Yanga Vegetation Mapping: Historical Community Extent and Condition

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Introduction

Mapping of vegetation was undertaken for Yanga National Park (NP), Yanga Nature Reserve (NR) and Yanga State Conservation Area (SCA) from aerial photography for the years of 1965, 1973, 1997 and 2005. The purpose of the project was to map temporal and spatial changes in the extent and condition of vegetation communities, with particular emphasis on the flood dependent communities of:

- *Eleocharis* sedgelands;
- River Redgum (*Eucalyptus camaldulensis*) forests;
- Black Box (*Eucalyptus largiflorens*) woodlands; and
- Lignum (*Muehlenbeckia florulenta*) shrublands.

Prior mapping of vegetation communities had been undertaken for this area by Scott (1992). Scott's map was used as a guide for the initial formulation of vegetation mapping units for the present study. Similarly, descriptions of plant communities for the Yanga reserve system by Benson *et al*. (2006) assisted with formulation of mapping units. Vegetation mapping units are generally consistent with the vegetation types described by Benson *et al*.

The Yanga reserve complex comprises a number of vegetation communities which fall into two major categories, *viz*. flood dependent and flood free communities. The flood dependent communities include extensive areas of River Reg Gum forests and Black Box woodlands. Smaller areas of Lignum shrublands and Spike-rush dominated sedgelands also occur on the active floodplain of the Murrumbidgee River. The flood free communities on elevated land not subject to flooding include woodlands and shrublands. They occur primarily on Yanga SCA but also include elevated 'ridges' within the floodplain in Yanga NP and NR.

Method

The aerial photography was scanned at 1200 dpi. The scanned photographs were ortho-rectified to produce images that could be used as an accurate base for mapping the vegetation.

An Aerial Triangulated (AT) block model was established for each set of photography in SOCET photogrammetric software. A rigorous AT solution was produced using ground control points picked up from SPOT 2.5 metre imagery, tie points between overlapping photos and a surface DEM. The AT model mathematically determined the position and orientation of each photograph and the residual errors.

The ortho-rectified photographs were mosaiced to produce a digital mosaic for each of the four years. Mapping was performed in MapInfo GIS using the ortho-photo mosaic as a base. Vegetation boundaries were drawn as lines in MapInfo. A label was placed in each map unit to denote vegetation type, density and condition. The form of the label was x,y,z, where x is the vegetation assemblage, y is the crown cover of dominant species, and z is the canopy condition determined from the crown density (projected foliage cover) of dominant species. Hence a label 1d.3.5 would indicate vegetation type 1d (River Redgum with Lignum understorey) of sparse crown cover (10-30%) in extremely poor condition (1-5% projected foliage cover).

The linework and labels were converted to topologically clean GIS datasets. A GIS polygon layer was constructed in Arc GIS for each set of line-work and labels. Topology was established by snapping and intersecting lines, removing overshoots (dangles) and sliver polygons. A series of tests was run to identify issues to be resolved by the botanist. The tests identified irregularities in polygon labelling. These polygons were flagged and returned to the interpreter for resolution. The final vegetation maps were checked polygon by polygon by the project botanist.

Mapping Attributes

Vegetation type

1a	River Red Gum tall gallery forest (adjacent to rivers)
1b	River Red Gum forest with Spike-rush ground cover
1c	River Red Gum forest with grass / chenopod shrub groundcover
1d	River Red Gum forest with shrubby (Lignum / River Cooba) understorey
2a	Black Box with Lignum / Nitre Goosefoot understorey
2b	Black Box with grass / chenopod shrub groundcover
3	Spike-rush dominated Sedgelands (*Eleocharis* sp.)
4a	Lignum dominated shrubland
4b	Nitre Goosefoot dominated shrubland
4	Dillon Bush dominated shrubland
5	Scald areas with scattered Blue Bush / Dillon Bush / grassland
6	Belah / Rosewood dominated woodland
7	*Acacia melvillei* woodland
8	Red mallee (*Eucalyptus oleosa*) woodland
9	Prickly wattle (*Acacia victoriae*) woodland
10	Saltbush (*Atriplex nummularia*) shrubland
11	Myall woodland
C	cleared land
W	water body

Crown Cover

Crown cover is derived from an estimation of the distance between tree crowns relative to the size of the tree crown. The tree crown is imagined as an opaque object. The method employed for determining crown cover is consistent with that described by Walker and Hopkins (1984).

