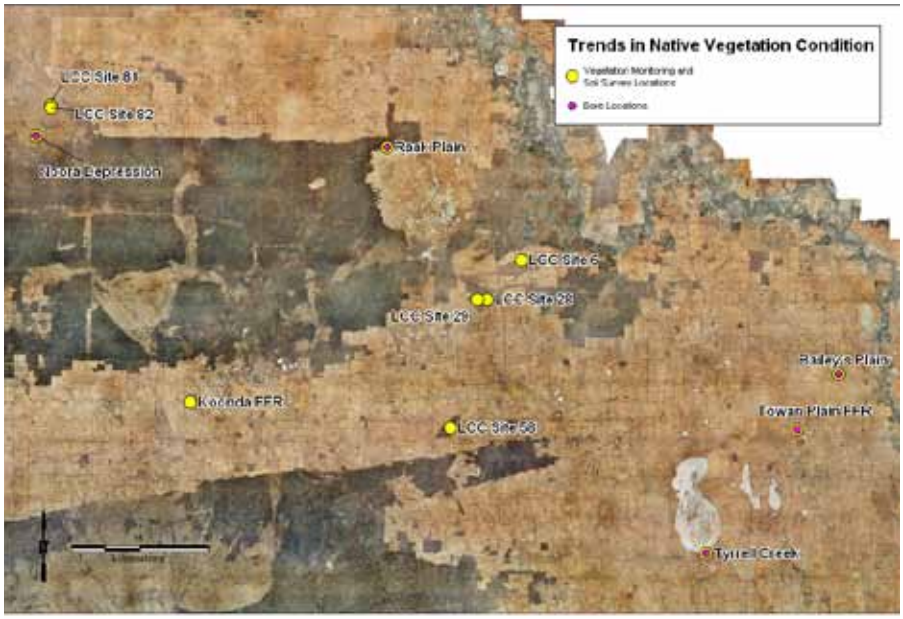
The objective of this project was to improve knowledge of the current vegetation condition at established long-term monitoring sites to determine if there has been a change in condition over time.

Background

Long-term flora studies within Victoria are rare. The Mallee Study Area Land Conservation Council (LCC) and Mallee Mandatory Monitoring (3MP) datasets stand out from others and allow current comparisons with past vegetation condition. The LCC data were collected over 25 years ago providing long-term insights into vegetation change. The 3MP data were collected from permanently established sites in 1995 which were monitored yearly to 2004, and again in 2007.

Well above average rainfall across the Mallee catchment in the 2010-11 period associated with a La Nina climatic event caused visible widespread changes in Mallee vegetation.

mallee
catchment management authority



Above: Location map of the study sites.

This project aimed to assess changes in vegetation condition in relation to rainfall, soil salinity, grazing and groundwater data. The following questions were investigated as part of this project:

1. Have there been significant and measurable vegetation changes over time?
2. What are the environmental causes of these changes?

Methods

Vegetation assessments were made in October 2011 at six LCC sites and six 3MP sites as outlined below.

Site Locations

The six LCC study sites selected for assessment were LCC site 6 – Hattah-Kulkyne National Park; LCC sites 28, 29, 81 and 82 - Murray-Sunset National Park; and LCC site 58 – Timberoo Flora and Fauna Reserve (FFR).

The six 3MP sites studied were Bailey's Plain (near Piangil), Raak Plain (south of Mildura), Towan Plain (west of Nyah), Tyrrell Creek (near Sea Lake and the entrance to Lake Tyrrell), Noora Depression (Morkalla South) and Koonda (north of Tutye). Figure 1 shows the location of the study sites.

Vegetation Monitoring

At each LCC study site the following methods were used to assess the vegetation:

- Floristic data (cover abundance) was recorded using fixed 20x20m (400m²) quadrats as per the method used in the initial LCC survey in the mid 1980s;
- Photographs were taken to replicate existing photos taken approximately 25 years ago; and
- A 20m monitoring transect was also established to undertake detailed floristic assessments to enable detailed botanical comparisons to be made in the future.

At 3MP study sites the following methods were used to collect floristic information:

- Species cover/abundance was recorded at all sites using small 1m² quadrats that were established in 1995 and monitored yearly over the next decade;
- Photopoint photos from permanently established points were taken at each site and compared with past photos across two former baseline years – i.e. 1997 and 2002;
- A 20m monitoring transect was established at six quadrat locations to undertake detailed floristic assessments to enable detailed botanical comparisons to be made in the future.

Soil Surveys

Soil auger holes were dug and soil profiles described and sampled for soil salinity (electrical conductivity) and pH at each site.

Groundwater

Groundwater bore data were collected from five 3MP sites where bores exist and compared with past data collected between 1995 and 2007.

Cumulative Rainfall Data

Past rainfall data was obtained from the nearest reliable Bureau of Meteorology station to the sites so that cumulative rainfall totals could be assembled for 6, 12, 18 and 24 month intervals prior to sampling.

Grazing

Historic grazing was determined based on anecdotal evidence from local experts, while current grazing was based on local knowledge and evidence of grazing at the sites.

Results and Key Findings

The six LCC study sites included three where large changes (LCC Sites 58, 81 and 82) were evident and three where changes were evident, but more subdued (LCC Sites 6, 28 and 29). The removal of grazing was found to have a major influence in the improvement in vegetation condition at four sites. Large cumulative rainfall totals in the period leading up to the 2011 survey were also implicated at some sites, in particular at one site in Murray Sunset National Park near Trinita (LCC Site 28). A decline in vegetation condition at the other site near Trinita (LCC Site 29) was considered attributable to increasing salinity of the soil at this location. The number of study sites was low and a broader spread would have provided more insight into changes in vegetation over the 25 year period.

