



# Key Management Actions for Lake Kununurra

Ord Land and Water Component  
2006 – 2008



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## 1.0 HISTORY

### 1.1 Lake Kununurra:

Lake Kununurra was formed in 1963 with the building of the Kununurra Diversion Dam. Its initial role was to supply a hydraulic head for irrigation but since then it has also developed high conservation, recreational and commercial values.

In 1991 the lake was gazetted as a Ramsar site along with Lake Argyle in recognition of its importance as a migratory bird habitat or stop over point.

Currently the lake is an important recreational source for both locals and visitors with fishing, water skiing and pleasure cruises being the main activities. Several tour boat businesses operate on the lake either with powered boat day trips or canoeing and camping trips.



Kununurra Diversion Dam

### 1.2 Weeds of Lake Kununurra

The lake and the river before its damming in 1963 have had a long history of steadily increasing weed pressure. Prior to the damming it would have come about most likely as a result of cattle production activities. However once the townsite of Kununurra and neighbouring communities were established a new range of weeds were introduced to the Environment. With the forming of Lake Kununurra large numbers of people were able to access the area and the number and types of weeds rapidly grew.

Whilst some weeds were introduced inadvertently there is good evidence and an associated verbal history to indicate that many of the garden plants and fruit trees were deliberately planted by one person as a means to provide sustenance for lake users in case of a perceived future scenario where people may be forced to relocate from the townsite to the lake's shores to live. Hence it is common to find a number of different species of these types of weeds in one location, usually on a water course.

In 2002 the East Kimberley Weeds Working Group identified 134 different species of weed on or around the lake. This included the aquatic weed salvinia, feral bananas and mangoes, grasses such as Johnson grass, woody weeds like neem and parkinsonia and several types of vine. Later that year an aerial survey was conducted on the lake to identify the location of some of these weeds

Despite the large numbers of weed species present their impacts on the environment is varied. Close to the community centers of Kununurra, Packsaddle, Crossing Falls and Maxwell Plain large populations of weeds such as leucaena, neem, hyptis and parkinsonia are entrenched. These infestations are significantly impacting on native vegetation in the area (see appended maps).

However beyond the community of Geboowami approximately 17 kilometres south of Kununurra and the surrounding barrier hills weed pressure and associated impacts drop away significantly for the remaining length of the lake and the associated catchment.

### 1.2 Weed control 2003 – 2006:

Since 2003 Ord Land and Water has been controlling weeds on the lake. Weeds targeted were selected for a number of reasons. Most were identified in the work done by the Weeds Group in 2002; a remaining couple that was missed in the survey work due to their low numbers were subsequently included once they were found. All of the weeds were selected on the basis that they could potentially displace large areas of riparian flora if left in an uncontrolled state but were not yet considered beyond control.

Initially six sites were selected covering approximately 20 hectares, these were –

- ✚ Town Beach site.
- ✚ Maxwell Creek (now site 1)
- ✚ Jump Rock (now Site 6)
- ✚ Coolimon Creek (now Site 9)
- ✚ Ord Dam (now site 12)
- ✚ Salvinia (now site 15)

Control work was carried out using the organisation Conservation Volunteers Australia. This proved to be mixed in its success as finding the volunteer labour by the organisation was often problematical.



Volunteers controlling Moringa at Site 9 August 2006

Due to the isolated nature of some of the sites access can only be gained by boat and walking. As the riparian vegetation is only relatively narrow most of the weeds targeted are within a hundred metres of the water's edge, though some sites were much wider.

During this period weed control techniques were trialed; the most effective was the application of a pesticide to the basal bark of the plant. This was reasonably selective ensuring little or no damage done to native plants if applied correctly.

## 2.0 PROJECT WEED CONTROL

Since the start of this current project the work has extended to a total of 19 project sites covering 1,640 hectares of riparian shoreline and associated catchment. The Sites range from small areas of .1 hectare up to large areas of over 1,000 hectares. In the three year period weeds were controlled over the following areas -

### 2.1 2006:

A total of 150 hectares of weeds were controlled in this year on nine sites, five of which were new. These sites were –

- ✚ Maxwell Creek, Site 1
- ✚ Maxwell Plain Riparian Strip Site 3
- ✚ Rainforest C, Site 4
- ✚ Rainforest Site 5
- ✚ Jump Rock, Site 6
- ✚ Herbies, Site 8
- ✚ Coolimon Creek, Site 9
- ✚ Spillway Lake, Site 14
- ✚ Salvinia. Site 15



In filling the salvinia site August 2006

The Town Beach site was given over to the Shire of Wyndham East Kimberley as part of their work program. Weed control was mainly done in the cooler months of June to September and concentrated on destroying as many mature trees as possible to reduce the production and distribution of seed.

