

WEEDS OF NATIONAL SIGNIFICANCE

ALLIGATOR WEED

(Alternanthera philoxeroides)

Strategic Plan

© Commonwealth of Australia and the National Weeds Strategy Executive Committee, 2000

ISBN 1 876977 00 0

This work is copyright. Apart from any use as permitted under the *Copyright Act 1968*, no part may be reproduced by any process without prior written permission from the National Weeds Strategy Executive Committee. Requests and inquiries concerning reproduction and rights should be addressed to the Project Manager, National Weeds Strategy Executive Committee.

Supporting information about the National Weeds Strategy, Weeds of National Significance and progress to date may be found at www.weeds.org.au where links and downloads provide contact details for all species, their management committees and copies of the strategy.

This strategy was developed under the leadership of the NSW Agriculture with full cooperation of all the States, Territories and Commonwealth of Australia.

Comments and constructive criticism are welcomed as an aid to improving the process and future revisions of this strategy.

Published by: National Weeds Strategy Executive Committee, Launceston

For further information contact:

John R Thorp, Project Manager

For the National Weeds Strategy Executive Committee

16 Flowers Court LAUNCESTON Tas. 7250

Telephone: (03) 6344 9657 Mobile: 0419 323 400 Fax: (03) 6343 1877

Email: jthorp@jta.com.au Web: www.weeds.org.au

Publication date: December 2000

Copies available from:

NSW Agriculture

Locked Bag 21

ORANGE, NSW 2800

Preferred way to cite this publication:

Agriculture & Resource Management Council of Australia & New Zealand, Australian & New Zealand Environment & Conservation Council and Forestry Ministers, (2000) *Weeds of National Significance Alligator Weed (Alternanthera philoxeroides) Strategic Plan*. National Weeds Strategy Executive Committee, Launceston.

Cover design by: Simone Chown and Grant Flockhart, Queensland Department of Natural Resources

The editors have tried to make the information in this product as accurate as possible. However, they do not guarantee that the information is totally accurate or complete. Therefore, you should not rely solely on this information when making a commercial decision.

CONTENTS

EXECUTIVE SUMMARY	1
THE CHALLENGE	2
1 BACKGROUND	3
1.1 The biology of alligator weed	3
1.2 History of spread	3
1.3 Current impacts of alligator weed	4
1.4 Control methods	5
1.5 Socioeconomic factors affecting management.....	6
1.6 Principles underpinning the plan	6
1.7 The process followed.....	7
1.8 Relevance to other strategies	7
1.9 Quarantine and legislative controls.....	7
2 STRATEGIC PLAN.....	9
2.1 Prevent the spread of alligator weed.....	9
2.2 Identify and eradicate non-core infestations.....	10
2.3 Manage Core Infestations.....	12
3 MONITORING AND EVALUATION	14
4 STAKEHOLDER ROLES AND RESPONSIBILITIES.....	15
5 ADDITIONAL READING	17
6 GLOSSARY	18



Figure 1 Dense alligator weed infestation growing in Duck creek, Sydney. (photo by M Julien)

EXECUTIVE SUMMARY

Alligator weed is one of the greatest threats to our rivers, wetlands and irrigation systems in Australia. First detected here in 1946, it has spread to all states, has become endemic in parts of NSW and is currently posing serious threats to QLD and Victoria. The weed's primary habitats are wet lowlands and the banks of fresh water-bodies. From there it extends dense floating mats over the water surface choking waterways and also extends over wetlands and irrigated land. In aquatic habitats alligator weed has deleterious effects on other plant and animal species, water quality, aesthetics, access and use of waterways, vector populations, flow, flooding and sedimentation. In terrestrial habitats it degrades pasture, crop production, irrigation management.

Approximately \$3 million has been spent to successfully control a small infestation in an irrigated system in order to prevent losses estimated at \$250 million. The weed eliminated turf and vegetable production in parts of the Lower Hunter and multi-million dollar turf and vegetable industries are under threat in the Sydney basin.

The weed is extremely difficult to control, is able to reproduce from plant fragments and grows in a wide range of habitats. Current controls have limited application and success. In most cases control programs have not prevented expansion of the larger infestations nor protected areas previously free of the weed. An efficient and effect management program must be implemented otherwise alligator weed will invade all major catchments in Australia and cause serious degradation to conservation areas and increase costs of waterway management. It will invade important agricultural systems particularly irrigation areas and significantly reduce production.

This strategy aims to coordinate the management of alligator weed nationally, by preventing its further spread and protecting high-risk sites. Community education is recognised a key factor for its successful management. Priority for control is targeted

at non-core infestations with the aim of eradication. While core infestations will be managed with the aim of containment and reduction of spread. Further investigations into improving integrated control techniques are required.

The National Alligator Weed Working Group will coordinate ongoing management of the strategy. The group will consist of stakeholders from the states and industry. Meetings will be held annually with reports forwarded to the National Weeds Strategy Executive Committee.

