Markaranka Flat Baseline Vegetation Survey

K.B. Marsland and J.M. Nicol

6 February 2008
SARDI Aquatic Sciences Publication Number F2008/000059-1

This Publication may be cited as:
Marsland, K.B. and Nicol, J.M. (2008). Markaranka Flat Baseline Vegetation Survey. South Australian Research and Development Institute (Aquatic Sciences), Adelaide, 17pp. SARDI Publication Number F2008/000059-1.

South Australian Research and Development Institute
SARDI Aquatic Sciences
2 Hamra Avenue
West Beach SA 5024

Telephone: (08) 8207 2400
Facsimile: (08) 8207 5481
http://www.sardi.sa.gov.au

Printed in Adelaide February 2008

SARDI Aquatic Sciences Publication Number F2008/000059-1
SARDI Research Report Series Number 269
ISBN Number 978-0-7308-5384-8

Authors: Kelly Marsland and Jason Nicol
Reviewers: Aimee Linke (Mid Murray Local Action Planning Association) and Leigh Thwaites
Approved by: Q. Ye

Signed:
Date: 6 February 2008
Distribution: Mid Murray LAP, Riverland West LAP, SAMDBNRM Board, Southcorp Wines and SARDI Aquatic Sciences Library
Circulation: Public Domain

Table of Contents

Table of Contents i
List of Figures i
List of Tables i
Acknowledgements 1
Executive Summary 2
1. Background and Aims 3
2. Methods 4
2.1. Quantitative Vegetation Survey 4
2.2. Vegetation Mapping and Species Lists 5
2.3. Tree Health 6
3. Results 8
3.1. Surveyed quadrats 8
3.2. Tree Health 12
4. Implications of the data 15
5. References 16

List of Figures

Figure 1: Species area curves for Yatco Lagoon, Reedy Creek-Paringa, Poltalloch and Rocky Gully Wetlands (Nicol *et al.* 2006). 5
Figure 2: Vegetation map of Markaranka Flat showing the quantitatively surveyed quadrats and large-scale vegetation communities. 11
Figure 3: *Eucalyptus camaldulensis* var. *camaldulensis* tree health across Markaranka Flat. 13
Figure 4: *Eucalyptus largiflorens tree* health across Markaranka Flat. 14

List of Tables

Table 1. Modified Braun-Blanquet (1932) scale estimating cover/abundance as per Heard and Channon (1997). 5
Table 2: Tree health scale for *Eucalyptus camaldulensis* var. *camaldulensis* and *Eucalyptus largiflorens* (Tucker *et al.* 2003). 6
Table 3: Species list for Markaranka Flat (includes opportunistic observations not surveyed in quadrats) (*denotes exotic species) 9

Acknowledgements

The authors thank Aimee Linke, Aaron Boehm, Jack Caufield and other Penfolds employees for their assistance, Aimee Linke and Leigh Thwaites for comments on early drafts of this report. The Natural Heritage Trust Envirofund Program provided the funding to undertake this project.

Executive Summary

Markaranka Flat is a temporary wetland of 197.8 ha located approximately 25 km downstream of the township of Waikerie. The lagoon was artificially flooded in spring 2006 with water donated by Penfolds winery and the Red Gum Recovery Project in an endeavour to improve river red gum and back box health. A baseline vegetation survey of the wetland was undertaken in October 2007 after the lagoon had dried (with the exception of a few shallow pools at low elevations) to determine the current distribution and abundance of plant species.

Quantitative vegetation surveys were undertaken in the area artificially flooded and the remainder of the floodplain vegetation was mapped using ground-truthed aerial photography and a species list for the system compiled. In addition, visual health estimates of 50 *Eucalyptus camaldulensis* var. *camaldulensis* and 50 *Eucalyptus largiflorens* trees were undertaken.

The data were collected to identify management objectives and provide the basis for ongoing monitoring to determine temporal trends and changes brought about by management actions. Methods were designed to be scientifically robust but straightforward to allow non-specialists to undertake monitoring in the future.

A total of 73 plant species were recorded including 24 exotics. Eight different vegetation communities in the lagoon and floodplain areas were identified. Tree health was variable across the floodplain. *Eucalyptus camaldulensis* var. *camaldulensis* health ranged from poor to good and trees were generally healthier closer to the lagoon and river. *Eucalyptus largiflorens* tree health also ranged from poor to good but there were no spatial patterns.

The large number and high abundances of amphibious and flood dependent native species present was probably due to the artificial flooding. In addition, there were several flood dependent exotic species present in large numbers in the flooded area that will require control.