This strategy was only partially successful as hard to kill trees such as leucaena and moringa reestablished themselves during the wet season along with a higher than normal germination of seedlings due to the loss of shading from dead mature trees in the area.

Salvinia was found on a monitoring run within Site 15 for the first time since December 2004. Despite control efforts this new infestation grew within the confines of an earthen Groyne that had been constructed in December 2004 and a floating boom that had been placed around the site in 2000. The area inside the earthen groyne was in filled with a metre of soil in August allowing control efforts to focus on the area between the groyne and the floating boom.

## 2.2 2007:

A total of 510 hectares of weeds were controlled in this year on ten sites, two of which were new.

These sites were –

- ✚ Maxwell Creek, Site 1
- ✚ Maxwell Plain, Site 2
- ✚ Maxwell Plain Riparian Strip Site 3
- ✚ Rainforest C, Site 4
- ✚ Rainforest Site 5
- ✚ Jump Rock, Site 6
  
- ✚ Long Michael Plain Riparian Site 7
- ✚ Herbies, Site 8
- ✚ Coolimon Creek, Site 9
- ✚ Salvinia. Site 15



Weed control on Site 5 October 2007

Weed control once again started in July but it was decided that it needed to be continued right through the wet season despite the climate to ensure weeds were contained during the wet season. In an initiative jointly funded by this and another weed control project Indigenous CDEP workers were utilised to control weeds on 415 hectares of Site 2.

A new groyne and 2 new booms installed at the salvinia site in August – September 2007 to further secure the site. This allowed a large section of cumbungi where small pockets of salvinia were hiding to be dug out. The remaining salvinia was picked up by hand on the monitoring runs. The last find was outside the booms on the 25th Sept and a smaller amount in the same location 2nd October. It was believed that wave action from the construction works probably bushed a small piece past the boom and was picked up when it grew large enough to be found. Monitoring was maintained at every two weeks for the remainder of the year.



A line of leucaena can be seen amongst the riparian vegetation at Site 12.

In December an aerial survey of the lake was

done to collect data on predominant weed species and their location. This information was used to create a map of the lake's weeds and compared with a similar map made back in 2002 (see appended). The data would also assist in determining the location of any new sites that need to be opened.

### 2.3 2008:

A total of 944 hectares of weeds were controlled in this year on 17 sites, seven of which were new. These sites were –

- ✚ Maxwell Plain, Site 2
- ✚ Maxwell Plain Riparian Strip Site 3
- ✚ Rainforest C, Site 4
- ✚ Rainforest Site 5
- ✚ Jump Rock, Site 6
- ✚ Long Michael Plain Riparian Site 7
- ✚ Herbies, Site 8
- ✚ Coolimon Creek, Site 9
- ✚ Raintree, Site 11
- ✚ Ord Dam, Site 12
- ✚ Parkinsonia, Site 13
- ✚ Spillway Lake, Site 14
- ✚ Salvinia, Site 15
- ✚ Long Michael Plain, Site 16
- ✚ Lake's End, Site 17
- ✚ Packsaddle, Site 18
- ✚ Flying Fox Colony, Site 19



The same area as previous page after weed control was undertaken in September 2008

The large number of sites added to the work program for 2008 came as a result of weed populations on existing sites being reduced and the aerial survey done in December 2007 identifying further sites that could be opened within the capabilities of the project.

The strategy of maintaining the work program right through the wet season proved to be the correct one, allowing a number of sites, or sections of sites to go from an 'active control' to a 'monitoring' phase. Weed germinations were caught at the one or two leaf stages where control is easily and relatively cheap to carry out. The lack of completion from the weeds and the use of selective herbicides allowed native grasses to start reestablishing on some of the sites.

Contractors were employed early in the year to control 50 hectares of high density weeds where density levels were in excess of 1,000 plants/hectare on Site 2 and 18. In total they controlled 67 hectares of high density weeds and a further 690 hectares of medium to low density weeds. Another run through the area was conducted later in the year by OLW staff to pick up on missed plants and any subsequent germination.



SEEKS members removing weed seeds prior to leaving Site 10 after the noogoora burr search.

The aerial survey picked out a couple of locations that appeared to have noogoora burr and belly ache bush on them. The noogoora burr site (Site 10) was checked three times in January but no burr was found. A fourth search using

Save Endangered East Kimberley Species members was done in April, the result being no burr was found. The site will be monitored for a couple of years to ensure the weed is not in the area. A similar sighting of bellyache bush on site 11 was checked in April but the plant was not found. Monitoring of that site will continue.