1	>70%	*dense*	crowns touching to overlapping
2	30-70%	*mid-dense*	crowns slightly separated

3	10-30%	*sparse*	crowns clearly separated
4	1-10%	*very sparse*	trees up to 100 m apart
5	<1%	*isolated*	trees greater than 100 m apart

Crown Condition

A condition rating scheme was derived from the method described by Walker and Hopkins (1984) for determining projective foliage cover. Projective foliage cover (pfc) is a measure of crown density, or the amount of light the plant is able to intercept. Trees with dense crowns are considered as being in good condition, whilst those with sparse foliage are considered as being stressed, or in poor condition. Projective foliage cover can be assessed from aerial photography. Trees with dark dense crowns have a high projective foliage cover, whilst those with light coloured transparent crowns have low projective foliage cover.

1	>75% pfc	excellent condition, dense crowns
2	50-75% pfc	good condition, healthy open crowns
3	25-50% pfc	moderate condition, sparse foliage, dieback evident
4	5-25% pfc	poor condition, dieback evident in most trees
5	1-5% pfc	very poor condition, many dead trees
6	<1% pfc	most trees either dead or almost totally defoliated

Ground Truthing

A field trip was conducted during April 2008 to collect data to verify mapping units. Sites to be surveyed during the field trip were selected following initial interpretation of 1997 aerial photography. A total of 150 sites were selected to ensure all potential vegetation types would be sampled. The coordinates of these sites were programmed into a hand held GPS to enable accurate location of the sites in the field. An additional 9 sites were sampled opportunistically in the field, resulting in data being collected from 159 sites across the study area.

Data collected from each site included:

- Site photograph and map grid coordinates
- Identification of dominant species at each site, generally one or two, but up to four species;
- Visual assessment of: (1) crown cover; (2) projected foliage cover; (3) percentage of trees (shrubs) dead; and (4) percentage of trees (shrubs) showing signs of stress such as dieback on outer branches and/or epicormic growth from larger branches;
- Identification of dominant species in lower stratum, to a maximum of four species;
- Crown cover and projected foliage cover of combined species in lower stratum;
- Visual assessment of non-vascular ground cover; and
- General comments on vegetation community condition at site, evidence of feral animals and previous disturbance such as clearing, ringbarking or logging.

Site photographs and an excel spreadsheet with site data are provided on a CD accompanying this report. A shapefile with site locations and data has also been prepared and supplied with the vegetation maps.

Discussion

The 1965 and 1973 aerial photography was black and white and small scale (approximately 1:80,000). The photographs supplied did not provide a complete coverage of the study area, consequently portion of the Yanga SCA and Yanga NR were not mapped from this earlier photography. However, all of the River Red Gum forests and most of the Black Box and Lignum communities were covered in the 1965 and 1973 photography available for the project. The small scale black and white photography also presented challenges for assessing vegetation condition, as images tended to become blurred when zoomed to larger scales. This was particularly the case with the 1973 photography. The 1997 and 2005 photography was colour and flown at approximately 1:50,000 scale. This photography provided a much sharper image when zoomed to larger scale, enabling interpretation of mapping attributes with a higher degree of confidence.

Boundaries between the major vegetation communities have remained relatively static over the 40 year period 1965 – 2005. However, some changes can be detected in canopy cover and condition during this time. These changes are most notable in the River Red Gum communities. It appears there had been some thickening in crown cover of River Red Gum in some areas since 1965, particularly in parts of map unit 1c and 1d. However most of these areas were showing signs of severe stress in the form of sparse canopy density (low projected foliage cover) in the latest (2005) coverage. Field assessment of sites in these areas during April 2008 revealed trees either dead or severely defoliated, apparently a result of severe moisture stress. These areas have been extensively logged in recent years.

Observations River Red Gum recruitment are consistent with views expressed by Eddy (1992), that the Lowbidgee Flood Control and Irrigation scheme has favoured regeneration of River Red Gum to the extent it is gradually dominating all suitable sites. Eddy's premise that the Lowbidgee scheme has resulted in more regular than natural flooding of parts of the flood plain, and hence colonisation of areas by River Red Gum where this species would not naturally occur appears to be supported by the results of the present mapping project. It may be that the areas of River Red Gum mapped as severely stressed in the 2005 map layer of the present study may not have supported this species prior to river regulation and water diversion, or the decline of the species in some areas is a natural process of thinning recruits that may have grown during the wet periods of 1950s and 70s.

The premise by Eddy that the Lowbidgee has received more regular flooding since the introduction of the Lowbidgee Flood Control and Irrigation scheme is at odds with the findings of Kingsford and Thomas (2004). Their study found that diversions have reduced the amount of water reaching the Lowbidgee floodplain by at least 60%. Annual waterbird surveys recorded a reduction by 90% of waterbirds during the period 1983 to 2001.