1. Background and Aims

This survey aimed to provide baseline data on the vegetation and tree health of Markaranka Flat to help identify management objectives, assess temporal trends via continued monitoring and evaluate the response of the vegetation to future management. The methods used were repeatable and statistically robust. Importantly they were also straightforward to enable future implementation by non-specialists, with minimal botanical expertise.

Markaranka Flat is a temporary wetland of 197.8 ha located approximately 25 km from the township of Waikerie. In spring 2006 the wetland was artificially flooded with water donated by Penfolds winery and the Red Gum Recovery Project in an endeavour to improve *Eucalyptus camaldulensis* var. *camaldulensis* and *Eucalyptus largiflorens* health adjacent to the lagoon. The lagoon was drawn down by evaporation and infiltration over a 12-month period and was largely dry, except for a few shallow pools at low elevations, when surveyed.

The quantitative survey focussed on the vegetation of the Markaranka Flat in the area artificially flooded in spring 2006. This area is most likely to be affected by changes in wetland hydrology, either by direct management actions (such as artificially flooding or weir pool manipulations) or changes to regional flow regimes in the future.

2. Methods

The vegetation surveys in each wetland consisted of three components:

- Quantitative vegetation surveys
- Vegetation mapping and species list
- Tree health assessment

The method used were identical to those used for the 2005 (Nicol *et al.,* 2006) and 2006 (Marsland and Nicol 2007) River Murray Wetlands baseline surveys.

2.1. Quantitative Vegetation Survey

The quantitative vegetation survey was conducted in the area of the wetland that was flooded in spring 2006. Three randomly located quadrats (n = 3) were surveyed within each plant community (selected from aerial photographs and ground truthed during the survey). Quadrat size was determined using species area curves (Figure 1). The most appropriate quadrat dimensions were 1 x 15 m (positioned parallel to the shoreline), which captured at least 95% of the species present in an association and enabled narrow riparian zones to be surveyed.

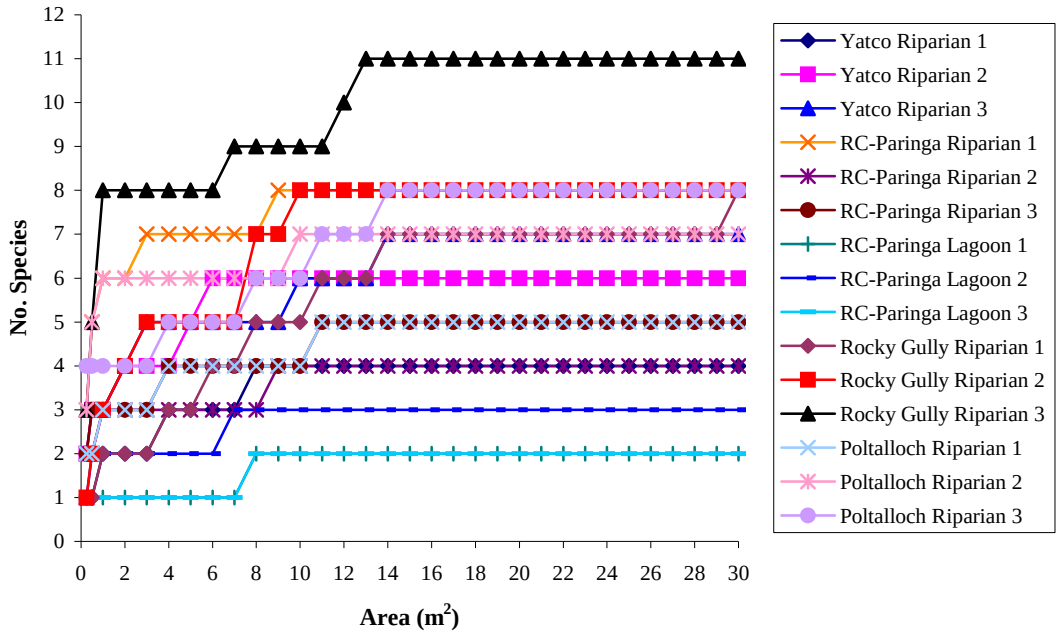

Figure 1: Species area curves for Yatco Lagoon, Reedy Creek-Paringa, Poltalloch and Rocky Gully Wetlands (Nicol *et al.* 2006).

Cover and abundance of each species present in the quadrat were estimated using the method outlined in Heard and Channon (1997) except that N and T were replaced by 0.1 and 0.5 to enable future statistical analyses (Table 1).