All five of the 3MP sites with bores followed a similar groundwater pattern.

Figure 2: Morkalla South LCC Site #81, June 1986. Photo: Photo: Ian Sluiter.

Figure 3: Figure 1: Morkalla South LCC Site #81, December 2011. Photo: Photo: Ian Sluiter.

In summary, groundwater levels fluctuated between 1997 and 2011, rising closer to the surface during 2000 before declining during the drought years and rising again in 2011 following significant rain in the region. Four of the five sites also became more acidic over the 14.5 year period studied. The vegetation changes at all six sites indicated a trend of increasing saline influence between 1997 and 2011. Plant taxa such as the highly salt tolerant Grey Glasswort (*Tecticornia halocnemoides ssp. halocnemoides*) and the less salt tolerant Leafy Sea-heath (*Frankenia foliosa*) expanded and contracted respectively at the lowest elevations (nearest to the regional groundwater table) at the sites at Bailey's Plain and Raak Plain where the most intensive monitoring work was conducted. When the more detailed botanical information from Bailey's Plain and Raak Plain were statistically analysed separately from other 3MP site data, the two dominant variables in decreasing order of importance were soil salinity at 5-30cm along with cumulative rainfall received in the previous 6 months.

In terms of relevance to the vegetation present at the six 3MP sites, the results provide a clear message that vegetation change has been impacted by increased soil salinity, in five cases (Bailey's Plain, Raak Plain, Towan Plain, Tyrrell Creek and Noora Depression) associated with measured rises in groundwater height. Increasing soil acidity at four sites (Bailey's, Raak, Towan and Tyrrell Creek) was shown to be the most dominant variable in that dataset and was shown to have the greatest influence on vegetation change.

Please refer to the case studies following for a summary of changes in vegetation condition assessed at selected survey sites.

Cast Study One - Morkalla South (LCC Site #81)

This site was State Forest until 1989 when the Land Conservation Council declared the area to be part of Murray-Sunset National Park (LCC 1989). In 1986 when the site was floristically surveyed, stock grazing pressure was 'high'. Grazing exclusion occurred from 1990 and the site is now classified as having 'low' grazing pressure. The topsoil and subsoil at this site is sandy, alkaline and non-saline.

Figures 2 and 3 provide a photographic comparison of the site 25 years apart in 1986 and 2011. The major change in 2011 was the extremely high Bladder Saltbush and Balcarra Speargrass plant cover. The former species, although present in 1986, was in no way as dominant at the time. The introduced Mediterranean Turnip (*Brassica tournefortii*) was also a dominant species in 1986.

The site had vastly different understorey types than what occurred at these sites in August 1986. In 2011, cover and biomass of native perennial grasses (mostly Austrostipa spp.), Bladder Saltbush and Limestone Copperburr (*Sclerolaena obliquicuspis*) was extremely high. The extremely high long-term cumulative rainfall totals for this site prior to the November 2011 sampling period, combined with a non-stock grazing regime are considered to be the primary drivers of vegetation recovery.

Case Study Two - Raak Plain

The major change at this site involved the expansion of Grey Glasswort in 2011 at the monitoring sites with the lowest elevations. This change also coincided with a contraction in the range and abundance of Leafy Sea-heath at this site. These vegetation changes appear to have occurred in response to significantly more saline soil conditions at all three monitoring points in 2011 compared with 2002. Groundwater at this site also increased in elevation by approximately 40cm between 1997 and 2011.

Groundwater pH also fluctuated between 4.5 to 3.25 over the period between 1997 and 2011, with a general trend toward increasing acidity in more recent years.

Implications of the Findings/ Recommendations

The project has shown the potential for successful statistical analysis of well collected and curated ecological data. Changes in vegetation condition at studied sites were clearly related to particular environmental variables.

Figure 4: Raak Plain Site #RP06, February 1997. Photo: Photo: Ian Sluiter.

Figure 5: Raak Plain Site #RP06, April 2002. Photo: Photo: Ian Sluiter.

Figure 6: Raak Plain Site #RP06, November 2011. Photo: Ian Sluiter.

The information previously collected from these sites, has the potential to inform a number of land managers on the subject of catchment condition and change.

A number of recommendations are considered relevant in the light of the results of this study and include:

1. A repeat monitoring (using identical vegetation and soil methodologies) of LCC study sites assessed in this report to be undertaken every 5 years;
2. That consideration be given to expanding the number of LCC sites assessed so that the statistical analyses undertaken can assess a wider degree of variation which would help with interpretation of changes in remnant vegetation at these long-term monitoring sites;
3. That surveys of vegetation (and accompanying groundwater bore data) at 3MP sites be conducted on an occasional basis, as was done in 2007;
4. As a minimum, it is recommended that such occasional monitoring includes all former Mallee Dryland sites;
5. The 20m long transects used at LCC study sites were established with wooden pegs. These should be replaced by galvanised metal stakes so that they can be located in the future.

Acknowledgements

The Mallee Catchment Management Authority (CMA) engaged Ogyris Pty Ltd to undertake this project, with funding provided by the Mallee CMA.

Further information

The information for this technical bulletin has been taken from *'Trends in native vegetation condition: An assessment of two long term mallee environmental datasets'*, a report for the Mallee CMA by Ogyris Pty Ltd. For further information about this project contact the Mallee CMA on (03) 5051 4671.

Project Partners

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