The vision of the strategy is:

To minimise the adverse impacts of alligator weed on Australia

The strategy aims to deliver three key outcomes:

- 1 Prevent further spread of the weed.**
 - Prevent new introductions to Australia
 - Identify and protect high risk sites
 - Educate the community
 - Coordinate actions at all levels.
- 2 Identify and eradicate all non-core infestations.**
 - Identify and record the extent of infestations
 - Eradicate all known infestations outside core infestations within 10 years of detection.
- 3 Manage core infestations to minimise impacts and minimise the threat to other areas.**
 - Develop and implement strategic management plans
 - Continuously improve the management options.

THE CHALLENGE

Alligator weed (*Alternanthera philoxeroides*) is a major weed with potential to become far more widespread and serious in Australia. It grows in a range of habitats from aquatic, semi aquatic to terrestrial. It is nationally significant because it invades waterways, spreads into conservation and agricultural lands causing serious degradation, is difficult to control and areas without alligator weed are under constant threat of invasion.

Alligator weed first arrived in Australia in 1946 at Newcastle harbour, NSW, apparently in ship's ballast from South America. It subsequently spread in NSW, and then to other States. Large infestations occur in the catchments of the Hunter, Georges and Hawkesbury/Nepean Rivers with more recent and very significant invasions into the Murrumbidgee Irrigation Area, northern NSW and south east QLD and Victoria. Recently deliberately spread as a substitute food plant has ensured its occurrence in many hundreds of domestic locations throughout Australia, with recorded spread to natural systems as a consequence. It is estimated that there is a total area of 4,000 hectares of alligator weed in Australia. This current area is small when compared to the potential range of the weed.

The weed spreads downstream by running water and between and within catchments by man. Spread by man is extremely important because it occurs both inadvertently in the course of normal commercial and recreational activities and intentionally as a food and aquarium plant. Its natural resistance to herbicides, ability to reproduce from small stems or root fragments and capability of growing in most environments makes alligator weed extremely difficult to control.

The challenge presented by alligator weed is to develop and implement strategies that lessen the threat of further invasion while reducing the impact of current infestations.

It is vital that the Commonwealth, States, Territories and local governments work together with the community at large to overcome the current rate of spread of alligator weed, find and eradicate small infestations, contain large ones and reduce the threat to many natural and agricultural systems not yet invaded.

Unless an efficient and effective management program can be implemented alligator weed will invade all major catchments in Australia and cause serious loss of biodiversity to conservation areas and increase costs of waterway management. It will invade important agricultural systems particularly irrigation areas and significantly reduce production and increase costs.



Figure 2 - alligator weed in flower

1 BACKGROUND

Alligator weed is a weed of national significance because it invades and forms a thick cover competing with other organisms in both aquatic and terrestrial habitats and in conservation and agricultural systems. It is difficult to control and therefore seriously threatens areas not already invaded. It is capable of growing in most non-desert locations in Australia though it mostly threatens riverine areas, wetlands, seasonally flooded lowlands and irrigated lands.

1.1 The biology of alligator weed

Alligator weed *Alternanthera philoxeroides*, is a summer growing perennial herb. It has small white papery flower heads 8-10 cm in diameter, that appear generally from November to March. Alligator weed does not produce viable seed. The leaves are shiny, spear-shaped, opposite, sessile, entire and about 2-7 cm long and about 1-2 cm wide. One of the main identifying features of alligator weed is that the stems are hollow when mature.

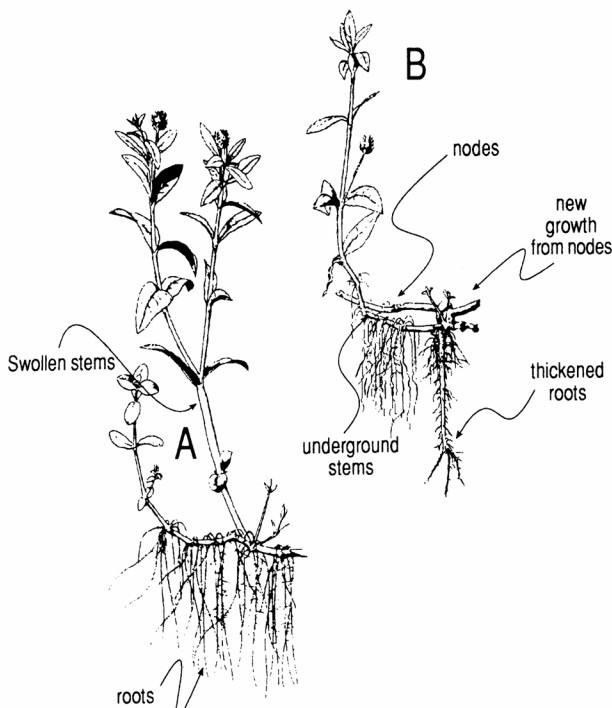


Figure 3 – Aquatic (A) and terrestrial (B) forms of alligator weed (drawing by S.Fiske)

This weed produces masses of creeping and layering stems, up to 10 m long. Over water, roots are adventitious. On land adventitious roots and thickened taproots occur. Over water stems grow to 60 cm high and have large, hollow internodes. On land stems are

shorter and internodes smaller and much less hollow. Frost and ice kill exposed stems and leaves; however, protected stems survive to support the next season's growth. The plant forms dense mats of interwoven stems over water and land. Mats may extend 15 metres over the water surface and become so robust they can support the weight of a man.