Table 1. Modified Braun-Blanquet (1932) scale estimating cover/abundance as per Heard and Channon (1997).

Score	Modified Score	Description
N	0.1	Not many, 1-10 individuals
T	0.5	Sparsely or very sparsely present; cover very small (less than 5%)
1	1	Plentiful but of small cover (less than 5%)
2	2	Any number of individuals covering 5-25% of the area
3	3	Any number of individuals covering 25-50% of the area
4	4	Any number of individuals covering 50-75% of the area
5	5	Covering more than 75% of the area

The location of the central point in each quadrat was marked by GPS so the same 1 x 15 m area can be re-surveyed in the future.

2.2. Vegetation Mapping and Species Lists

It was not possible to detect every plant species using quadrat data alone and so all species encountered in the survey area (below the 1956 flood level) were recorded. This provided a

more comprehensive species list and increased the chances of detecting species of conservation significance over the whole floodplain, not just the wetland.

Areas with different plant communities that were not quantitatively surveyed were mapped using ground-truthed, aerial photography (areas that were quantitatively surveyed were also included on the vegetation map). Polygons were then drawn on the aerial photographs and a GIS layer of the major vegetation communities produced.

Areas of interest in the survey area (e.g. an infestation of weeds or an area that was more species rich than the surrounding areas) that were too small to fit three quadrats were noted. A list of the species in the area was recorded, the location marked by GPS and the information incorporated into the vegetation map and wetland description.

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 terminology used to describe different vegetation associations (e.g. herbland, shrubland, woodland, grassland) follows that of the 2004 River Murray Wetlands baseline survey (Holt *et. al.* 2005).

2.3. Tree Health

Health of *Eucalyptus camaldulensis* var. *camaldulensis* and *Eucalyptus largiflorens* was assessed visually using the method described in Tucker *et al.* (2003) (Table 2).

Table 2: Tree health scale for *Eucalyptus camaldulensis* var. *camaldulensis* and *Eucalyptus largiflorens* (Tucker *et al.* 2003).

Tree Health Rating	Tree Health Rating Description
5-Excellent	Tree with >75% of original canopy present Less than 5% epicormic growth May include some dead branchlets and leaves.
4-Good	Tree with 50 – 75% of original canopy present Epicormic growth less than 10% of remaining canopy Some dead branchlets (<50% of canopy)
3-Moderate	Tree with 25 – 49% of original canopy present Some epicormic growth (<50% of remaining canopy) Some small dead branches.(<50% canopy)
2-Poor	Tree with < 25% of original canopy present, Predominantly epicormic growth (>50% of remaining canopy) Some main branches dead (<50% canopy)
1-Very Poor	Unhealthy tree with no original canopy All epicormic growth Most main branches dead. (>50% canopy)
0-Dead	Dead tree

Fifty trees of each species were randomly chosen and assessed (long term dead trees were not assessed). The location of each tree was marked by GPS and the location and health of each tree surveyed was used to produce a GIS layer and tree health map for each species using Arc GIS (ESRI 2006).

3. Results

A total of 73 species were observed in the survey area including 24 exotics (Table 3).

The floodplain of Markaranka was predominantly characterised by an open *Muehlenbeckia florulenta* shrubland with *Atriplex* spp., *Sclerolaena* spp. and *Maireana microcarpa* (Figure 2). 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* (Figure 2). 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. and *Sclerolaena* spp. (Figure 2).

Dense *Myriophyllum verrucosum* herbland dominated the lagoon in areas where there was high soil moisture or shallow water (Figure 2). *Abutilon theophrasti* herbland was present on the lagoon bed at higher elevations in areas with lower soil moisture (Figure 2). The riparian zone of the lagoon was a diverse *Cyperus gymnocaulos* sedgeland with *Psuedognaphalium luteo-album, Polygonum plebium, Sporobolus mitchelli*, *Agrostis avenacea, Heliotropium europaeum, Heliotropium curassavicum, Chenopodium* sp. and *Centipeda minima* (Figure 2). The channel that connects the lagoon to the River Murray at high flows was dominated by a *Chenopodium* sp. herbland with *Polygonum plebium, Atriplex* spp., *Sporobolus mitchelli*, *Agrostis avenacea, Heliotropium europaeum, Heliotropium curassavicum* and *Centipeda minima* (Figure 2).

