

# Alligator weed

**d e m a n d s   g u e r r i l l a   t a c t i c s**

Graeme Searby



*Alligator weed is perilously  
near to rice crops and  
irrigated pastures fed by the  
Barren Box Swamp in  
south-west New South  
Wales. From there it's only a  
hop, skip and jump to the  
Murrumbidgee and the  
Murray. A 'swat team' offers  
the best chance of control,  
writes Graeme O'Neill.*

**Inset:** The aquatic form of alligator weed at Barren Box swamp near Griffith in New South Wales, just 70 kilometres from the rice paddies of Coleambally, hub of Australia's rice industry.

**Main picture:** Alligator-weed on land. The terrestrial form is resistant to herbicides and existing biological controls. As a result, the threat to irrigated pasture across a broad region of southern Australia is serious.

**L**ike the Roman god Janus, alligator weed (*Alternanthera philoxeroides*) presents two faces to the world, both malign. An aquatic member of the amaranth family, this South American species can choke lakes, rivers, creeks and irrigation channels with free-floating mats of vegetation.

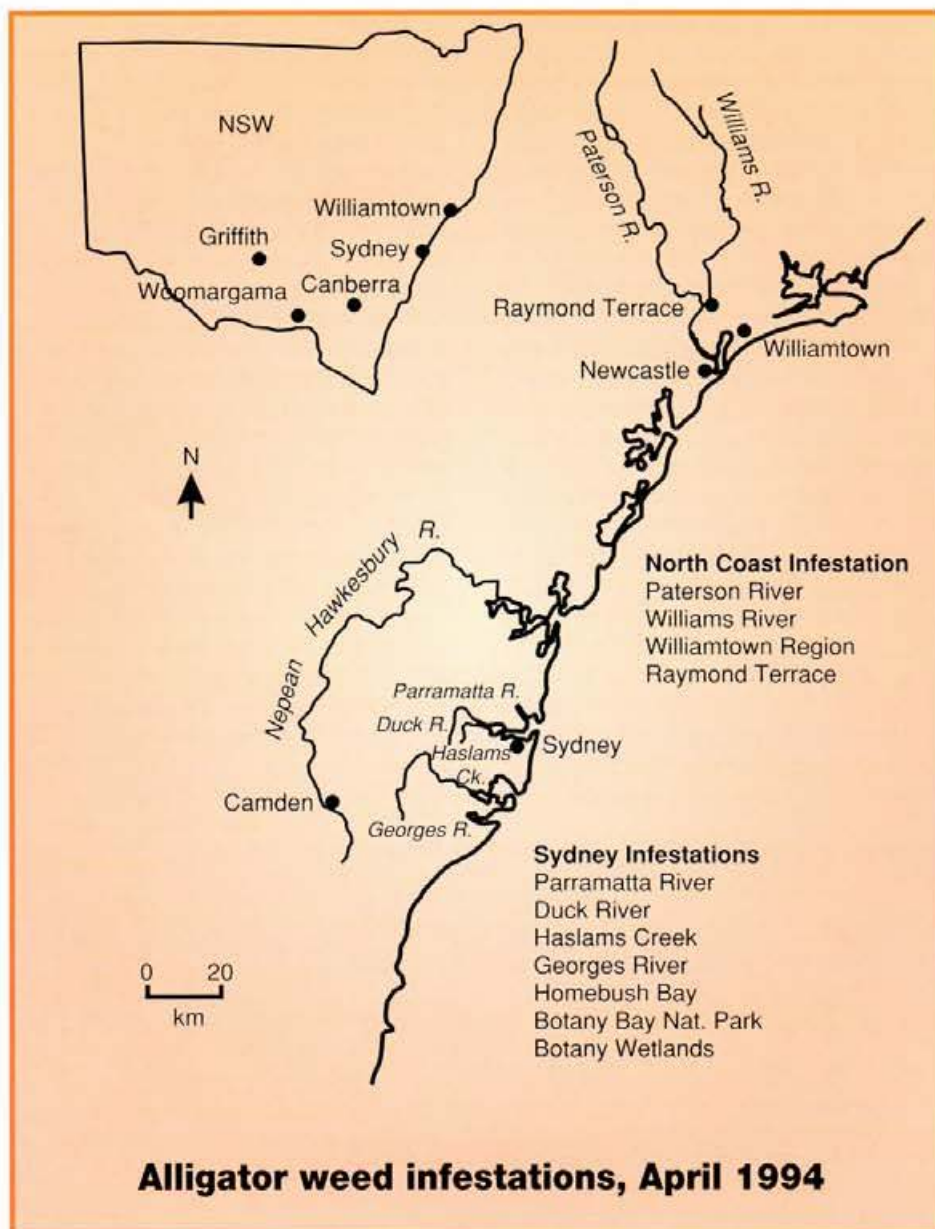
In its terrestrial alter-ego, alligator weed invades the banks of waterways, as well as wetlands and low-lying, swampy ground, suffocating other plants with its aggressive growth. This is the face that now threatens the irrigated pastures and crops of inland Australia.