Reproduction is asexual with maximum growth in mid-summer. The plant responds to high levels of nutrients and withstands 10 percent sea-strength salinity or up to 30 percent salinity in flowing brackish water.

1.2 History of spread

Alligator weed is a native plant of the Parana River floodplains of northern Argentina and adjacent countries. It was probably introduced into Australia at Carrington (Newcastle docks area) in NSW when ship's ballast was dumped. It was first recorded there in 1946. It then spread to nearby seasonally flooded agricultural and grazing lands of Fullerton Cove, Williamtown and Raymond Terrace areas and has steadily expanded to infest many creeks, lowlands and drainage channels in the lower Hunter. It was found in the Williams and Paterson Rivers in 1993, is invading adjacent land and is estimated to be spreading upstream in the Williams Rivers at 1.5 km per year on recreational craft. It currently infests 2,500 hectares of terrestrial and 500 hectares of aquatic area in the Lower Hunter region. By the mid 1980s it had invaded the Maitland, Cessnock, Lake Macquarie, Gosford, Great Lakes and Wyong Council areas.

It was first recorded in the Sydney basin at Duck creek, Auburn, in 1969 and spread within the Parramatta catchment and throughout the Georges River catchment from the Botany wetlands to above Casula. It was first recorded at Camden in 1981 and has spread to infest 71 km of the Nepean River and tributaries downstream as far as Windsor. It was taken to a pond at Woomargama near Albury in 1967 where it threatened the Murray River catchment. Concerted efforts over 30 years have contained but not eradicated this small bank

infestation. A small floating mat was recently eradicated from Lake Ginnindera, Canberra. In 1994 it was found in Barren Box Swamp, Griffith, and associated irrigation channels and was threatening to spread to adjacent rice fields. Such is the concern that over \$ 3 million dollars have been spent so far attempting to eradicate this infestation. During Christmas 1995 alligator weed was observed in a back yard vegetable garden in Brisbane, grown as a substitute for the herb and vegetable *Alternanthera sessilis*, favoured by Sri Lankans. Investigations during the following years found it in gardens in every state and territory; over 700 in Victoria, 108 in Queensland, over 500 in NSW, less than ten each in South Australia, NT, WA and Tasmania.

Three aquatic infestations have now been found in the Brisbane area, all are being managed with the aim of eradication. A significant infestation was found in December 1998 in Byron Creek, a tributary of the Richmond River, northern NSW where it has spread downstream.

Figure 4 shows the current distribution of naturalised alligator weed, which does not include the urban plantings in Victoria, NSW SA, WA and Tasmania, which are generally under control and persist as a result of cultivation.

This weed spreads naturally as fragments

and float downstream. This is exacerbated during flooding when pieces or mat sections may be deposited on floodplains. The most important spread between catchments in Australia has been through the commercial and recreational activities of people. Examples include: excavation machinery used to clean channels (Newcastle area), boats transported between water-bodies (Lake Ginnindera), deliberate planting (Woomagama) sometimes for sale (Byron Creek, Brisbane), movement of sand dredged from infested catchments (Chipping Norton to Camden), movement of turf from infested farms (Williamstown to Cessnock, Gosford, Sydney), etc.

1.3 Current impacts of alligator weed

Alligator weed disrupts the aquatic environments by blanketing the surface of the water impeding penetration of light, gaseous exchange (sometimes leading to anaerobic conditions) with adverse affects on flora and fauna. Mats impede flow and lodge against structures thereby promoting sedimentation and contributing to flooding. They prevent access to and use of water, promote health problems by providing habitats for mosquitoes and degrade natural aesthetics.

Liverpool City Council spent \$8,000 annually to reduce the visual impact from a bridge and to maintain a section of river available for use by a rowing club. alligator weed has