3.1. Surveyed quadrats

Seven different vegetation associations were quantitatively surveyed:

1) *Chenopodium* sp. herbland in the flood runner
2) *Chenopodium* sp./*Polygonum plebium* herbland in the flood runner
3) *Cyperus gymnocaulos* sedgeland
4) *Cyperus gymnocaulos*/*Psuedognaphalium luteo-album* sedgeland
5) *Cyperus gymnocaulos*/*Sporobolus mitchelli* sedgeland
6) *Myriophyllum verrucosum* herbland in the northern part of the lagoon
7) *Myriophyllum verrucosum* herbland in the eastern part of the lagoon
8) *Myriophyllum verrucosum*/*Abutilon theophrasti* herbland

9) *Myriophyllum verrucosum/Abutilon theophrasti* herbland along the western lagoon edge.

Table 3: Species list for Markaranka Flat (includes opportunistic observations not surveyed in quadrats) (*denotes exotic species).

Species	Common Name	Association Number								
		1	2	3	4	5	6	7	8	9
*Abutilon theophrasti**	Swamp Chinese-lantern		x			x	x		x	x
Acacia stenophylla	River cooba									
Agrostis avenacea	Blown grass	x	x	x	x	x				
Alternanthera denticulata	Lesser joyweed									
*Asphodelus fistulosus**	Onion weed									
Atriplex prostrata	Creeping saltbush									
Atriplex sp.	Saltbush	x	x							
Atriplex stipitata	Bitter saltbush			x					x	
Atriplex vesicaria	Bladder saltbush									
Brachycome basaltica	Swamp daisy									
Brassica sp.*										
*Bromus rubens**	Red brome									
Calotis hispidula	Bogan flea									
*Centaurium tenuiflorum**	Branched centaury									
Centipeda cunninghamii	Common sneezeweed									
Centipeda minima	Spreading sneezeweed	x	x	x	x	x				
Chenopodium sp.	Goosefoot	x	x	x	x	x			x	
Chenopodium pumilio	Small crumbweed									
*Citrullus lanatus**	Camel melon									
*Conyza bonariensis**	Flax-leaf fleabane				x	x				
Crinum flaccidum	Darling lily									
Cyperus gymnocaulos	Spiny flat-sedge		x	x	x	x				
*Datura ferox**	Fierce thornapple									
*Datura stramonium**	Common thornapple									
Dodonaea attenuata	Narrow-leaf hopbush									
*Echium plantagineum**	Salvation Jane									
Enchylaena tomentosa	Rudy saltbush									
Epaltes australis	Spreading nut-heads									
Eremophila gibbifolia	Coccid emubush									
Eremophila scoparia	Emu bush									
Eucalyptus camaldulensis var. *camaldulensis*	River red gum				x					
Eucalyptus largiflorens	River black box									
*Euphorbia terracina**	False caper									
Frankenia serpyllifolia	Bristly sea-heath								x	
Glycyrrhiza acanthocarpa	Native liquorice									
Haloragis aspera	Grey raspwort									

Species	Common Name	Association Number								
		1	2	3	4	5	6	7	8	9
*Heliotropium curassavicum**	Smooth heliotrope		x	x	x	x			x	
*Heliotropium europaeum**	Common heliotrope		x	x					x	
*Hypochaeris glabra**	Smooth cat's-ear									
*Hypochaeris radicata**	Flatweed									
Maireana microcarpa	Swamp bluebush									
*Marrubium vulgare**	Horehound									
*Medicago minima**	Medic									
*Medicago polymorpha**	Medic									
Mimulus repens	Creeping monkey-flower									
Morgania floribunda	Blue rod									
Muehlenbeckia florulenta	Lignum									x
Myriocephalus stuartii	Poached-egg daisy									
Myriophyllum verrucosum	Red milfoil		x		x	x	x	x		
Opuntia sp.*	Prickly pear									
Persicaria decipiens	Slender knotweed	x		x						
Persicaria lapathifolium	Pale knotweed				x					
*Phyla canescens**	Lippia									
Picris hieracioides var. *hieracioides**	Ox-tongue									
Polygonum aviculare	Wireweed				x					
Polygonum plebeium	Small knotweed		x		x	x				
Psuedognaphalium luteo-album	Jersey cudweed			x	x					
Rorippa eustylis	River cress									
Rorippa islandica	Marsh watercress									
Rumex bidens	Mud dock				x					
Scleroblitum atriplicinum	Purple goosefoot	x				x				
Sclerolaena blackiana	Black's copperburr									
Sclerolaena brachyptera	Short-winged copperburr									
Sclerolaena decurrens	Green copperburr									
Sclerolaena divaricata	Tangled bindy									
Senecio runcinifolius	Tall groundsel				x	x				
Senecio sp.	Groundsel									
Senna artemisiodes ssp. *filiofolia*	Punty bush									
*Solanum nigrum**	Black night shade									
*Sonchus oleraceus**	Common sow thistle									
Sporobolus mitchelli	Rat-tail couch		x		x	x				x
Wahlenbergia fluminalis	River bluebell									
*Xanthium occidentale**	Noogoora burr									

