Markaranka Flat Floodplain Vegetation Monitoring - Initial survey

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Executive Summary

Markaranka Flat is a temporary wetland of 197.8 ha located approximately 25 km from the township of Waikerie. The lagoon was artificially flooded in spring 2006 with water donated by Penfolds winery in an endeavour to improve tree health. The lagoon dried by evaporation and when surveyed in 2007 was dry, with the exception of remnant pools at low elevations (Marsland and Nicol, 2008). During the 2008 survey the lagoon had completely dried.

The current monitoring project was established with the aim to detect changes brought about by the expansion of the Waikerie salt interception scheme (SIS). The first round of surveys was undertaken in November 2008, prior to the commissioning of the expansion of the SIS, to determine the current distribution and abundance of plant species. Comparisons of the current data with that of future surveys will allow temporal changes in the understorey vegetation and tree health to be detected, which will assist managers to identify management objectives and assess the impacts of the expansion of the SIS.

Methods were designed to be scientifically robust but straightforward to allow non-specialists to undertake monitoring in the future. In addition, the methods are the same as those used for The Living Murray monitoring in South Australia (upstream of Wellington) and the Lindsay Wallpolla and Hattah systems that will allow comparisons to be made between these sites.

Quantitative vegetation surveys were undertaken along five transects that were spread across the floodplain and lagoon bed. Quadrats were established at the same elevations used in previous monitoring undertaken by DWLBC. In addition, visual condition estimates of 168 *Eucalyptus camaldulensis* var. *camaldulensis* and 40 *Eucalyptus largiflorens* trees were undertaken.

Understorey vegetation was dominated by desiccation tolerant species, with the exception of narrow bands of *Cyperus gymnocaulos* around the lagoon edge.

Tree condition was variable across the floodplain. *Eucalyptus camaldulensis* var. *camaldulensis* condition ranged from poor to good and trees were generally in better condition closer to the lagoon and river. Trees close to the lagoon were generally flowering and had active epicormic growth, whereas trees further from the lagoon showed no signs of flowering or epicormic growth and were generally declining in condition. *Eucalyptus largiflorens* condition ranged from moderate to good but there were no clear spatial patterns.

1. Background and Aims

The main aim of the survey was to establish a quantitative monitoring program that will assess the response of understorey vegetation and *Eucalyptus camaldulensis* var. *camaldulensis* individuals across Markaranka Flat to future management interventions; mainly the expansion of the Waikerie salt interception scheme (SIS) and engineered flooding of the temporary lagoon. Through continued monitoring, temporal changes in the health of the vegetation can be assessed and used to help identify management objectives. The methods used were repeatable and statistically robust. Importantly they were also straightforward to enable future implementation by non-specialists, who have minimal botanical expertise.

Markaranka Flat is a temporary wetland and floodplain system of 197.8 ha located approximately 25 km from the township of Waikerie. The system lies adjacent to the River Murray; however, the wetland and flood runners have been continuously disconnected from the river due to the lack of overbank flows. In spring 2006 the lagoon was flooded by pumping with water donated by Penfolds winery and the red gum recovery project in an endeavour to improve *Eucalyptus camaldulensis* var. *camaldulensis* health adjacent to the lagoon. The lagoon was drawn down by evapotranspiration and infiltration over a 24-month period and was dry at the time of this survey.

The monitoring program was established in order to monitor the vegetation of the dry lagoon bed and floodplain and the condition of *Eucalyptus camaldulensis* var. *camaldulensis* and *Eucalyptus largiflorens* trees. These features of the system are most likely to be affected by changes in wetland hydrology, either by direct management actions (such as the Waikerie SIS, engineered flooding or weir pool manipulations) or changes to regional flow regimes in the future.

2. Methods

The vegetation survey at Markaranka Flat consisted of two components:

- Quantitative vegetation surveys
- Tree condition assessment

2.1. Vegetation Survey

A total of 66 permanent quadrats, along five transects were established across the Markaranka Flat floodplain. Transects one, two and three were established by the DWLBC in 2005 and the corresponding quadrats were chosen to represent the different vegetation communities present. To standardise the monitoring program, the elevation of these quadrats was determined, and new quadrats were placed at the same elevations, if possible, along the remaining two transects. Each transect runs approximately perpendicular to the river through the dry lagoon bed (or lowest elevation). Sets of three quadrats, 50 metres apart, were placed at five elevations (3.56, 3.67, 4.33, 6.66 and 8.45 m AHD) along each transect, where possible.

