

AVON-RICHARDSON SITES

Site 1 Lake Buloke

The site appears to be in environmental decline and is visibly salt affected

Site Description

Lake Buloke now a Wildlife Reserve managed by Parks Victoria, is a terminal lake described as a shallow freshwater marsh as it does not have a permanent period of inundation. Most of the lakebed dries out each year, totally dries out every 3-5 years and has remained dry since early 1998. Heron et al (1991) had previously described Lake Buloke as a deep freshwater marsh. All of the streams in the Avon-Richardson catchment flow to the Richardson River, which then terminates at Lake Buloke. The lake also receives some runoff from the local catchment area.

The site is at an altitude of 100 metres on an almost flat alluvial plain with lunettes to the east. The plain is the result of deposition of sediments from the Richardson River and the Avoca River to the east. The lakebed has a long history of cropping and grazing and currently has 94 Perpetual Leases for agricultural purposes (N. Stimson pers. com. 1998). The wetland is of high habitat value due to the diverse range of habitats available when water is present and large size of the reserve (Davies 2003).

Vegetation Description and Composition

This wetland is dominated by *Eucalyptus camaldulensis* (Red Gum) open woodland to the high water mark, with *E. largiflorens* (Black Box) woodland above on the higher ground. The intact understorey is predominantly *Muehlenbeckia florulenta* (Tangled Lignum) and *Eragrostis infecunda* (Cane Grass). The Ecological Vegetation Class (EVC) outside of the lake margins is plains grassy woodland (DSE 2003).

The area had comprised of 60 percent introduced species when monitoring began in 1997 with a gradual increase and this has now reduced to about 50 percent of the species present in 2002 due to dry conditions. The decrease in introduced species was mostly from the Asteraceae family. Cover abundance of the plant species present has also declined. Grazing pressure may be another factor reducing number and abundance of species present.

There were three salt indicator species present within the quadrats being *Critesion marinum* (Sea Barley Grass), *Lolium rigidum* (Wimmera Rye grass) and *Enchylaena tomentosa* (Ruby Salt bush). *Muehlenbeckia horrida* (Spiny lignum) listed as rare under the FFG (1998) Act was also recorded (Davies 2003) (appendices 8.2 & 8.3).

Tree Health

Eight trees are monitored for tree canopy health and samples for leaf insect damage and chloride levels were collected from trees containing branches within reach of the pole pruners (<5m tall). Some regeneration was recorded at quadrat B however it is not recent and probably occurred the last time that the quadrat was flooded.

Six trees have remained very healthy since monitoring commenced, however the other two have suffered rapid decline especially in the last twelve months and are now virtually dead. They had been totally defoliated by leaf skeletoniser caterpillars, contained many dead branches and extensive epicormic growth.

Leaf chloride concentrations from the five trees that could be sampled ranged from 0.11-0.74 percent. The last reading is quite high and was recorded in a Red Gum that has suffered rapidly declining health. Red Gums often record much lower leaf chloride concentrations than Box species due to their salt exclusion mechanism, therefore it is possible that saline groundwater is affecting the health of many trees at this site (Collopy 2003). More results are needed to determine whether salinity and not prolonged drought is the major cause of tree dieback at the lake (appendix 8.4).

Birds

Bird species present at the time of the vegetation and tree health surveys were: - Brown Falcon, Brown Treecreeper, Galah, Magpie, Red-rumped Parrot, Starling, Superb Fairy-wren, Striated Pardalote, Tree Martin, Wedged-tailed Eagle, Welcome Swallow, White-plumed Honeyeater, Masked Lapwing, Willie Wagtail, Magpie Lark, Galah and Boobook Owl (resting in a monitored tree). The large number of species recorded reflects the diverse range of habitat that the lake offers. When the lake has contained water, many thousands of birds and a large range of species (some migratory and rare) flock to the area.