The present study indicates that plant communities are severely stressed across the entire floodplain within the Yanga reserve network, with the exception of small areas of River Red Gum wetland that have been receiving regular controlled flooding. There is little doubt that overbank flooding has been sporadic and infrequent over the last 10-15 years over much of the floodplain, resulting in a decline in condition of the vegetation communities.

Natural floodways are clearly discernible from the aerial photography. Condition of vegetation varies along these floodways according to recent flooding history. Healthiest stands of River Red Gum and associated wetlands occur in the north of the study area, in the general vicinity of Piggery Lake. The most stressed River Red Gum areas are those in the southern part of the study area, upstream and downstream of Yanga Lake.

The extensive areas of Black Box (*Eucalyptus largiflorens*) appear to have changed little in community structure during the 40 year period. However, field investigations supported the assertion that projected foliage cover was lower in the 2005 coverage than earlier photography. Most areas of Black Box displayed symptoms of moisture stress (defoliation and dieback) when surveyed in April 2008.

All areas of Lignum (*Muehlenbeckia florulenta*) have deteriorated in condition during the 40 year period. Field investigations found Lignum communities severely stressed in 2008. Similarly, the less frequently flooded community of Nitre Goosefoot (*Chenopodium nitrariaceum*) that occurs on the outer floodplain was observed as being severely stressed.

The terrestrial (flood free) woodlands and shrublands currently bear little resemblance to what their pre-European structure and composition would have been. Much of the Black Oak (*Casuarina pauper*) / Western Rosewood (*Alectryon oleifolius* subsp. *canescens*) woodlands was thinned or partially cleared prior to 1965. There has been little change in this community over the last 40 years. Similarly, the chenopod shrublands appear to have changed little over the last 40 years. The shrublands are generally dominated by Dillon Bush (*Nitraria billardieri*). The chenopod shrublands are severely degraded, a legacy of 150 years of sheep grazing and associated impacts, such as wind erosion. Rabbits were observed to be in high abundance in many areas. Severely scalded areas were mapped as a separate unit (vegetation type 6).

Beadle (1948) reported that heavy grazing of saltbush country has led to vast changes in the composition of these plant communities. Under extreme conditions of drought and grazing, the wholesale death of saltbush can occur, with subsequent wind erosion of topsoil and scalding. Beadle observed that Dillon Bush, Cottonbush (*Maireana aphylla*), copperburrs (*Sclerolaena divaricata, S. longicuspis*) and roly-poly (*Sclerolaena muricata*) invade and replace the palatable saltbush species with continual grazing.

The shrublands on Yanga are typical of the degraded saltbush communities described by Beadle (1948). Dillon Bush is dominant on the lighter soils, with Cottonbush dominant on heavier clay soils. Palatable saltbushes have largely disappeared from the plant assemblage.

Conclusion

The extended drought of the late 20th century and early 21st century has taken a toll on vegetation across the Yanga reserve network. The most severely affected are the River Red Gum, Black Box and Lignum communities, which are severely moisture stressed. Relatively small areas of River Red Gum forest and Black Box woodland are currently in good condition. The study has revealed a decline in condition of the flood dependent communities since the 1970s.

Impacts of land use on the flood free communities were in place long before the era of the present study. Degradation of the chenopod shrublands probably commenced in the late 19th century, whilst clearing of the woodlands probably occurred in the early 20th century. There appears to have been little change in these communities over the last 40 years.

References

Beadle, N.C.W. (1948) *The Vegetation and Pasture of Western New South Wales with Special Reference to Soil Erosion*. Department of Conservation of New South Wales, Sydney.

Benson, J.S., Allen, C.B., Togher, C. and Lemmon, J. (2006) Plant Communities of the New South Wales Western Plains. *Cunninghamia* **9**(3):383-450.

Eddy, V. (1992) The Lowbidgee Experience: Simulated Natural Flooding and River Red Gum. pp. 149-156 in Catchments of Green – a national conference on vegetation and water management. Vol B. Greening Australia. Adelaide.

Kingsford, R.T. and Thomas, R.F. (2004) Destruction of wetlands and waterbird populations by dams and irrigation on the Murrumbidgee River in arid Australia. *Environmental Management* **34**(3):383-396.

Scott, J. A. (1992) The natural vegetation of the Balranald – Swan Hill area. *Cunninghamia* **2**(4):597-652.

Walker, J. and Hopkins, M.S. (1984) Vegetation. In McDonald, R.C., Isbell, R.F., Speight, J.G., Walker, J. and Hopkins, M.S. *Australian Soil and Land Survey – Field Handbook*. Inkata Press, Sydney.