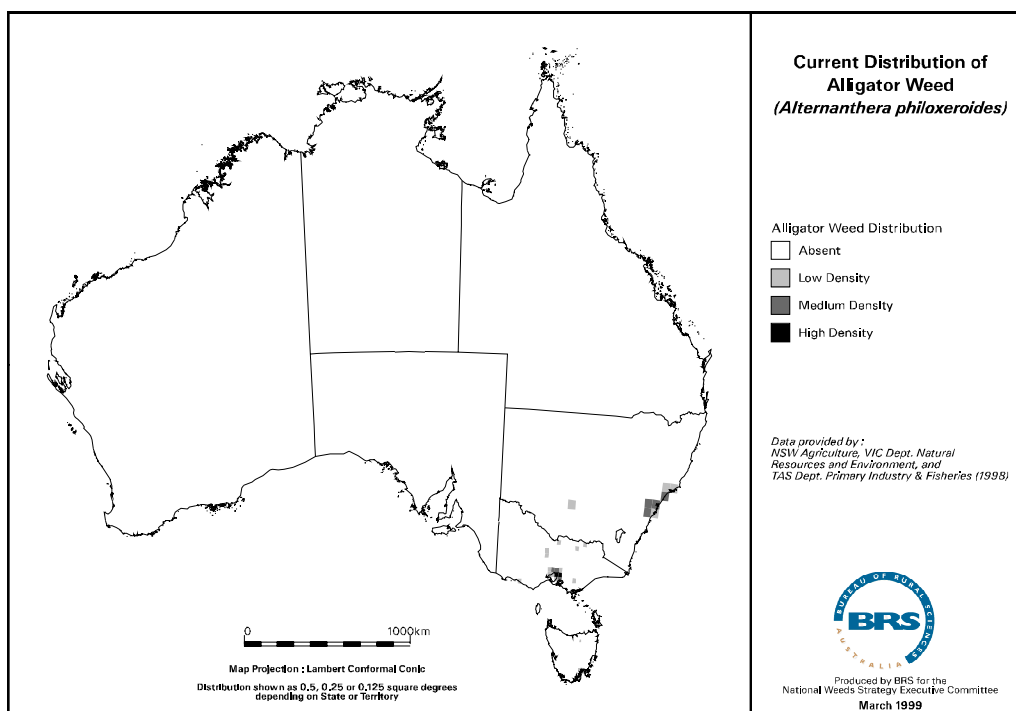


Figure 4 -Current range of alligator weed in Australia as determined for weeds of national significance(Thorp and Lynch)

eliminated small crop and turf farming from parts of the Lower Hunter.

In the USA floating alligator weed caused major impediments to navigation on the Mississippi River. In North Carolina aquatic infestations increased from 376 acres in 1963 to 2,500 acres in 1999 along with a conservative estimate of 10,000 acres of cropping land. It is a major weed of transplanted rice wherever it is grown in the world.

In China it reduces production of rice by 45%, wheat by 36%, corn 19%, sweet potato 63% and lettuce 47%. On average vegetable production is reduced 5-15%. The losses are significant for cotton, soybean, peanuts, etc but have not been calculated. It infests orchards, gardens, tea plantations, mulberry fields, medicinal and herbal crops, etc. It impacts on hydro power production and impedes fishing in China. Fish ponds are abandoned to alligator weed. It has seriously degraded famous scenic spots in China. It is a problem weed in 10 crops in 30 countries, a serious or principal weed in eight of these countries and a major weed in others. As forage in China it contributes to internal parasite infections and ill health in cattle and milking cows. In New Zealand and Australia it causes photosynthesis of the skin in cattle, resulting in cancerous lesions.

When the, Barren Box Swamp infestation in NSW was found in 1994, it was estimated that the potential costs to the irrigation farming community could be as high as \$250 million per year. An annual control program would have cost \$6 to \$8 per mega L of water at the farm gate, an increase of 30% delivery cost. Hence an eradication program of this relatively small infestation was undertaken, costing more than \$3 millions to date and continuing. In the Hawkesbury/Nepean catchment the weed is upstream of and threatens the \$35 million per year turf industry and the \$50 million per year vegetable industry, as well as recreational use and in-stream extraction.

The main issue is that effective, affordable and sustainable control strategies are currently limited. It is difficult and costly to eradicate even small, accessible, terrestrial patches. Better management practices are essential, including an effective early

detection and eradication program, to containing this weed.

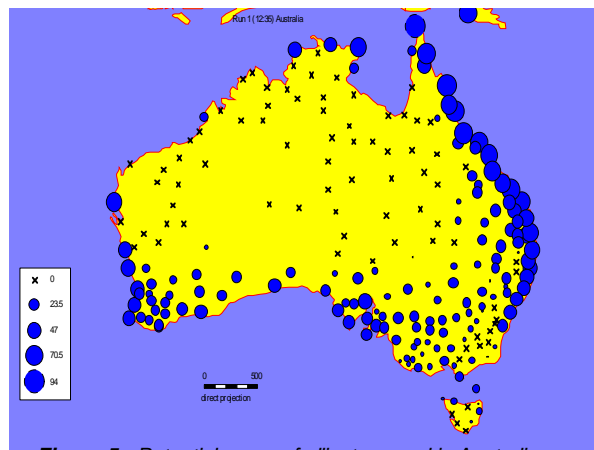


Figure 5 - Potential range of alligator weed in Australia as predicted using the Climex model. (CSIRO entomology)

1.4 Control methods

The three principal means of controlling alligator weed in Australia have been chemical, biological and physical control.

Chemical Control. The weed is resistant to many chemicals and others kill tops but do not affect older stems, rhizomes or roots. Three useful herbicides have been utilised. Glyphosate can kill floating mats but due to poor translocation through the stems, is of little use for terrestrial plants. Dichlobenil is useful for spot treatments where bare patches are acceptable. It is effective on banks and in shallow water except where the substrate is loose, deep or organic. Metsulfuron methyl provides selectivity for grasses and is useful in terrestrial areas but cannot be used where water may be contaminated (unless granted a NRA permit, which has occurred for small scale treatment for new infestations).