No salvinia was found in 2008 but monitoring will continue into 2009 as it has disappeared from the site for over 12 months once before reestablishing itself.

#### **2.4 Project sites:**

There are a total of 19 project sites covering 1,624 hectares of riparian shoreline on Lake Kununurra. They range from small areas of .1 hectare up to sites of over 1,000 hectares. By the end of this project 14 sites were still active requiring regular control work on either all or sections of the site. The remaining five were being monitored either once or twice a year with weeds killed if found.

Although the sites are scattered along the length of the lake the larger, more heavily infested sites are clustered towards the downstream section of the lake close to communities and rural and residential land.

**Site 1 - Maxwell Creek 274 hectares, established June 2003:** Is situated next to the Crossing Fall community on the junction of the lake and Maxwell Creek. The site follows the creek for close to four kilometres and is bounded on its northern boundary by the escarpment. Weeds controlled by this project include neem, raintree, pawpaw, leucaena and parkinsonia. Only a couple of days have been spent controlling weeds on this site using a contractor. The vegetation is quite thick and free movement is significantly restricted in some of the thicker areas.

**Site 2 - Maxwell Plain 1128 hectares, established August 2007:** Is situated on the eastern bank of Lake Kununurra three kilometres upstream from Crossing Falls. The area includes four Indigenous communities and one private block. Weeds controlled on this site include Neem, leucaena parkinsonia, bellyache bush and raintree. Between this and another Ord Land and Water weed project this area has been the subject of significant weed control activities. The area holds the single largest and densest neem population in the region and is a source of infestation for the surrounding area. By the end of 2008 approximately 75% of mature neem trees have been destroyed and all of the low density weed areas have been gone over twice. This site remains as one of the main areas requiring weed control on the lake and is strategic in terms of the fact that it and the Packsaddle Site are the southern limit of human habitation along the lakes banks and therefore remain as a source for the spread of new weeds onto the lake.

**Site 3 - Maxwell Plain riparian 8.4 hectares established August 2006:** Is situated south of Munthanmar, one of the Maxwell Plain communities and butts onto the Main Maxwell Plain site. Weeds are restricted to a low density population of neem, scattered leucaena plants and one high density stand of leucaena. The site is still active however the high density leucaena stand situated on the site entered its monitoring phase in April 2008.

**Site 4: - Rainforest C 7.2 hectares established July 2007:** This site is situated seven kilometres south of Crossing Falls, on the western side of the lake, at the base of the cliff known locally as Wallaby Rock. Weeds are restricted to low density populations of leucaena, neem, pawpaw, golden shower and date palm. One high density stand of leucaena exists on

the site on the water's edge. Work is still ongoing on this site but the high density leucaena stand entered its monitoring phase in April 2008.

**Site 5 - Rainforest 43.9 hectares established July 2006:** This site is situated eight kilometres south of Crossing Falls, on the western side of the lake. The site was set up as a monitoring site for a separate but aligned weed project, because of this it has had some extensive control carried out on it over project's life. Weeds controlled on this site include neem, date palm, pawpaw, carpentaria palm, poinciana, banana, raintree, leucaena and parkinsonia. Work is still ongoing on this site but is expected to enter its monitoring phase by the end of 2009 provided work continues.

**Site 6 - Jump Rock 2.9 hectares established June 2003:** This site is situated next to the popular swimming spot known as Jump rock 1.6 kilometres upstream of the mouth of Spillway Creek. The site has seen control work carried out dating back to 2003 in previous projects. Weeds controlled on this site include coral vine, banana, leucaena, pawpaw, mango, raintree and poinciana. A number of carpentaria palms are situated close to the site and remain uncontrolled to date. This site is still active only because of a number of coral vine plants in one location that are proving hard to kill. The rest of the site entered its monitoring phase in December 2008.

**Site 7 - Long Michael Plain leucaena .2 hectares established July 2007:** This site is situated opposite the popular swimming and camping spot known as Sandy Beach, four kilometres upstream of Spillway Creek. Weeds controlled on this site include leucaena and pawpaw. This site entered its monitoring phase in April 2008.

**Site 8 - Herby's .2 hectares established July 2006:** This site is situated at the start of the trail that leads to Herby's Hole six kilometres upstream of Spillway Creek. Weeds controlled on this site include leucaena and poinciana; several unsuccessful attempts were made initially to kill off the wild sweet potato growing in one place along the track. This was later abandoned when it was apparent that control was not working. This site entered its monitoring phase in February 2008.