Groundwater and Salinity

There are three bores in the area, two are near the lake edge and suffer from gaps in data due to periodic inundation. The groundwater has fallen since the lake dried up in 1998 but they have all shown an overall rising pressure trend meaning that the deep drainage capacity in the area is seriously diminished. The other bore located further away from the lake has shown a downward trend in response to the lake drying up and the dry seasonal conditions. Groundwater intrusion into the Richardson River is also having downstream effects when it flows from the site of intrusion to Lake Buloke, although this has not occurred for several years (appendix 8.5).

Water Quality

Lake Buloke has been listed as a wetland of exceptional environmental value and individually important habitat for native flora and fauna (Heron 1991). The lake has been dry since 1998 and only seven months of water quality data has been collected. Limited interpretation of the results has shown that seasonal variations and depth of the lake strongly influenced all readings. Reduction in water through evaporation increased temperature, conductivity, turbidity and pH readings. Phosphorus and nitrogen concentrations also increased as the water volume decreased (Davies 1998). None of these results are of concern unless high concentrations are recorded when the lake is full again (appendix 8.6).

The single macroinvertebrate survey conducted in spring 1997 shown that Lake Buloke had medium quality water in terms of organic pollution. The presence of large numbers of Ostracods (Seed Shrimps) which are tolerant of large salinity increases may indicate that salinity levels are affecting taxa richness (appendix 8.7) (Kefford 1997, Davies 1998).

Site Threats

- Possible changes to natural flooding regime
- Rising salinity levels across the entire catchment

- Extensive grazing and cropping reducing the site's potential for natural regeneration
 - Continued tree health decline
- (Davies 2003).

Surrounding Land Use

Outside the wetland is cropping and some grazing. Many paddocks appear to contain crops that have failed due to the impacts of drought.



Figure 4. A very dry and barren looking Lake Buloke in spring 2002



Figure 5. The view of Lake Buloke from the western side at Quadrat B

Site 2 Reseigh's Red Gums

This site appears to be in environmental decline and the Richardson River is in extremely poor condition.

Site Description

The area is freehold, fenced from grazing and listed as Land for Wildlife. The site is adjacent to the Richardson River on a narrow alluvial plain at an altitude of 120m. The area has moderate habitat value due to the high value of the riparian vegetation being reduced by high salinity levels of the Richardson River (Davies 2003).

Vegetation Description and Composition

The site comprises areas of grassland and open woodland dominated by *E. largiflorens* (Black Box) and *E. camaldulensis* (Red Gum). Native grasses and species from the Asteraceae and Chenopodiaceae (saltbush) families, dominate the grassland section. The understorey of the open woodland adjacent to the Richardson River is predominantly *Muehlenbeckia florulenta* (Tangled Lignum) and *Eragrostis infecunda* (Cane Grass). The EVCs at the site are floodplain riparian woodland directly adjacent to the Richardson River and is surrounded by plains grassy woodland/plains grassland mosaic (DSE 2003).

The 1997 survey indicated that about 30 percent of the species present were introduced and mostly from the Asteraceae and Poaceae (grass) families. The number of species present has been reduced to between 10 to 20 percent in 2002. These decreases were mainly introduced species from the Asteraceae family. The species composition at the site is changing to more drought tolerant species such as those from the Chenopodiaceae (saltbush) family.

Three salt indicator species were recorded in 1997; this had increased to four in 1999. They are *Chloris truncata* (Windmill grass), *Lolium sp.* (Rye grass), *Enchylaena tomentosa* (Ruby saltbush) and *Atriplex semibaccata* (Creeping saltbush). Although the Richardson River nearby is visibly salt affected, the presence of these salt indicator species is also likely to be reflecting the extended dry conditions with many salt bush species adapted to arid conditions. *Muehlenbeckia horrida* (Spiny Lignum) was still present (appendices 8.2 & 8.3) (Davies 2003).

Tree Health

Four trees, all Red Gum have experienced severe decline in health since 1997 with reduced canopy densities, dead branches and epicormic growth. These are signs of stress due to prolonged dry conditions. Red Gum trees appear to be suffering greater amounts of insect attack and epicormic growth than the Black Box trees, because they cannot withstand long periods without inundation. Highly saline groundwater may also be contributing to decline in vegetation health at the site.