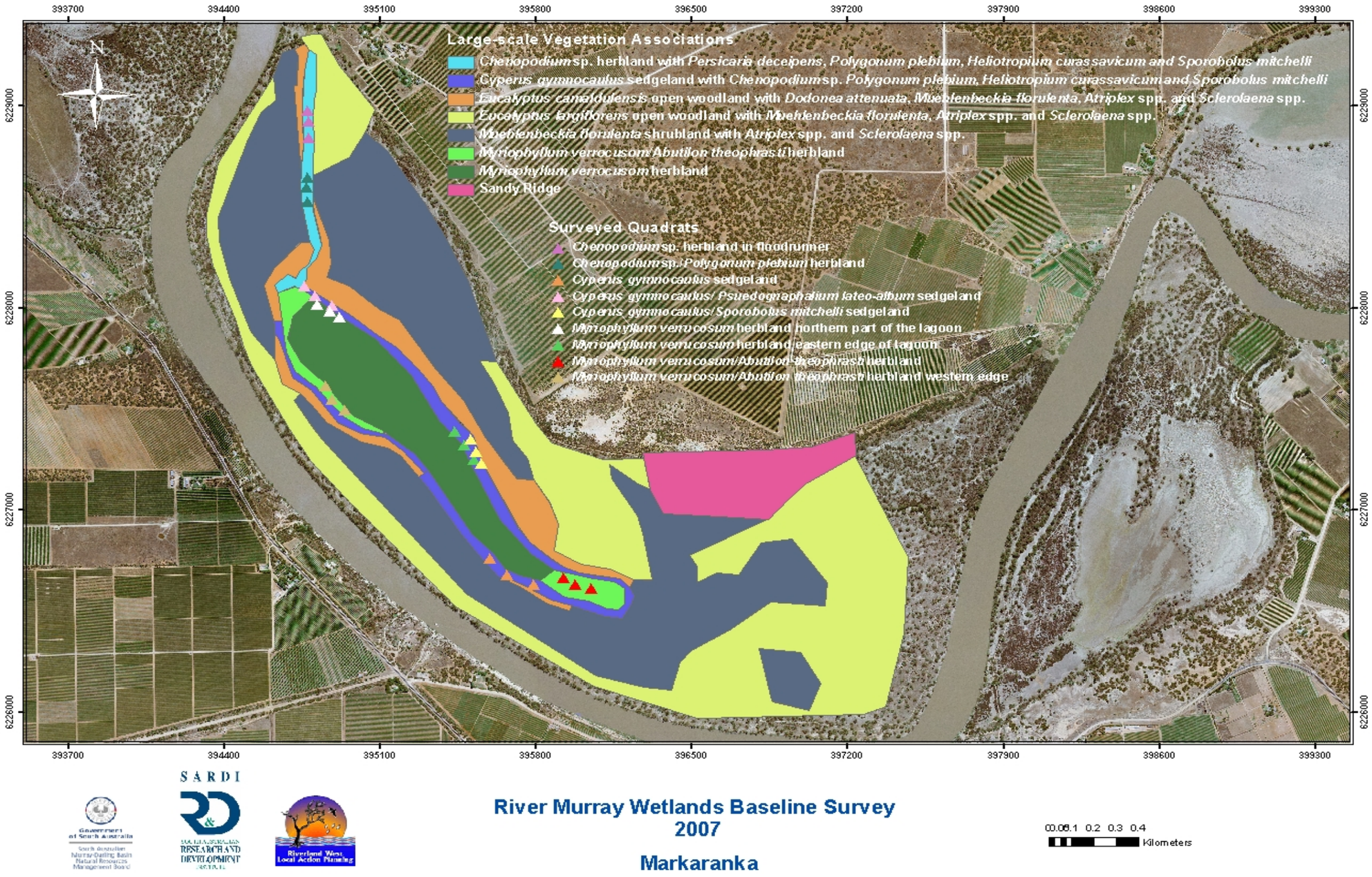

Figure 2: Vegetation map of Markaranka Flat showing the quantitatively surveyed quadrats and large-scale vegetation communities.