Transect one is composed of four sets of quadrats at four elevation points (3.56, 3.67, 4.33 and 6.66 m AHD). Survey points were also established at the same elevations along transect two; however, this transect included survey points on either side of the lagoon, (i.e. 1 x 3.56, 2 x 3.67, 2 x 4.33 and 2 x 6.66 m AHD). Transect three runs along one side of the dry lagoon bed and quadrats were placed at all five elevations. Both transects four and five were positioned away from the lagoon on higher ground, and quadrats were only established for the higher elevations. For these transects two sets of quadrats were established for each elevation, specifically, two at 6.66 and 8.45 m AHD (transect four) and two at 8.45 m AHD (transect five).

The survey methods were the same as used by Weedon and Nicol (2006) and Zampatti *et al.* (2006) for monitoring floodplain understorey at Chowilla. Quadrat size was determined by species area curves conducted in previous surveys of River Murray floodplain wetlands (Nicol *et al.* 2006), which resulted in quadrats with dimensions of 15 x 1 m (Figure 1). This size captured at least 95% of the species present in an association and enables narrow riparian zones to be surveyed.

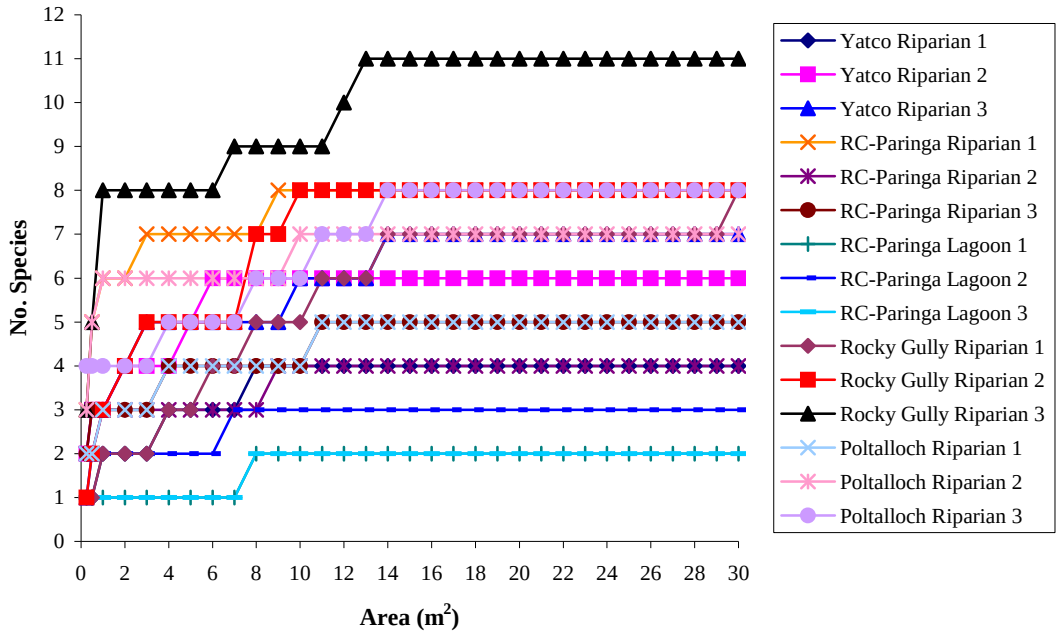

Figure 1: Species area curves for Yatco Lagoon, Reedy Creek-Paringa, Poltalloch and Rocky Gully Wetlands (Nicol *et al.* 2006).

Species abundances were determined by frequencies; each quadrat was divided into 15, 1 x 1 m cells and the presence or absence of species was noted for each cell. This resulted in a score for each species of between zero and 15 for each quadrat. Cells with no living plants were given a score of one for "Bare soil".

Plants were identified using keys in Jessop and Tolken (1986), Jessop *et al.* (2006), Cunningham *et al.* (1981) and Sainty and Jacobs (1981; 1994). Nomenclature follows Barker *et al.* (2005).

The location of the survey point for each set of quadrats was marked by GPS and identified by a star dropper to enable the same area to be re-surveyed in the future.

2.2. Tree Health

Condition of *Eucalyptus camaldulensis* var. *camaldulensis* and *Eucalyptus largiflorens* were assessed visually using the method developed by Souter *et al.* (2008). Unlike the method used in baseline surveys (e.g. Nicol *et al.* 2006), which give a snapshot of tree condition, this method takes into consideration not only current condition but crown density and extent, bark form, leaf damage, leaf die off, trajectory (whether condition is improving, declining or remaining the same) and reproduction (Souter *et al.* 2008). In addition, this method is used by The Living Murray and will allow comparisons to be made with other sites throughout the Murray Darling Basin.