All eight trees could be reached with the pole pruners, however two Red Gums contained so much leaf insect damage, that it was impossible to collect a large enough sample for leaf chloride analysis. Chloride levels ranged from 0.09-0.55 percent. No regeneration was recorded at either vegetation quadrat (appendix 8.4).

Birds

Bird species present at the time of the vegetation and tree health surveys were :-

Galah, Magpie, Red-rumped Parrot, Welcome Swallow, White-plumed Honeyeater, Willie Wagtail, Eastern Rosella and Brown Tree Creeper.

Groundwater and Salinity

Two long term monitored bores are located adjacent to the site and were approximately four metres below natural surface in 2002. They respond to seasonal fluctuations and have dropped in response to dry conditions. They are also demonstrating a high rising pressure trend above the water table, indicating that the deep drainage capacity around the site is limited (similar to the situation found at Lake Buloke).

Saline groundwater intrusion into the Richardson River can have downstream effects when river volume allow flows from the site of intrusion to Lake Buloke, although this has not occurred for several years. The Richardson River (300 metres away from the site) is currently dry at present but when it contained water in November 1999, a salinity reading recorded 52000 EC. This is considered hypersaline, saltier than seawater and caused by low water volume in the river and subsequent high evaporation rates that concentrate the salts.

Due to the combination of factors listed above, if salinity mitigation works do not have an effect on this site in the near future, the ecological health of the vegetation is in jeopardy (appendix 8.5) (Davies 2003).

Water Quality and Macroinvertebrates

These tests do not apply to this remnant vegetation site.

Site Threats

- Possible future grazing and weed invasion
- Increasing salinity levels in the Richardson River from groundwater intrusion
- Rising water tables affecting the vegetation and ecological health of the site (Davies 2003).

Surrounding Landuse

Land use in the area was a mixture of dryland cropping and sheep grazing. The impact of drought was very noticeable; many paddocks hadn't been sown in 2002.



Figure 6. Reseigh's Red Gums. The Richardson River is in the background

Site 3 Lake Cope Cope

The site appears to be in environmental decline and is visibly salt affected

Site Description

Lake Cope Cope is gazetted as a Public Recreation Purposes Reserve and is circled by a water reserve (N. Stimson pers.com. 1998). The wetland is a shallow freshwater marsh with water supplied from a creek flowing into Lake Grassy then overflowing into Lake Cope Cope from the east.

The site is at an altitude of 120 metres on an almost flat alluvial plain with lunettes to the east. The plain is the result of deposition of sediments from the Richardson River. The lake is of moderate habitat value due to the high percentage of introduced species and stock grazing. However, the area does have a wide range and age of tree species, fallen timber and is over 200 hectares in size (Davies 2003).

Vegetation Description and Composition

The wetland is circled by open woodland dominated by *E. largiflorens* (Black Box) and *E. camaldulensis* (Red Gum). The understorey is predominantly *Muehlenbeckia florulenta* (Tangled Lignum) and *Eragrostis infecunda* (Cane Grass) and species from the Cyperaceae (sedge) and Juncaceae (rush) Families. The EVC outside of the lake margins is plains grassy woodland (DSE 2003).

The total number of species present has decreased when compared with previous survey results, especially since the 2001 survey. Prolonged dry conditions have caused a large decrease in the number and cover abundance of introduced species, particularly from the Asteraceae Family.

Three salt indicator species were present in 1997, eight in 2001 and this has reduced to six in 2002. These results are more likely due to dry seasonal conditions than any sudden favourable change in groundwater salinity. However it does need to be stated that the site is becoming severely salt affected. Salt indicator species present included *Critesion marinum* (Sea Barley Grass), *Lolium rigidum* (Wimmera Rye Grass), *Atriplex semibaccata* (Berry Saltbush), *Enchylaena tomentosa* (Ruby Saltbush), *Sarcocornia sp.* (Samphire) and *Wilsonia rotundifolia* (Round-leaf Wilsonia) (appendices 8.2 & 8.3) (Davies 2003).