**Site 9 - Coolimon Creek 9.2 hectares established June 2003:** This site starts at the mouth of Coolimon Creek and runs for two kilometres along its length. The site has seen control work carried out dating back to 2003 in previous projects. Weeds controlled on this site include Moringa, carpentaria, rain tree, date palm, poinciana, leucaena, coral vine, banana, pawpaw and parkinsonia. Work on this site is ongoing, except for a stand of leucaena upstream of where the main body of work has been done. This section entered its monitoring phase in August 2007, it's expected that the rest of the site will enter its monitoring phase by mid 2009 providing work continues.

**Site 10 - Sandy Beach 27.8 hectares, established January 2008:** This site is situated next to the popular swimming and camping spot known as Sandy Beach, four kilometres upstream of Spillway Creek. This site was established as a result of the aerial survey done in late 2007 when it appeared that noogoora burr may have been present on the site. Three subsequent foot surveys in January 2008 and a further survey in April involving Save Endangered East Kimberly Species (SEEKS) failed to find any sign on the plant. Previous to this noogoora burr was found on the site in 2000 but was eradicated by SEEKS and the then Department of Agriculture. The site entered its monitoring phase in April 2008.

**Site 11 - Raintree 1.5 hectares, established April 2008:** This site is situated three kilometres downstream of the Ord Dam and was established as a result of the aerial survey done in late 2007 when it appeared that belly ache bush may have been present on the site. A subsequent foot survey in April failed to find any sign on the plant. However the raintree on the site has since being controlled. The site entered its monitoring phase in April 2008.

**Site 12 Ord Dam 9.3 hectares established April 2008:** This site is situated directly under and downstream of the Ord Dam. Weeds controlled on this site include leucaena, parkinsonia, bellyache bush, neem and moringa: the leucaena stands are of particularly high density and could be considered to be a monoculture on at least two hectares of the site. Work is ongoing, it is expected that all mature trees will be destroyed by the end of 2009.

**Site 13 - Parkinsonia .4 hectares established June 2008:** This site is situated six kilometres downstream of the Ord Dam. The Weed controlled on this site is parkinsonia. This site entered its monitoring phase in September 2008.

**Site 14 Spillway-lake 31.6 hectares established July 2008:** This site is situated over a four kilometre section of Spillway Creek starting at its mouth. Weeds controlled on the site include parkinsonia and date palm. Work on this site is ongoing.

**Site 15 Salvinia 1 hectare established 2000:** This site is situated within Lily Creek at the bottom of a residential drain of Lakeside Kununurra: the sole weed controlled is salvinia. The site has been active for eight years with the last plants found in early October 2007. The site has three booms surrounding it supported by two earthen groynes. This site entered its monitoring phase in January 2008.

**Site 16 Long Michael Plain 14.1 hectares established August / December 2008:** This site is situated two kilometres inland from the lake on Long Michael Plain. It is centered on two non permanent wetlands that drain to Spillway Creek. The weed controlled on the site is parkinsonia. Work on this site is ongoing.

**Site 17 Lake's End .1 hectares established August 2008:** This site is situated seven kilometres upstream from Coolimon Creek. Weeds controlled on the site include raintree, moringa and date palm. Work on this site is ongoing.

**Site 18 Packsaddle 63.6 hectares established January 2008:** This site is situated directly opposite Crossing Falls. Weeds controlled include neem, pawpaw and leucaena. There are have high density stands of both neem and leucaena scattered along its length and has had some intensive control work done on it in 2008. Work on this site is ongoing.



Parkinsonia in a dry waterhole next to Lake Kununurra

**Site 19 Flying Fox Colony 6.4 hectares established September 2008:** This site is situated 9 kilometres downstream of the Ord Dam. Parkinsonia is the only weed controlled on the site. This site should enter its monitoring phase in early 2008.

### 3.0 WEEDS

#### 3.1 Parkinsonia (*Parkinsonia aculeata*):

Parkinsonia is an exotic plant that has been recognised nationally as a weed of national significance (WONS) because of its invasiveness and its ecological, economic and social impacts. At a State level it has been declared by the Department of Agriculture and Food a P1 weed across the state (Prohibits movement) and a P4 weed (Aims to prevent infestation spreading beyond existing boundaries of infestation) in the Shire of Wyndham East Kimberly. It is a native of tropical America. It was introduced into northern Australia as an ornamental plant, because of its attractive foliage and its drought tolerance. It was then known as Jerusalem thorn. Currently it is a serious weed in pastoral areas of the Kimberley and Pilbara. Neighbouring and upper catchment pastoral stations carry out regular control programs on the plant.