Control using herbicides has been generally unsatisfactory due to lack of selectivity, concerns about water contamination, effects of unsuitable substrates, difficulty of access, cost of application and concerns over sections of disintegrating mats floating downstream and taking root. Many attempts to control alligator weed have been tried but few have provided eradication or containment. Chemical control of small infestations may prove possible, but the cost will be so great that it is unlikely to be repeated many times. Case histories for herbicide control, Sainty et al (1998), show

the difficulties and limitation of this method. Chemical eradication of small infestations is currently being attempted in many backyards throughout Australia. It has been suggested that until new compounds are available little progress will be made with herbicidal control.

Biological control. The flea beetle *Agasicles hygrophila* provides good control in aquatic environments in the Sydney region. This is a truly aquatic insect and is limited to warm temperate and sub tropical areas. The predicted range for alligator weed in Australia far exceeds the predicted range for the flea beetle. A moth *Arcola malloi* contributes to control in aquatic habitats and is established but has no impact on terrestrial alligator weed. Further biological control programs are being targeted.

Physical control. The value of physical controls (mechanical or manual) is limited to small and isolated situations and could be particularly useful in removing initial invaders of a catchment if they can be located early enough. Mechanical removal, particularly in waterways, is problematic and may contribute to downstream spread. Disposal of the collected material poses specific problems.

1.5 Socioeconomic factors affecting management

The range of impacts that alligator weed can have effects the community in a number of ways. The effects on agricultural communities include; increased costs, decreased production, an additional difficult problem to deal with and potentially the loss of industries, ie turf. In conservation areas the effects are loss of biodiversity and therefore ecological integrity, yet another difficult problem to manage and increased costs at the expense of other issues.

In waterways and wetland areas the weed limits recreational activities, reduces the aesthetic values, and increases mosquito populations. For the stakeholders involved, ie the rural community, waterway and conservation land managers, recreational managers and users, and the general public (in relation to maintenance of ecological integrity), effective management would have positive outcomes. The down side could be the diversion of government monies and or produce levies to alligator weed rather than

elsewhere.

For other stakeholders alligator weed holds benefits and they may experience a net loss if effective management is practiced. To counteract this and encourage identification of existing Australian household sites, chiefly of Sri Lankan origin, that have grown it and have been offered substitute *Alternanthera* species.

Early detection so that eradication of new infestations is possible and a dramatic reduction in rate of spread will only be achieved with community involvement. Ongoing community awareness, education and involvement will be essential for all stakeholders.

1.6 Principles underpinning the plan

This strategic plan is based on a recognition and acceptance of four strategic principles of the National Weeds Strategy. These are –

- Weed management is an essential and integral part of the sustainable management of natural resources and the environment, and requires an integrated multi disciplinary approach.
- Prevention and early intervention are the most cost-effective techniques that can be deployed against weeds.
- Successful weed management requires a coordinated national approach that involves all levels of government in establishing appropriate legislative, educational and coordination frameworks in partnership with industry, landholders and community.
- The primary responsibility for weed management rests with landholders/land managers however collective action is necessary where the problems transcends the capacity of the individual landholder/land manager to address it adequately.

The success of this plan will largely depend on stakeholders allocating sufficient financial and other resources to ensure its implementation. All states are actively involved in alligator weed management at various levels. This plan provides the framework for collaboration nationally.

1.7 The process followed

The National Alligator Weed strategy was developed after a stakeholder workshop was held in Sydney on the 27th of October 1999. The workshop involved representatives from Queensland, Northern Territory, Western Australia, Victoria and NSW. A draft strategy was distributed for consultation and comment. The strategy takes into account stakeholder feedback from four states.

1.8 Relevance to other strategies

Surveillance and early detection, a key component of the plan, requires direct involvement with Landcare, catchment management and other community based

groups. The wide range of habitats and climates in which the weed can grow has determined that wide consultation and broad involvement is necessary.

Where other plans relate to areas infested or threatened by alligator weed, this plan will link with them. Where similar strategies are required synergism may be advantageous. One avenue for improved control of alligator weed and for another WONS weed, Cabomba, is through biological control. The native ranges of these two weeds in South America, where new agents would be sought, overlap. The strategy is linked to other national and state resource plans as detailed below..

Scale	Natural Resource Management	Pest Management	Weed Species Management
National	National Strategy for the Conservation of Australia's Biological Diversity National Strategy for NRM (under development) National Strategy for Ecological Sustainable development	National Weeds Strategy	Alligator Weed Strategic Plan Cabomba Strategic Plan Salvinia Strategic Plan
State	NSW Rivers and Estuaries Policy NSW Wetland Management Policy	NSW Weeds Strategy QLD Weeds Strategy WA Weeds Strategy NT Weeds Strategy	NSW Alligator Weed Strategic Plan
Regional	Regional Natural Resource Management Plans Regional Vegetation Plans Healthy Rivers Commission Reports	Regional Pest Management Strategies	NSW Regional Alligator Weed Plans North Coast, Lower Hunter, Sydney Basin Plans
Catchment	Catchment Strategies	Hawkesbury/Nepean Aquatic Weed Management Plan	Draft Hawkesbury Nepean Alligator Weed strategy Barren Box Alligator Weed Management Plan
Local	Landcare plans Riparian Vegetation Management Plans	Local Government Pest Management Plans (QLD)	Local Council Alligator Weed Plans
Property	Property Management Plans		