Tree Health

Three trees have experienced declining health with reduced canopy densities, dead branches and epicormic growth. These are signs of stress due to prolonged dry conditions. Red Gum trees appear to be suffering greater amounts of insect attack and epicormic growth than the Black Box trees, because they cannot withstand long periods without inundation. Highly saline groundwater may also be contributing to the decline in tree health. The leaf chloride concentrations from the seven trees sampled did not reflect recent uptake of salt as they only ranged from 0.06-0.52 percent. However dry seasonal conditions and a lowered water table would cause a decrease in leaf chloride levels (Collopy 2003). Further sampling needs to occur to allow comparative analysis. Some regeneration was recorded at both quadrats however the tree regeneration was not recent and probably occurred after the last flood event. Some lignum regeneration was

recent (appendix 8.4).

Birds

Bird species present at the time of the vegetation and tree health surveys were: - Galah, Magpie, Red-rumped Parrot, Sparrow, Welcome Swallow, White-plumed Honeyeater (hundreds), Willie Wagtail, Masked Lapwing, Pigeon and Eastern Rosella.

Groundwater and Salinity

Three bores are located around the lake edge. Groundwater levels have varied between one to six metres and display seasonal groundwater behaviour, which corresponds well with lake levels. Apart from the obvious cyclic temporal variation, there are no long-term groundwater trends at this stage. Salinity levels of the groundwater are extremely high, and are concerning if groundwater levels were to rise when wet conditions return in the future. Saline groundwater is contributing to the declining health Red Gum trees around the lake (appendix 8.5) (Davies 2003).

Water Quality

Lake Cope Cope has remained dry since autumn 1999 with the northern end drying up first. The limited data collected showed trends that were similar to Lake Buloke. Seasonal variation and lake depth strongly influenced all readings. Reduction in water through evaporation increased temperature, conductivity, turbidity and pH readings. Phosphorus and nitrogen concentrations also increased as the water volume decreased (Davies 1998).

Two macroinvertebrate surveys have been performed in spring 1997 and 1998. The first survey found that Lake Cope Cope had medium quality water in terms of organic pollution. Ephemeroptera (Mayflies) and Atyidae (Freshwater Shrimps) taxa that are classed as sensitive to organic pollution were present. They are also sensitive to increases in salinity and would be expected to decline with an increase in levels. In spring 1998 the lake contained a much smaller volume of water, with a subsequent increase in nutrient and salinity concentrations. This was reflected by the absence of the above two taxa along with many other sensitive taxa (Kefford 1997, Davies 1998, Davies 1999).

Site Threats

- Grazing by stock, kangaroos, rabbits and hares
- Increased salinity from groundwater intrusion
- Weed invasion
- Possible future change to flooding regime
- Continued tree health decline
- Build up of wind blown lakebed sediments on western side of lake

(Davies 2003).

Surrounding Land use

Land use was a mixture of dryland cropping and sheep grazing. Many paddocks hadn't been sown due to the effects of drought.



Figure 7. Looking over dry Lake Cope Cope from the western side in spring 2002

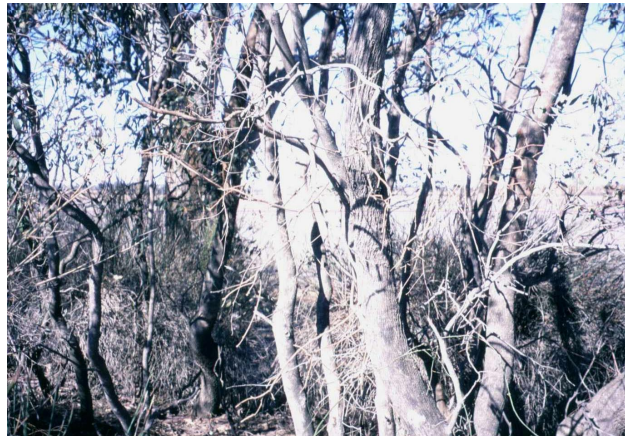


Figure 8. Lake Cope Cope on the eastern side is flanked by Black Box trees and Tangled Lignum

Site 4 Bryce's Buloke

This site is of uncertain environmental stability and is within the Avon-Richardson Targeted salinity project sub-catchment.