Parkinsonia plant re-shooting from base of killed off tree.

Parkinsonia has been present on and next to the lake for many years and is now the most widespread of all the weeds this project controlled. The weed surveys carried out in 2002 and again in 2008 indicate that the plant's distribution has changed very little in that time. Field observations during control have noted that some plants die off completely to ground level and some or all of those re-shoot later. This die off could be one reason the plant's distribution has remained static recently. If pests or diseases are having an impact on the plant, control measures may prove to be effective.

This project only started to specifically target parkinsonia in 2008 once new sites further up the lake were opened and other weeds within earlier sites were controlled allowing some work to be done on parkinsonia. Parkinsonia is not a priority weed in the project due to it being widespread across the East Kimberley, however in selected isolated pockets such as sites 9 and 13 the weeds is being completely removed, or in areas such as site 5 where large scale control, work of other weeds has been carried out parkinsonia is removed to ensure it does not out compete the native vegetation as it moves back into the area.



A neem tree growing on the banks of Lake Kununurra.

#### 3.2 Neem (*Azadirachta indica*):

Neem first appears to have been planted on the fringes of the lake in the late 1980s around the Munthanmar community on Maxwell Plain. The plant was also planted at Packsaddle and in the Kununurra townsite not long after as an ornamental shade tree and as a mosquito deterrent because of its supposed insecticidal properties.

The plant has since spread along the banks of the lake and currently can be found on seven project sites occupying 1533 hectares. Information of the rate of spread is incomplete due to limited survey work done in the past but

it appears that from the aerial surveys done in 2002 and again in 2008 that an area of 129 hectares of neem along the riparian zone of the lake has gone from low/medium density to high density in six years. Most of this area is on Maxwell Plain and an area of river flat just north of the Crossing Falls community. A few plants have been found at site 12 under the Ord Dam but these and the single parent tree planted in the BBQ area have been killed. Any subsequent germination should be dealt with in ongoing work in 2009.

Neem has demonstrated itself to be the single biggest threat to the lake of all weeds controlled by the project. It has the ability to form monocultures within the lake's riparian zones excluding all but a few of the larger native trees. Below the tree canopy very few lower storey plants, if any are able to survive. In other regions of similar climate the complete loss of grasses and shrubs has contributed significantly to the erosion of the banks and infilling of the waterways. The high impact rain events typical of Kununurra would make the banks of the lake particularly susceptible to erosion caused by neem monocultures if they were allowed to continue to spread.



A leucaena thicket on Site 9.

Funding from other weed control projects run by Ord Land and Water has assisted in the work been done in the past and into 2009, however it is likely a control program would need to run for a further 5 years to see the weed brought into a controlled phase.

### 3.3 Leucaena (*Leucaena leucocephala*):

*Leucaena* was initially introduced into the region as cattle feed and has since spread throughout the Kununurra townsite and can now be found on 11 of the project sites where it's usually restricted to small high density populations in areas less than half a hectare. One notable exception is site 12 where at least half of the site's 9.4 hectares is either a monoculture or a high density population and the other half of the site comprises of a low density population.



Moringa flowering at Site 9.

*Leucaena* has proven to be a difficult plant to kill in some circumstances with plants resprouting from ground level up to a couple of months after spraying. These plants often need to be resprayed a number of times before they eventually die. To counter this, basal bark applications had to be applied constantly right to ground level on all plants. From the two aerial surveys done it appears that the plant is not spreading rapidly so provided control measures include a number of revisits to pick up wet season germinations and resprouting trees eradication from the immediate area is appearing to be a plausible option.

Six sites that have *leucaena* on them have areas where the plant has been controlled to the point that only one visit a year is required to pick up any plants that may have been previously missed.

### 3.4 Moringa (*Moringa oleifera*):

Moringa, or horseradish tree has been found on three of the project sites, the largest being Site 9 at the mouth of Coolimon Creek. The plant is easily killed by spraying but will often resprout some months later, a follow up spray usually totally kills the plant. Plant control benefits significantly by a return to an infested area during the wet season to destroy newly germinated seedlings. If the return visit is delayed by a few months the seedlings would have attained the size of small trees in that time and may have even produced fruit and seeds.

Moringa does not appear to be spreading along the lake but in other regions it has been observed to form monocultures due to its extremely rapid growth rate that outstrips most other plants.