Existing trees surveyed by DWLBC staff were re-surveyed and an extra transect of *Eucalyptus camaldulensis* var. *camaldulensis* and *Eucalyptus largiflorens* trees was established adjacent to understorey transect five. Trees were randomly selected and marked with a cattle ear tag bearing the tree number. The location of each tree was also marked by GPS.

3. Results

3.1. Vegetation Survey

During the spring 2008 survey the floodplain of Markaranka was predominantly characterised by an open *Muehlenbeckia florulenta* shrubland with *Atriplex* spp., *Sclerolaena* spp., *Enchylaena tomentosa* and *Maireana microcarpa.* Adjacent to the lagoon, the floodplain was dominated by open *Eucalyptus camaldulensis* var. *camaldulensis* woodland with a diverse understorey assemblage including *Atriplex* spp., *Sclerolaena* spp. and *Maireana microcarpa*, interspersed with *Muehlenbeckia florulenta, Senna artemisiodes* ssp. *filiofolia* and *Dodonaea attenuata.* The remaining area of floodplain, further away from the lagoon, was characterised by open *Eucalyptus largiflorens* woodland with a sparse understorey including *Muehlenbeckia florulenta, Atriplex* spp., *Sclerolaena* spp. and *Enchylaena tomentosa.* In this survey the lagoon bed was predominantly bare with patches of *Chenopodium* sp. with *Heliotropium curassavicum, Sonchus* sp. and *Glycyrrhiza acanthocarpa.* The lagoon edge was a diverse *Cyperus gymnocaulos* sedgeland with *Atriplex* spp., *Psuedognaphalium luteo-album, Sporobolus mitchelli*, *Polygonum aviculare, Heliotropium curassavicum, Chenopodium* sp. and *Morgania floribunda.*

3.2. Tree Health

Eucalyptus camaldulensis var. *camaldulensis* tree health was variable across the floodplain. Trees closest to the lagoon tended to be in better condition than those further away. Trees adjacent to the lagoon generally had denser canopies, active epicormic growth, flowers or buds present, active crown growth and minimal leaf damage and die off. In contrast, trees located away from the lagoon had no epicormic growth or crown growth, canopies were less dense, flowers or buds not present and significant leaf damage and die off.

Eucalyptus largiflorens tree condition varied from moderate to good across the floodplain. Canopy densities were generally high, the majority of trees had buds present and actively growing crowns, no epicormic growth and minimal leaf damage and die off. However, most trees had mistletoe present.

4. Discussion

Marsland and Nicol (2008) reported a large number of amphibious and flood dependent species present at Markaranka Flat in spring 2007, which was probably the result of engineered flooding of the lagoon. In spring 2008 the lagoon bed was largely devoid of plants; however, the majority of the species present in 2007 were short-lived annual species that are well adapted to ephemeral systems (Cunningham *et al.* 1981). Future flooding (engineered or natural) will probably result in recruitment of amphibious and flood dependant understorey species on the lagoon bed as the majority of species present in 2007 have long-lived persistent seed banks (Nicol 2004).

The data show that there is evidence that engineered flooding can have a lasting positive impact on *Eucalyptus camaldulensis* var. *camaldulensis* condition. Trees growing around the edge of the lagoon were in better condition (and appear to be improving) than those growing away from the lagoon, which appear to be declining. *Eucalyptus largiflorens* condition was generally moderate to good with active growth and flowering; however, it is likely that the condition of these trees will decline in the absence of flooding; similar to what has been observed in the Chowilla system in recent years (J. Nicol pers. obs.).

The combination of saline groundwater lowering due to the expansion of the Waikerie SIS and engineered flooding may have increased benefits in comparison to engineered flooding alone. A deeper freshwater lens below the lagoon bed may develop, which will provide a longer lasting water source for the perennial fringing vegetation. In addition, the lowering of the saline water table may result in deeper infiltration of rainfall. If this is the case, there should be a lasting improvement in tree condition that correlates with saline water table depth after the expansion of the SIS is switched on and the system is flooded (engineered or natural).

The data presented in this report provide a basis for comparison with monitoring in future years to detect changes in vegetation across the Markaranka Flat floodplain.

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