Alligator weed was discovered in Australia nearly 50 years ago in ships' ballast heaps at Carrington, near Newcastle. It has since become a serious weed in several coastal river systems and estuaries in the Sydney and Hunter Valley regions of New South Wales. Today it is a declared noxious weed throughout Australia.

The weed's potential to invade irrigated agriculture and wetlands across a wide area of Australia was recognised in the late 1970s, yet only one infestation had been found west of the Great Dividing Range. This was discovered 18 years ago in a creek at Woomargama, near Holbrook in southern NSW. Repeated efforts to eradicate this infestation have failed. This year a small infestation was found on Lake Ginninderra, in north-western Canberra.

But alligator weed's potential threat to irrigated agriculture across a broad region of southern Australia has now become serious. In February this year, acting on a complaint by a grazier of poor water flow in a channel supplying his property, Adrian Baird from the NSW Department of Water Resources found unfamiliar plants growing in a Wah Wah irrigation scheme channel, north-west of Griffith. He told the department's weeds officer, who promptly contacted Dr Jane Roberts at the CSIRO Division of Water Resources at Griffith. Roberts identified the plants as alligator weed. A subsequent survey found other small aggregations of the weed, all in the early stages of growth, in about 40 kilometres of channels.

The network of narrow, slow-flowing channels that supply the pastures of the Wah Wah Irrigation Scheme provides an ideal environment for alligator weed. The scheme draws its water from Mirrool Creek, which flows into Barren Box Swamp, the main impoundment for drainage water from the Murrumbidgee Irrigation Area.



A further search revealed an alligator weed infestation along about 4 km of the lower reaches of Mirrool Creek, near its entry to the swamp, and then to the discovery of an even larger infestation on the foreshores of the swamp itself.

The ultimate source of the weed may have been Australia's largest and most persistent infestation, which covers 2000 hectares of swampy land, including paddocks, near the mouth of the Hunter River at Williamtown, north of Newcastle. The infestation has also proved impossible to eradicate, because over much of the area, the terrestrial form of the weed predominates. Boat owners may inadvertently have carried fragments across the Great Divide to Barren Box Swamp.

In the 1980s, CSIRO researchers identified herbicides which variously kill the aquatic or terrestrial forms of

alligator weed. An aquatic infestation in Sydney's Georges River has been controlled by insects, natural enemies of the weed, imported by the Division of Entomology from South America in the late 1970s. But the new, inland infestation is cause for much greater concern, because of the threat it poses to irrigated agriculture in Australia.

Regional director of the NSW Department of Agriculture at Griffith, Chris McIntosh, says the Barren Box Swamp-Mirrool Creek infestation is just 70 km from the rice paddies of Coleambally, hub of Australia's rice industry.

Because of the flat relief of the Riverina plain, Mirrool Creek's flow is only weakly confined by low levees, and in flood the creek backs up and overtops its banks. Alligator weed could choke the Wah Wah scheme, and a flood could carry the weed into the wildlife-

rich wetlands of the Great Cumbungi Swamp, which drains into the Lachlan River. From the Lachlan it is just a few weeks' drift, via the Murrumbidgee River, to the Murray River.

The NSW Department of Water Resources recognised the threat posed by the Barren Box infestation, and moved quickly to eradicate it. A regional task force, headed by McIntosh, has coordinated the work.

'It would do a lot of damage if it became established in the area,' McIntosh says. 'There is some question as to whether it would survive in a rice-crop rotation system, but the real threat is to the 5000 ha of irrigated pastures in the Wah Wah irrigation district.'

The eradication project, which began in March, employs the herbicides glyphosate and metsulfuron. So far it has cost \$400 000, and total projected cost during the next three years is \$850 000. That cost, and the logistical problems experienced, offer a preview of the consequences should alligator weed spread throughout Australia.