1.9 Quarantine and legislative controls

It is important that new introductions are detected and circumvented by the AQIS to help prevent introduction to currently uninfested areas and to exclude biotypes that may not already be in Australia. AQIS

administers the Quarantine (Plants) Regulations and regulation 20A that provides wide powers for the destruction of noxious plant material. It is an offence under the various State and Territory legislation to possess, propagate or sell alligator weed.

State	Declaration Status of Alligator Weed
Western Australia	Category P1, P2 plant - to be eradicated and prevented from sale, trade or movement.
Tasmania	Prohibited weed – illegal to import, cultivate, sell or move from one place to another within the State.
Northern Territory	Class A Noxious Weed - to be eradicated; Class C - not to be introduced.
Queensland	P1 declared plant, illegal to carry it into the state and sell it. Landowners must destroy it
Victoria	Landowners are required to eradicate and prevent spread
South Australia	Landowners are required to notify the Animal & Plant Control Commission and destroy the weed. It cannot be bought into the state, transported or sold.
New South Wales	W1 Noxious weed, presence must be notified to the authorities and be fully and continuously suppressed and destroyed

Table 1. Status of alligator weed declaration in Australia.

2 STRATEGIC PLAN

VISION

To minimise the adverse impacts of alligator weed on Australia.

2.1 Prevent the spread of alligator weed

Background

Alligator weed only occupies a small area of its potential range in Australia. There is great potential for it to spread. Spread occurs by human activities and natural movement in waterways. The contributing activities and vectors should be identified, and through targeted awareness and education, the rate and risk of spread will be reduced. This process will also help identify areas of particular risk where more intense awareness and surveillance could be required.

Particular attention should be paid to isolated jurisdictions where existing quarantine protocols and predictions limit the movement of plant material, eg Tasmania and WA.

Early detection and control of alligator weed is the key for successful management. Pro-

active inspection and surveillance programs should be encouraged to detect the weed before it establishes. Inspection of potential sites for weed invasion may save many thousand of dollars. There is suspicion that individuals have spread alligator weed for commercial harvesting. The aquarium industry is aware of declared plants and their legislative responsibilities. Ongoing liaison will improve cooperation.

A national management group will be established to assist with the coordination of the strategy at all levels. The National Alligator Weed Working Group (NAWWG) will consist of stakeholders from all relevant states and industries.

Objectives

- 2.1.1 - Prevent new introductions to Australia
- 2.1.2 - Identify and protect high-risk sites, monitor and survey
- 2.1.3 - Identify vectors and reduce dispersal
- 2.1.4 - Educate the community
- 2.1.5 - Coordinate actions at all levels.

Strategy	Actions	Responsibility	Rank
2.1.1 Maintain quarantine prohibition on alligator weed imports	Continue to prevent importations of the plant	AQIS	1
2.1.2 Identify High risk sites	Identify known and potential high-risk sites and assess risk categories for each site.	National coordinator Appropriate state and regional authorities	1
	Include in state and regional catchment plans for mapping and monitoring.	Appropriate state and regional authorities	1

2.1.3 Identify likely vectors	Produce a national checklist of potential vectors Key vectors addressed in state, regional and catchment plans Identify other potential pathways for introductions and spread	National coordinator	1
	To have safe disposal protocols available and applied	State implementation committee NAWWG 1999	1 2
Reduce dispersal	Prohibit the sale and trade, propagation and deliberate dispersal	State agencies	3
	Prevent cultivation Replace with an alternative vegetable Eradicate from home gardens Improve techniques for use in home gardens.	State Authority	2
		State Authority State Authority	1 2
		State Authority State Authority	1 2
Strategy	Actions	Responsibility	Rank
2.1.4 National awareness program	Identify key issues and develop extension programs Identify stakeholders	National committee	2
	State/regional and catchment awareness programs	National committee	1
		Develop programs	State Implementation committees (defined in regional plans)
Specific education programs	Key people trained in identification and importance of the weed	State agencies	1
2.1.5 Form an implementation committee at national level. Each state form an implementation committee	Convene a national committee	NAWWG	1
	Report to NWSEC and stakeholders annually	NAWWG	1
	Convene state committees	State nominees	1

2.2 Identify and eradicate non-core infestations

Background

Knowledge of the distribution of alligator weed is essential to delimit infestation, then classify them as non-core and core areas where containment and control will be focused. Numerous non-core infestations occur in NSW and other states including backyard infestations. Non-core infestations are those that can be significantly reduced or eradicated within 10 years of management.