### 3.5 Coral vine (*Antigonon leptopus*):

Coral vine was originally found only on two project sites. But since cyclone Ingrid removed over 20 metres of bank from the Coolimon Creek mouth in March of 2005 the plant can now only be found at Site 6. The plant is extremely difficult to destroy due to its size and its ability to root sucker. If the plant found a means to spread itself along the lakes foreshore it would soon be a significant threat



Coral vine flowering at Site 6.

to native trees due to its ability to rapidly grow over their canopy.

### 3.6 Bellyache bush (*Jatropha gossypifolia*):

Bellyache bush is widespread in the upper catchment of the Ord River but is much less prevalent downstream of the Ord Dam. Only two project sites have the plant present, the largest area being site 12 under the Ord Dam.

At a State level the plant has been declared by the Department of Agriculture and Food a P1 weed across the state (Prohibits movement) and a P4 weed (Aims to prevent infestation spreading beyond existing boundaries of infestation) north of the 26<sup>th</sup> parallel.

Control techniques in the dry season usually involve cutting the stump and applying a pesticide as the plant stops growing at this time of year, however basal bark application of pesticides has also shown to be effective providing the application is rigorous.

### 3.7 Fruit trees (Mangoes, date palm, pawpaw):

A total of six sites, all downstream of Coolimon Creek have low populations of fruit trees scattered throughout them, usually along a creek line. Currently none of them appear to be rapidly spreading or creating monocultures, date palm is



A mature date palm at Site 5.

the more widespread of the plants and seedlings have been discovered under or close to fully

mature plants, they are also the hardest plants to kill with large plants requiring a chainsaw to kill them.

All fruit trees are controlled to ensure they do not become a potential host for any exotic pests or diseases that may invade the irrigation area adjacent to the lake.

### **3.8 Garden Plants (Rain trees, carpentaria palms, poinciana, golden shower):**

A total of eight sites have low populations of garden plants scattered throughout them. There is a distinctive correlation between their location and the location of fruit trees suggesting that they were planted together.

Rain trees appear to be the most invasive of these plants, though their spread appears slow compared with other garden escapees such as neem.

#### **Salvinia (Salvinia molesta)**

Salvinia is an aquatic plant that has been recognised nationally as a weed of national significance (WONS). It has the capacity to rapidly spread across the surface of waterways choking out all other plants and killing fish. At a State level the plant has been declared by the Department of Agriculture and Food a P1 weed across the state (Prohibits movement) and a P2 weed across the state (Requires infestation destroyed and prevent propagation each year until no plants remain).



Salvinia in Lily Creek

The plant was first discovered on one Site in Lily Creek of Lake Kununurra in 2000 at the base of a residential drain. Since then numerous organisations have been involved in an eradication program. Control methods have ranged from applying pesticides where the plants were wide spread, picking up by hand where there were only a few plants to burying a large area under a metre of fill.

In 2007 the remaining affected area had a second groyne built around it and two extra booms added to the original to ensure the plant remained contained. The last plants found on the Site was in early October 2007. Ongoing monitoring of the Site is continued monthly.

## **4.0 MAPPING**

To build on the data collected in 2002 on weed distribution on the lake another aerial survey was conducted in December of 2007. This information and was compared to the 2002 data to determine what weeds were spreading and what weed if any were decreasing due to control efforts to date.

On comparing the data the following observations were made –

- ✚ The largest areas of weed were close to either the Kununurra townsite or other neighbouring communities. These areas had the greatest increase in size and weed distribution over the past six years.
- ✚ Neem was the most aggressive weed this project targets showing a rapid spread on sites 1 to 5 and 18. Although a number of these sites didn't have neem recorded during the mapping process in 2002 it has since been determined that neem was

present but was not high or thick enough to be detected amongst the native canopy.

- ✚ Weeds such as leucaena and parkinsonia although found in a number of locations were expanding at a much lower rate than neem. Although these weeds are quite capable of displacing large areas of native bush such as Site 12 the work done to date has demonstrated that these weeds can be controlled relatively quickly.
- ✚ Weeds such as moringa and coral vine don't appear to be able to spread from their initial site. Although killing individual plants is problematical do to their regrowth capabilities persistence should see these plants removed from the lake's foreshore.
- ✚ Of the fruit trees and garden plants found on the lake, pawpaw is the only one that is being distributed, most likely by birds.