3.2. Tree Health

Eucalyptus camaldulensis var. *camaldulensis* tree health was variable across the floodplain (Figure 3). Trees closest to the lagoon bed and flood runner tended to be in good health, whereas individuals further away from the lagoon were generally in moderate health (Figure 3).

Eucalyptus largiflorens tree health varied from moderate to good across the floodplain (Figure 4). The majority of individuals that were found to be in moderate health were located in the southwestern corner of the floodplain (Figure 4). Individuals adjacent to the flood runner, north of the lagoon and in the southern portion of the floodplain tended to be in good health (Figure 4).

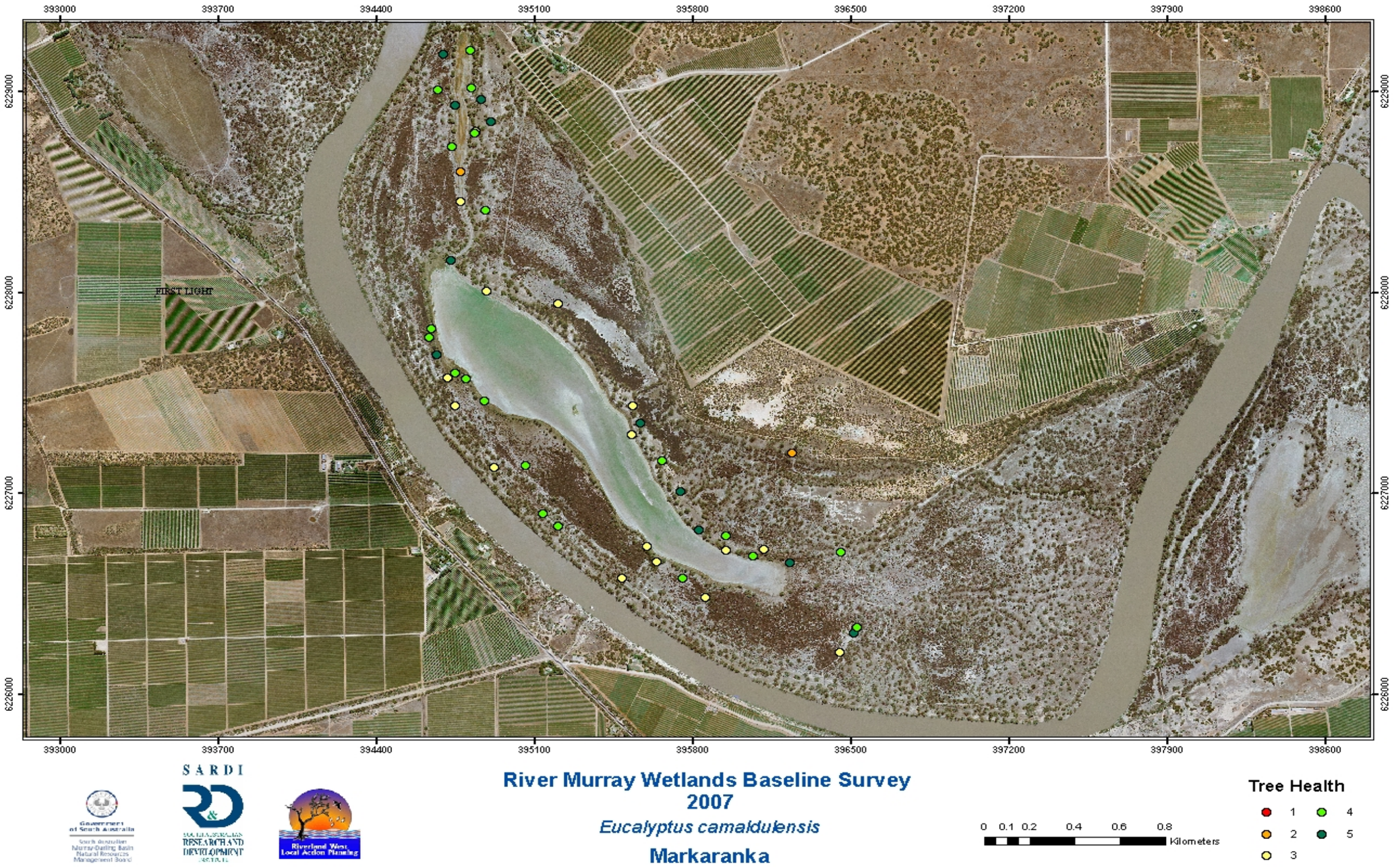

Figure 3: *Eucalyptus camaldulensis* var. *camaldulensis* tree health across Markaranka Flat.