Site Description

The site is on freehold land and is fenced from grazing. It is at an altitude of 150 metres on a gentle easterly aspect, with the area on an almost level alluvial plain. The site is only of low habitat value due to the low number of habitat trees, small site size and adjacent farmland (Davies 2003).

Vegetation Description and Composition

The site contains open woodland dominated by *Allocasuarina luehmannii* (Buloke) and the EVC is the endangered plains grassy woodland (DSE 2003).

Almost 50 percent of total species present are introduced, being mainly pasture weeds. Native grasses dominate the herbaceous layer. Three salt indicator species were still present and are *Chloris truncata* (Windmill grass), *Lolium* sp. (Rye grass) and *Enchylaena tomentosa* (Ruby saltbush). The presence of these species does not necessarily indicate salinity for they are commonly found in the plains grassy woodland EVC. Soil tests need to be performed to be certain. The rare *Maireana humillima* (Dwarf blue bush) was still present in spring 2002.

There appeared to be a slight change in vegetation survey results when compared with previous survey data. In 2002 the total number of species present was similar, but the particular species are changing to more drought tolerant species. The level of abundance of introduced grasses and species from the Asteraceae family have again decreased, due to the continued dry conditions (appendices 8.2 & 8.3) (Davies 2003).

Tree Health

It needs to be stated that the tree health methodology does not correspond well to assessing the health of Buloke trees, because it was developed for assessing Red Gum and Black Box tree health. It therefore may not provide an accurate health indication for this species as what it does for Eucalypts.

All trees appeared to be reasonably healthy however there were only slight signs of regeneration, which is a concern for the future ecological health of this site. Buloke trees are extremely slow growing and may die out if new regeneration does not occur soon.

Leaf chloride concentrations ranged from 0.52-0.91 percent. These are very high readings in comparison to results from Eucalypts at other sites. This is more likely to be highlighting differences between species rather than an indication of saline soils. There are no discharge areas nearby, nor does the site appear salt affected. Performing soil tests would be the only way to know for certain (appendix 8.4).

Birds

Bird species present at the time of the vegetation and tree health surveys were: -

Chestnut-rumped Thornbill, Galah, Magpie, Red-rumped Parrot, Starling, Welcome Swallow, White-plumed Honeyeater, Willie Wagtail, Yellow-rumped Thornbill, Brown Falcon, Eastern Rosella and Little Raven.

Groundwater and Salinity

The one bore near the site is showing a slight linear rising trend despite prevailing dry conditions. The water table is still more than nine metres below natural surface. Given the relatively deep watertable level at this site and the considerable areas of higher risk ground not yet affected by salt, it is possible, though not certain, that this site may not be at risk from salinity (appendix 8.5) (Davies 2003).

Water Quality and Macroinvertebrates

These tests do not apply to this remnant vegetation site.

Site Threats

- Weed invasion from adjacent farmland and roadside *Phalaris*
- Potential loss of Buloke due to limited regeneration

(Davies 2003).

Surrounding Land use

Land use activities were a mixture of dryland cropping and sheep grazing. Cereal crops were getting close to harvesting stage at the time of the tree health surveys.



Figure 9. Bryce's Buloke in spring 2002

Site 5 Box Swamp

The site is of uncertain environmental stability and is within the Avon-Richardson Targeted salinity project sub-catchment.