## 5.0 WEED PRIORITISATION

From the data collected from this project has allowed some limited prioritisation to be done of the target weeds –

### High priority weeds

- ✚ **Salvinia:** Based its ability to rapidly spread across waterways choking out native aquatic plant life and killing fish and other animals. This weed would have major impacts to the lake and Ord River environment, recreational activities on the lake and the agricultural industry within the Ord River Irrigation Area if it could not be controlled.
- ✚ **Neem:** Based on its rapid spread and ability to completely displace native vegetation. This weed has demonstrated it is capable of rapidly out competing native plants within the lake's riparian zone and surrounding areas. It forms monocultures shading out ground cover plants making the soil susceptible to erosion during wet season rain events.
- ✚ **Leucaena:** Based on its spread along the lake and ability to completely displace native vegetation. This weed is less invasive than neem but is already spread along the lake can be found on 70% of the project sites. It has been proven to be hard to kill and does form monocultures shading out ground cover plants making the soil susceptible to erosion during wet season rain events.
- ✚ **Fruit trees:** Based on their threat to the tree crop industry within the Ord River Irrigation Area. As weeds their impacts on the lake's environment is minimal, however in the event of an exotic pest incursion these trees could become a harbouring refuge for that pest.

### Medium priority weeds

- ✚ **Parkinsonia:** Although widespread along the lake it appears only to be spreading slowly, if at all. Additionally there is evidence to suggest that it is being controlled, at least partially by an insect pest, disease or both. Parkinsonia is widespread in the East Kimberley so there is always the risk of infection from land adjacent to the lake.
- ✚ **Coral vine:** Whilst extremely difficult to kill it can now be only found on one site where it is being actively controlled. If allowed to spread it is an aggressive climber that can rapidly cover large trees. It appears to favour large broad canopy trees such as boabs.
- ✚ **Bellyache bush:** Although it is currently only found on two sites the weed has a track record of being highly invasive in the Ord Catchment, upstream of the Ord Dam.
- ✚ **Moringa:** This weed appears to be unable to move any distance from its initial planting site and its spread on that site still limited. However at Site 9 the weed

was capable of forming two small high density pockets of mature trees. The plant is quick to mature and is able to reshoot from its base after being sprayed.

#### Low priority weeds

- ✚ Garden plants: Raintree is the only plant that could possibly be considered a medium priority weed as it can be found on a number of sites, although usually in low numbers. Poinciana and carpentaria palms have been found to reproduce but numbers are very limited.

## 6.0 REVEGETATION

Observation sites were set up on the lake to determine if any revegetation may be required where large scale control activities would be taking place. Two sites were selected on Site 2; they were monitored over the 2007/08 wet season to see what, if anything grew back and if the sites were impacted by erosion in any way.

From the observations it was concluded that due to the decrease in canopy as a direct result of killing off the mature weed trees more light was able to penetrate to ground level. This encouraged of a significant increase of growth of native grasses and broadleaf plants including the weed hyptis that was already present on the site.

Whilst no erosion was found on the observation sites or any others it was noted on one site that feral cattle were grazing the leucaena at a time that it was being controlled, subsequently there was some damage done to that site as a result of cattle activities in the area. Further to this it was noted that on a number of locations, both on and off project sites the impacts of cattle on vegetation, the shoreline and levy banks was becoming increasingly more common.

## 7.0 DEGRADATION

Site 9, in particular the section on the junction of Coolimon Creek and Lake Kununurra has by the end of this project has been the recipient of five years of intensive weed control. The area has also seen the steady increase in the movement of cattle feeding on leucaena stands and trampling native vegetation. Additionally the same area is a high use area for visitors with a canoe camp established on the site.

From observations of the area it is apparent that there has been a significant loss of large native trees from the section where weed control has been the most intense. Some of these native trees have either died off or have been blown over up to a year after any major control had last had been done. Whilst it is clear that the weed control activities have not directly responsible for the loss there still may be some link that has contributed either in isolation or in conjunction with the other impacts on the site. Ord Land and Water will continue to monitor this site in the hope an answer may be forthcoming.

## 8.0 FERAL ANIMAL CONTROL

The forming of Lake Kununurra in 1963 created pockets of land where station cattle had become trapped between neighbouring mountain ranges and the waters of the lake. The cattle continued to breed in these pockets over the years with little or no control. In 2007 it was noticed by lake users that numbers had appeared to have substantially increased with sightings going from rare to common. The associated impacts of the cattle included an increasing amount of cattle tracks, areas of land and foreshore becoming degraded due to cattle activity and an increase in the spread of leucaena on Site 9.

In December 2008 a total of 69 head of feral cattle were shot in various locations along the lake (see appended map). This work was carried out using Department of Agriculture and Food personnel and resourced through this project and the Department of Environment and Conservation.

## 9.0 SUMMARY

This project has significantly extended the weed work done on Lake Kununurra from the initial six sites covering 20 hectares prior to the project to 19 sites covering 1,640 hectares by its end.