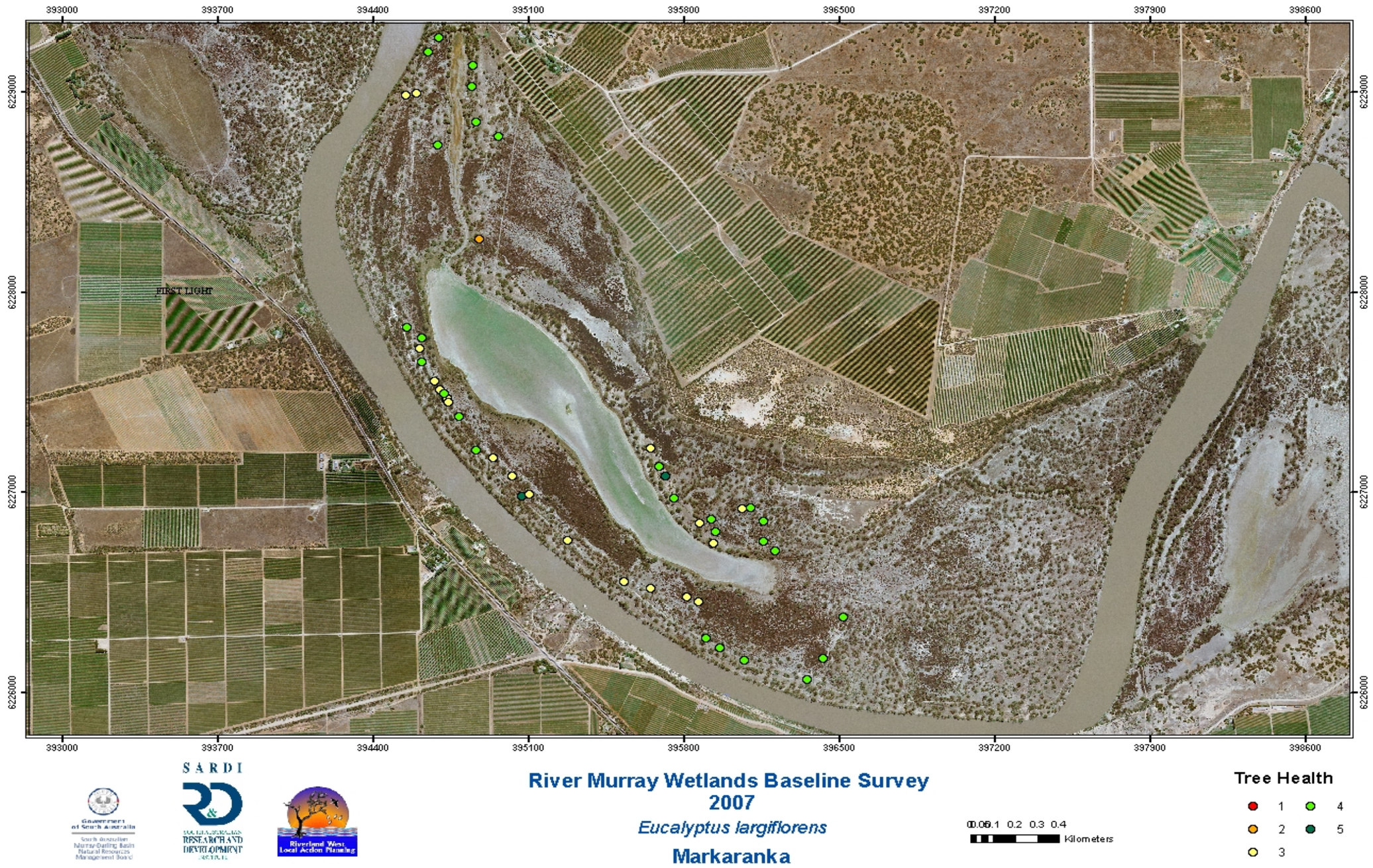

Figure 4: *Eucalyptus largiflorens* tree health across Markaranka Flat.

4. Implications of the data

A large number of amphibious and flood dependent species were present at Markaranka Flat, which was probably the result of the artificial flooding of the lagoon. A pre-flooding survey was not undertaken; however results from other temporary River Murray wetlands that have been artificially flooded have shown a significant increase in the abundance of flood dependent species post-flooding (e.g. Nicol *et al.* 2007).