'It has been difficult to get access to the weed because in most areas it grows among cumbungi, box trees, willows, and dead timber around the swamp's perimeter,' McIntosh says. 'The NSW Department of Water Resources has tried using ground rigs, boats, helicopters, airboats and hovercraft.'

Much of the initial expense involved constructing three large trash screens, at \$80 000 each, to prevent downstream movement of the weed in Mirrool Creek. The screens also capture other debris, and must be cleaned daily to prevent them blocking and impeding water flow.

In March the Griffith City Council decided to close off the swamp to public access for 12 months, while the eradication project is being carried out. Barren Box Swamp is a popular destination both for duck-hunters and anti-hunting activists, and the council was concerned that they could spread the weed. The swamp is also a popular recreation area for fishing, boating, duck-hunting and swimming.

'Closing it was a very unpopular measure in some quarters, but when we conducted a publicity campaign to explain why people couldn't use it, user groups could see that if the weed was not controlled, the wetland would disappear rapidly,' McIntosh says.

He believes that eradication is still technically and physically feasible, but if the campaign had come 12 months later, the weed might have reached the floodplain around the lower section of Mirrool Creek, where it would have been impossible to eradicate.

## Control with herbicides

The control measures are based on experiments conducted on the Williamtown infestation in the mid-1980s by Dr Kath Bowmer from the Division of Water Resources, (see 'Queen of the Waterways', *Ecos* 80), a specialist in the control of aquatic weeds with herbicides.

'We tried about 100 different combinations of herbicides, additives and surfactants,' Bowmer says.

# Herbicide use: factors to consider

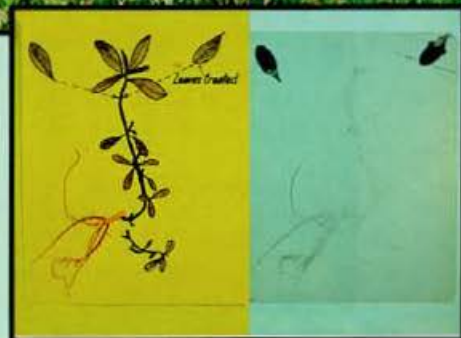
Devising a strategy for the control of alligator weed was the aim of research by Dr Kath Bowmer and her team of scientists from the Division of Water Resources. They screened 21 different types of herbicides in more than 100 combinations during seven field trials near Williamtown. Glyphosate, metsulfuron and dichlobenil were the most effective.

Alligator weed's resistance to chemical control was also investigated. Radioactive herbicides were applied in pot experiments to observe uptake into the leaves, translocation from shoots to underground parts, and the plant's ability to detoxify the herbicides. Bowmer's team studied the factors affecting herbicide performance:

- the form of the weed, terrestrial or aquatic;
- timing of herbicide application;
- soil moisture content at the time of application;
- grazing or cutting the weed before herbicide is applied;
- scorching with diquat before applying other herbicides;
- varying the ratio of spray volume to leaf area;
- the effect of competition of understorey species such as grasses;
- the speed of pasture re-establishment;
- the effect of cultivation after herbicides are applied; and
- various combinations of herbicides and other chemicals. For example, glyphosate combined with hormone compounds, additives (such as ammonium sulfate), oils or wetting agents.



**Above:** Geoff McCorkelle from the Division of Water Resources records the effects of a dichlobenil application on a trial plot of alligator weed. More than 100 different herbicide combinations were tested.



**Above right:** An autoradiograph of a potted alligator weed plant, two leaves of which were treated with radioactive glyphosate. The intensity of shadow reflects glyphosate concentrations. The translocation was rapid, but not sufficient to completely inhibit regrowth from the plant's rhizomes.

'Many simply scorched off the top of the weed leaving underground rhizomes intact. Eventually it was found that the herbicide glyphosate would only control floating mats of the aquatic form, which does not form rhizomes. Glyphosate is usually very effective on plants with underground rhizomes and root systems, but the terrestrial form of alligator weed proved quite resistant.'

Using radioactive tracers, Bowmer and her colleagues were able to track the uptake of glyphosate by the plants. They found that only a tiny fraction of the herbicide applied to the leaves was translocated to the underground parts of the plant. Additionally, the plants were able to exude the herbicide from their root systems. Another herbicide, metsulfuron, was found to be effective on the weed's terrestrial forms, while a third, dichlobenil, controlled marginal detached plants on the edges of waterways.