In the three years of project work 963 of the 1,615 project hectares has had control activities carried out on them. The work has included up to three passes over some of the sites to remove all seeding plants initially and follow up work to remove new germinations of plants. As a result five of the 19 sites are now just monitored for weed regrowth a couple of times a year and controlled as required, a further three sites have some sections that are in a similar position and monitored and controlled accordingly.

In this time weeding techniques were refined to suit the target weeds and the climate; this included the following actions –

- ✚ The initial control work concentrated on killing adult trees to stop any further seed production on the site, subsequent control work done in the following seasons focused on killing seedlings and juvenile plants as they grew to a height they could be detected.
- ✚ Hard to kill plants such as leucaena and moringa were sprayed carefully to reduce regrowth and checked three months later to ensure all plants had died.
- ✚ Control work continued throughout the wet season to get on top of seed germination at the seedling stage. This was the single most effective strategy employed, however operators need to be cautious of heat exhaustion issues and take preventative measures.
- ✚ Revegetation by means of replanting proved to be not necessary due to the vigorous nature of native regrowth.

Mapping gave an indication of the spread of weeds on the lake, what weeds were spreading the quickest and what ones were capable of completely displacing native bushland given enough time. This enabled the target weeds to be prioritised accordingly –

- ✚ High priority weeds: Salvinia, neem, leucaena and fruit trees (Mangoes, date palm, pawpaw)
- ✚ Medium priority weeds: Parkinsonia, Bellyache bush, moringa and coral vine.
- ✚ Low priority weeds: Garden Plants (Rain trees, carpentaria palms, poinciana, golden shower)

Revegetation and monitoring sites have been set up as a part of this and other Ord Land and Water projects, this work will be maintained into the future with ongoing projects.

Finally the project culled feral cattle from areas on the lake where their numbers were starting to have an impact on native vegetation through the spread of weeds and trampling.

## PRIORITY WEED SCORES 2002

Species	Common name	Risk Scores				Setting Priority		Priority score
		Economic	Environmental	Urban or nuisance	Potential for spread	Total score	Control feasibility	
<i>Salvinia molesta</i>	Salvinia	4	4	3	1	12	3	<b>36</b>
<i>Carpentaria acuminata</i>	Carpentaria Palm	0	1	0	1	2	3	<b>6</b>
<i>Cocos nucifera</i>	Coconut	1	1	0	0	2	3	<b>6</b>
<i>Phoenix dactylifera</i>	Date Palm	0	3	1	2	6	3	<b>18</b>
<i>Cyperus rotundus</i>	Nut Grass	2				2		<b>0</b>
<i>Cenchrus echinatus</i>	Mossman River Grass			3	3	6	2	<b>12</b>
<i>Echinochloa colona</i>	Barnyard Grass	3			3	6	1	<b>6</b>
<i>Sorghum bicolor</i>	Forage Sorghum	3				3		<b>0</b>
<i>Sorghum halepense</i>	Johnson Grass	3			3	6	2	<b>12</b>
<i>Trianthema portulacastrum</i>	Giant Pigweed	3			3	6	1	<b>6</b>
<i>Alternanthera pungens</i>	Khaki Weed			2		2		<b>0</b>
<i>Mangifera indica</i>	Mango	2			1	3	3	<b>9</b>
<i>Annona squamosa</i>	Custard Apple	2			1	3	3	<b>9</b>
<i>Xanthium occidentale</i>	Noogoora Burr	3	3		3	9	2	<b>18</b>
<i>Carica papaya</i>	Pawpaw	2			1	3	3	<b>9</b>
<i>Citrullus lanatus</i>	Pie Melon	3				3	1	<b>3</b>
<i>Citrullus colocynthis</i>	Colocynth	3				3	1	<b>3</b>
<i>Citrullus lanatus</i>		3				3	1	<b>3</b>
<i>Cucumis melo</i>	Ulcardo Melon	3				3	1	<b>3</b>
<i>Jatropha gossypifolia</i>	Bellyache Bush,	3	3		3	9	1	<b>9</b>
<i>Hibiscus sabdariffa</i>	Rosella	1				1		<b>0</b>
<i>Azadirachta indica</i>	Neem		2		3	5	2	<b>10</b>
<i>Musa acuminata</i>	Banana	2			1	3	3	<b>9</b>
<i>Passiflora foetida</i>	Wild Passionfruit		2		3	5	1	<b>5</b>
<i>Tribulus terrestris</i>	Caltrop, Bindii	3		3	3	9	2	<b>18</b>