The large number and, in some cases, abundances of exotic species is also probably a result of artificial watering. There are numerous exotic species (e.g. *Xanthium* spp., *Heliotropium europaeaum, Heliotropium curassivicum, Abutilon theophrasti*) that have similar water regime and growing season requirements for germination and establishment to many flood dependent native species and will recruit in response to natural or artificial flooding (Nicol *et al.* 2007; Nicol 2007). *Xanthium occidentale, Heliotropium europaeaum, Heliotropium curassivicum* and *Abutilon theophrasti* were present at Markaranka Flat in the area artificially flooded. *Abutilon theophrasti* was the most abundant and needs to be controlled before it flowers and sets seed. This species can be controlled by spraying with herbicides (Cunningham *et al.* 1981) but in this situation control could be achieved by flooding.

Similar to most floodplains in this region, the lack of flooding in the past 10 years has led to a significant decline in tree health and overall floodplain condition. Artificial flooding has probably resulted in improvement in tree health (especially *Eucalyptus camaldulensis* var. *camaldulensis* individuals close to the lagoon) and when water becomes available this may be an important short-term action to maintain and improve tree health. High river flows may also result in an improvement in tree health and floodplain condition; however, this is dependent on flows from upstream reaching the South Australian section of the River Murray.

5. References

Anderson, M.J. (2001). A new method for non-parametric analysis of variance. *Austral Ecology* **26:** 32-46.

Barker, W.R., Barker, R.M., Jessop, J.P. and Vonow, H.P. (2005). Census of South Australian vascular plants. Botanic Gardens of Adelaide and State Herbarium, Adelaide.

Cunningham, G.M., Mulham, W.E., Milthorpe, P.L. and Leigh, J.H. (1981). 'Plants of Western New South Wales.' (New South Wales Government Printing Office: Sydney).

Dufrene, M. and Legendre, P. (1997). Species assemblages and indicator species: the need for a flexible asymmetrical approach. *Ecological Monographs* **67:** 345-366.

ESRI (2006). Arc GIS, Version 9. (ESRI: Redlands, California, USA).

Heard, L. and Channon, B. (1997). Guide to a native vegetation survey using the biological survey of South Australia. South Australian Department of Environment and Natural Resources, Adelaide.

Holt, M., Swingler, K., O'Donnell, E., Shirley, M., Lake, M., Conallin, A., Meredith, S., Ho, S., Prider, J,, Poulsen, D., Richardson, S. and Cooling, M. (2005). River Murray Wetlands Baseline Survey. River Murray Catchment Water Management Board, Berri.

Jessop, J.P. Dashorst, G.R.M. and James, F.R. (2006). 'Grasses of South Australia. An illustrated guide to the native and naturalised species.' (Wakefield Press: Adelaide).

Jessop, J.P. and Tolken, H.R. (1986). 'The Flora of South Australia.' (Government of South Australia Printer: Adelaide).

Marsland, K. and Nicol, J. (2007). 2006 River Murray Wetland Baseline Survey. Vegetation Component. South Australian Research and Development Institute (Aquatic Sciences), Adelaide, 59pp. SARDI Publication Number RD04/0245-4.

McCune, B., Grace, J.B. and Urban, D.L. (2002). 'Analysis of Ecological Communities.' (MjM Software Design: Gleneden Beach, Oregon).

Nicol, J. (2007). Risk of pest plant recruitment as a result of the operation of Chowilla environmental regulator. South Australian Research and Development Institute (Aquatic Sciences), Adelaide, 51pp. SARDI Publication Number F2007/000253-1.

Nicol, J.M., Weedon, J.T. and Doonan, A. (2006). Vegetation Surveys. In 'River Murray Wetlands Baseline Survey – 2005'. (Eds D. Simpson, M. Holt, T. Champion, A. Horan and M. Shirley). (South Australian Murray Darling Basin Natural Resources Management Board: Berri).

Nicol, J.M., Weedon, J.T. and Marsland, K.B. (2007). Understorey Vegetation Monitoring of the Chowilla River Red Gum Watering Sites. South Australian Research and Development Institute (Aquatic Sciences), Adelaide, 76pp. SARDI Publication Number RD06/0333.

Sainty, G.R. and Jacobs, S.W.L. (1981). 'Water Plants of New South Wales.' (Water Resources Commission New South Wales: Sydney).

Sainty, G.R. and Jacobs, S.W.L. (1994) 'Waterplants in Australia.' (Sainty and Associates: Darlinghurst, N.S.W., Australia).

Tucker, P., Dominelli. S., Harper, M., Nichols, S., Jolly. I. and Seekamp, J. (2003). 'Your wetland: Wetland monitoring manual, River Murray, South Australia.' River Murray Catchment Water Management Board: Berri and Australian Landscape Trust: Renmark.