Public awareness is identified as an important factor in locating and managing infestations. Alligator weed is spread by man, therefore an effective way to prevent further distribution is through education. An informed community will have an

understanding of the importance of catchments, freshwater ecology, the impacts of aquatic weeds as well as the specific problems and nature of alligator weed. Understanding why weeds are able to invade, or what processes promote weed invasions is also important to catchment management. Training programs to increase the communities knowledge in plant botany and identification of aquatic plants will help broaden the base of surveillance.

Objectives

2.2.1 Identify and record the extent of infestations by June 2001

2.2.2 Eradicate all known infestations outside core areas within 10 years of detection.

Strategy	Actions	Responsibility	Rank
2.2.1 Raise public awareness	Conduct education programs (as per goal 2.1.4)	NAWWG, State agencies, Local Control Authorities	1
	Implement staff and community training	State agencies, Local Control Authorities	1
	Conduct targeted campaigns eg ethnic communities	State agencies, Local Control Authorities	1
	Identify areas at high risk of invasion	State agencies	1
	Inspect high risk areas	State agencies, Local Control Authorities	1
	Record and map infestations	State agencies	1
Undertake survey programs	Develop a standardised database	NAWWG, State agencies	1
2.2.2 Destroy infestations	Treat infestations to destroy and prevent propagation of AW	State agencies, Local Control Authorities, Councils	1
	Implement a five year program of audit, inspection and monitoring programs after last observed occurrences	State agencies, Local Control Authorities, Councils	1

2.3 Manage Core Infestations

Background

Current knowledge indicates that the principal core areas in Australia include the catchments of the Parramatta River and Georges River in the Sydney basin, parts of the Hawkesbury/Nepean catchment and the local government areas of Newcastle and Port Stephens in the lower Hunter River catchment in NSW. These are areas where alligator weed at best can be managed but not eradicated. If other infestation meet these criteria they also may be included. Regional and catchment management plans will also determine whether an area is considered a core infestation and managed appropriately. It is vital to the success of the strategy that core areas are well managed and spread is minimised. Core areas provide the main potential for spread into uninfested parts of Australia.

There should be further support provided for biological control programs for alligator weed. Successful management of core

infestations will rely heavily on biological control programs. Further investigations are required into chemical and other controls, as current options are limited. Strategies that integrate all available control techniques to provide best results for particular habitats must be developed.

Management plans should be developed at a regional and local level for each core infestation to involve the relevant stakeholders, to coordinate actions and perform best practices. It is important to foster and encourage community group involvement, particularly in biological control programs, monitoring infestations and detecting new ones.

Objectives

- 2.3.1 Prioritise infestations depending on potential impacts
- 2.3.2 Develop and implement strategic management plans
- 2.3.3 Continuously improve management options.

Strategy	Actions	Responsibility	Rank
2.3.1 Define core areas Consolidate and describe prioritised core infestations	Decide on criteria	NAWWG	1
	Decide data requirements	NAWWG	2
	Collect data	State agencies	2
	Produce information maps	Local Government Regional committees	2
	Define criteria for potential spread potential impacts feasible actions	NAWWG	2
	Apply criteria to core infestations	NAWWG	2
2.3.2 Develop state or regional plans for each core infestation Foster and expand the role of community groups Implement plans	Identify values at risk	State agencies	1
	Involve stakeholders	State agencies	1
	Identify options for management	Regional Weed Advisory Committees	1
	List resource requirements	NAWWG	1
	Work with community groups	State and Local agencies	1
	Identify funding resources	NAWWG	1
	Implement and record activities	State agencies	1
	Monitor and evaluate the programs	Regional committees	1

Strategy	Actions	Responsibility	Rank
2.3.3 Improve catchment management	Reduce nutrient inflows	State agencies	3
	Identify polluters and beneficiaries	State agencies	3
Identify Knowledge gaps	Peak river flows and environmental flows monitored	Catchment Management Groups	3
	Conduct searches worldwide, gather information and identify knowledge gaps in the following areas. Alligator weed biology and ecology Impacts on agriculture (cropping and grazing) Impacts on environmental	NAWWG CSIRO, CRC*, State agencies	1
	Management options, cause/effects	CSIRO, CRC*, State agencies	1
	Develop techniques for improved herbicide control	CSIRO, CRC*, State agencies	1
	Develop biological control	CSIRO, CRC*, State agencies	1
	Develop integrated management strategies Ensure integrated strategies link with other weed management plans when applicable	CSIRO, CRC*, State agencies	1
	Research investigations	Integrate improvement into the management strategies	State agencies Water & Irrigation Auth.
Review options and build efficiencies	Support and implement new initiatives	CSIRO CSIRO, State agencies	1 1
		Water & Irrigation Auth. NAWWG	1
		State agencies	2
		RWAC , Local Government	1

* CRCWM will also be able to contribute if it is renewed in 2001

3 MONITORING AND EVALUATION

This strategy is subject to 5 year cycle of review. The National Alligator Weed Working Group, as a component of its meetings will monitor the implementation of the plan. Annual reports will be forwarded to the NWSEC and made available to relevant stakeholders.