Bowmer believes no further study of herbicidal control of alligator weed is necessary, but there is a urgent need for

research into integrated chemical/biological control methods for persistent coastal infestations. She believes there must be a renewed search in South America for new biological control agents for the terrestrial form of the weed. 'But we're not guaranteed of finding one, so chemical control becomes very important', she says.

Bowmer says a first priority would be a concerted effort to eradicate the big infestation at Williamtown, the original source of infestations elsewhere along the coast and inland. There are also several long-established infestations in the Sydney area, on the Georges River, at Liverpool and in Duck Creek, as well as more recent outbreaks at Camden and in the Botany wetlands. These could be eradicated by repeated use of a combination of herbicides. But Bowmer worries there may be other, unidentified patches of alligator weed along the 20 000 km of creeks in the Hawkesbury-Nepean area, many of which could be relatively inaccessible.

'It would be difficult to survey the

entire area, but we are at a crossroads,' Bowmer says. 'We must tackle this weed while we have a chance.'

'While the infestations remain fairly small, they could be controlled with a chemical spraying program. Otherwise we will probably be left with biological control, which currently doesn't touch the weed's terrestrial form.'

'The nature of biological control is that it suppresses the weed, but doesn't eradicate it, so we need to develop integrated methods of weed control.'

But Bowmer foresees problems in organising such an eradication campaign. Small infestations would be the responsibility of local councils, whose staff may not recognise the weed, and would require training in control measures.

'I think we need to put together a "swat" team: people who are familiar with the plant, who have the right equipment and training to carry out spraying, and who are prepared to seek out infestations wherever they occur,' she says.



Kath Bowmer



Kath Bowmer



Kath Bowmer



Kath Bowmer

**Above:** A good time to apply herbicides is after flowering, because the nutrients will be translocated quickly to the plant's roots.

**Left, top and below:** Alligator weed is remarkably persistent. Three weeks after a herbicide application, the plant is scorched. But the underground rhizomes are still intact and a few weeks later, the green leaves come back.

Another South American water weed, water hyacinth (*Eichhornia crassipes*) also infests some of these rivers, most notably the Hawkesbury River near Richmond in Sydney's north-west.

The association between aggressive water weeds and rapidly-expanding suburban regions is not coincidental. Effluent from sewage treatment works along the river normally accounts for at least half the river's flow, a proportion that increases during periods of low rainfall. Slow-flowing, nutrient-enriched waters provide an ideal environment in which alligator weed and other exotic water weeds can flourish.

#### More about alligator weed

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Eberbach PL and Bowmer KH (in press) Conversion of  $C^{14}$ -glyphosate to carbon dioxide by alligator weed. *Journal of Aquatic Plant Management*.

Julien MH Bourne AS Low VHK (1992) Growth of the weed *Alternanthera philoxeroides* (Mart) Griseb. (alligator weed) in aquatic and terrestrial habitats in Australia. *Plant Protection Quarterly*, Vol 7 (3):102-108.

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A concerted effort is needed to eradicate alligator weed at Williamtown, the original source of infestations along the coast and inland. Several long-established infestations exist in the Sydney area, on the Georges River (pictured), at Liverpool and in Duck Creek. There have been recent outbreaks at Camden and in the Botany wetlands.

## Group formed to combat alligator weed

A working group to assess the threat posed by alligator weed, and propose measures for its control, has been convened by the Murray-Darling Basin Commission.

The group, headed by Chris McIntosh of New South Wales Agriculture, includes representatives from CSIRO (Dr Kath Bowmer), the Murray-Darling Basin Commission, the Victorian Department of Conservation and Natural Resources, the NSW Department of Water Resources and the Pest, Animal and Plant Commission of South Australia.

At the working group's first meeting in August 1994, it was decided to:

- Determine the cost of assessing the distribution of alligator weed including surveys of areas likely to be infested.
- Determine what administrative, legal and operational issues might arise due to the potential spread of the weed.

- Investigate the prospects for searching for the weed over a large area of the Murray-Darling Basin, particularly in areas where access is difficult (such as the Macquarie Marshes). Aerial survey and satellite imagery are possibilities.

Once the potential environmental and economic costs of the control of alligator weed are estimated, the group will recommend a management strategy to the commission. A crucial part of the strategy will be increasing the awareness of the public and government agencies to alligator weed.

*The following people can be contacted for further information about alligator weed. Geoff McCorkelle, CSIRO Division of Water Resources, Griffith (069) 60 1500; Chris McIntosh, NSW Agriculture (069) 53 0346; Dr Bob Banens, MDBC (06) 279 0100.*