Site Description

The area is a proclaimed Government Road (the site is bisected by the Wimmera Highway), at an altitude of 110 metres and is on an almost level alluvial plain north of the Avon River. The area has high habitat value due to the Woodland being dominated by a range of sizes and age classes of *E. largiflorens* (Black Box) and the proximity of the Avon River (Davies 2003).

Vegetation Description and Composition

This area is open woodland dominated by *E. largiflorens* (Black Box). The understorey is predominantly *Muehlenbeckia florulenta* (Tangled Lignum) and *Eragrostis infecunda* (Cane Grass) and species from the Cyperaceae (sedge) and Juncaceae (rush) Families. The EVC surrounding the wetland formation is plains grassy woodland (DSE 2003).

The 1997 survey indicated that up to 50 percent of the species present were introduced, mostly from the Asteraceae and Poaceae (grass) Families. This had increased to between 60 to 70 percent of the species present in the 1998 to 2001 surveys. However the number of introduced species recorded in 2002 has dropped from between 10 to 20 percent due to the continued dry conditions. These decreases were mainly from the Asteraceae and Fabaceae Families.

The site still has only one salt indicator specie being *Lolium* sp. (Rye Grass). This does not necessarily represent saline conditions because there are no other salt tolerant species present and it is a common agricultural weed (appendices 8.2 & 8.3) (Davies 2003).

Tree Health

All monitored Black Box trees except for one have increased in health since monitoring commenced in 1997. This tree is covered in dead branches, epicormic growth and has a low canopy density. Only four trees could be reached for leaf analysis which revealed minimal damage from insects and leaf chloride concentrations ranging from 0.19-0.36 percent. No regeneration was recorded within either vegetation quadrat (appendix 8.4).

Birds

Bird species present at the time of the vegetation and tree health surveys were :- Galah, Magpie, Red-rumped Parrot, Starling, Superb Fairy-wren, Striated Pardalote, Welcome Swallow, Willie Wagtail, Eastern Rosella, Brown Tree Creeper, White Plumed Honeyeater, Noisy Miner, Kookaburra and Red Wattlebird. Good habitat and shelter in the form of mixed age classed trees and good lignum cover would encourage birds to the site. The Avon River is also located nearby.

Groundwater and Salinity

Two bores near Box Swamp recorded the water table as deeper than 16 metres below natural surface during 2002-2003. The hydrograph records indicate that one bore is displaying a very slight rising trend and the other has dropped in response to dry

seasonal conditions. This site is not under threat in the near future due to the depth of the water table but an upward trend in regional groundwater could have wider salinity implications for areas downstream, particularly the lower Avon River floodplain area and its margins (appendix 8.5).

Water Quality and Macroinvertebrates

Although this site is a swamp, it is rarely inundated and is assessed as a remnant vegetation site.

Site Threats

- Weed invasion
- Spillage of gravel and blue metal from adjacent gravel dump
- Possible long term pooling of water
- Dumping of rubbish

(Davies 2003).

Surrounding Land use

Land use in the area around Box Swamp was dryland cropping. The mostly cereal crops were getting close to harvesting stage at the time of the tree health surveys.

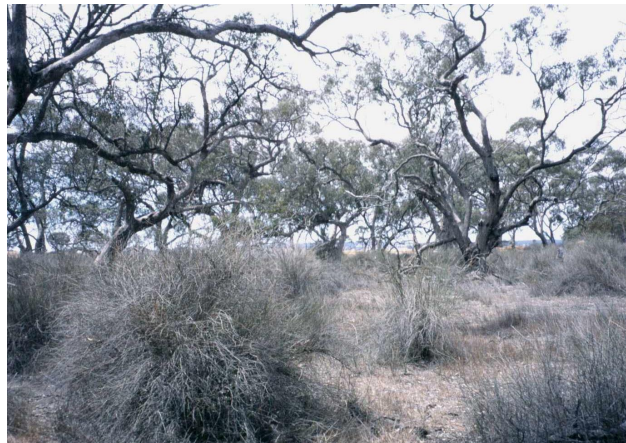


Figure 10. A very dry Box Swamp in spring 2002