Monitoring and evaluation is essential to the continued development of the strategy to gain efficiencies and to obtain best results. It may require up to 3% of the control budget. Evaluation would include assessing changes in distribution of the weed (current versus potential), determining efficacy of the various control techniques and their integration, determining changes in rate of spread, frequency of locating new infestations, and assessments of the costs and benefits of the strategies.

Performance indicators

The performance indicators that would be used in relation to alligator weed control include -

- No new importations of alligator weed in to Australia
- Increased awareness of alligator weed by the community and reduced use as a vegetable
- Increased reporting rate of new infestations
- Improved understanding of the social, economic and biodiversity impacts of the weed
- Improved understanding of biology and ecology of the weed
- Better treatment packages for eradication of small infestations
- Improved biological control
- Reduced rate of spread
- Decline in the number of small infestations in non core areas
- Effective collaboration between government agencies
- Collaboration and co-operation with community resulting in better education, surveillance and control
- Increased resources to develop the national strategy.

4 STAKEHOLDER ROLES AND RESPONSIBILITIES

Private Landholders

Prevent the introduction of alligator weed onto their lands:

- Be aware of the potential of alligator weed to be introduced onto property ;
- Alert government if alligator weed is found;

Manage infestations on their own land/water:

- Eradicate infestations where feasible;
- Maintain control pressure on other infestations to reduce the potential spread.

Recreational groups

- Ensure members are aware of alligator weed and can identify it;
- Educate members on quarantine and weed hygiene protocols;
- Not to undertake recreational activities or actions that will spread alligator weed;
- Practice weed hygiene on recreational equipment (boats, nets etc);
- Help monitor water bodies and report infestations of alligator weed.

Aquarium industry

- Ensure the pet industry continues to improve its responsibility for weed management;
- Create awareness amongst their members of the legislation on alligator weed.

Conservation groups

- Improve identification skills of members;
- Promote awareness of alligator weed impacts on freshwater ecosystems;
- Report infestations.

Landcare Catchment Management Groups

- Monitor the catchment for alligator weed and report any findings;
- Identify and reduce contributions to nutrient loading from septic systems, livestock, garden run-off and urban development etc;
- Develop and employ hygiene protocols for local infestations and 'clean' water bodies;

- Ensure catchment management plans incorporate alligator weed management;
- Seek funding for management programs.

Water and Irrigation Authorities (Regional Water boards & Authorities, RIRDC)

- Contribute funds to research improved integrated control techniques.

Local and State Government

- Continue to develop efficient, effective and appropriate control techniques;
- Provide extension and education services to urban and industry stakeholders;
- Support enforcement of legislation and control measures;
- Ensure that alligator weed is identified in local, regional and State level pest management plans;
- Liaise with landholder, community and industry interest groups to coordinate management and control;
- Research and develop best practice management;
- Monitor water pollution;
- Undertake pro-active inspection programs;
- Promote reporting of alligator weed infestations.

Federal government departments and corporations

- Ensure quarantine controls on entry of alligator weed (AQIS);
- Ensure uptake by Departmental staff to restrict movement of weeds (agencies that manage land and travel on non-government land);
- Ensure alligator weed control is undertaken on all federally managed lands (Defence, Environment Australia and other Commonwealth departments/corporations that manage land);
- Oversee and manage federal funds including Natural Heritage Trust and National Weed Program (Environment Australia, Agriculture, Forestry and Fisheries – Australia).

5 ADDITIONAL READING

Gunasekera, L. and Rajapakse, H. 1998. Alligator weed – a potential ecological disaster lurking in Australian backyards. Proceedings of the 10th EWRS Symposium on Aquatic Weeds, Lisbon, September 1998, pp 261-264.

Julien, M.H. 1995. *Alternanthera philoxeroides* (Mart.) Griseb. In: Eds R.H. Groves, R.C.H. Shepherd and R.G. Richardson, *The Biology of Australian Weeds*, Volume 1, pp 1-12.

Julien, H.H. and Stanley, J.N. 1999. The management of alligator weed, a challenge for the new millenium. Proceedings of the 10th Biennial Noxious Weeds Conference, Ballina July 20-22 1999, pp 2-13.

Sainty, G., McCorkelle, G. and Julien, M.H. 1998. Control AND Spread of alligator weed, *Alternanthera philoxeroides*, in Australia: lessons for other regions. *Wetlands Ecology Management*, 5: 195-201.

Thorp, J R, & Lynch, R 2000 The Determination of Weeds of National Significance. National Weeds Strategy Executive Committee, Launceston.

Acknowledgements

The National Alligator Weed Strategic Plan was collated by Clyde Alchin and Rod Ensbey from NSW Agriculture and Mic Julien from CSIRO, Brisbane.

6 GLOSSARY

AQIS	Australian Quarantine Inspection Service
AW	Alligator Weed
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CRC	Cooperative Research Centre for Weed Management Systems
NAWWG	National Alligator Weed Working Group
NRA	National Registration Authority
NWSEC	National Weeds Strategy Executive Committee
RIRDC	Rural Industries Research & Development Corporation
RWAC	Regional Weed Advisory Committees in NSW
WONS	Weeds of National Significance