WEEDS OF NATIONAL SIGNIFICANCE

PARTHENIUM WEED

(*Parthenium hysterophorus*)

Strategic Plan

ISBN 1 876977 13 2

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 Dept of Natural Resources, Queensland 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: September 2000

Copies available from:
Dept of Natural Resources, Qld
Land Protection
Locked Bag 40
COORPAROO DC QLD 4151

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 Parthenium weed (Parthenium hysterophorus) Strategic Plan.* National Weeds Strategy Executive Committee, Launceston.

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

CONTENTS

EXECUTIVE SUMMARY

Parthenium weed (*Parthenium hysterophorus*) is a major pest plant in Queensland with the potential to spread to all medium rainfall rangelands and summer cropping areas. It is an annual herb that aggressively colonises disturbed sites. It has major impacts on pasture and cropping industries, with estimated losses of $16 million per year for Queensland pastoralists. Infestations of parthenium weed also degrade natural ecosystems. The plant can produce serious allergenic reactions in humans.

Parthenium weed poses a potential risk to most grazing and cropping areas in eastern and northern Australia. Currently, large infestations are found in central Queensland, with serious outbreaks in the south and west of the State, and there are sporadic occurrences in northern and central New South Wales.

This strategy has been prepared in response to growing community concern regarding the spread of parthenium weed, both within Queensland and interstate and the effects of parthenium weed in production areas, on the environment and on human health. It follows from a Queensland parthenium weed workshop in 1999 and incorporates actions from the state containment strategy. Major challenges are to raise awareness of parthenium weed; to stop the spread of weed seed via vehicles, produce and livestock; to further improve integrated control and establish economically feasible management practices; and to coordinate nationwide management of parthenium weed.

The vision of the strategy is that:

Parthenium weed is confined to core infested areas in Queensland and its social, economic and environmental impacts are reduced to a minimum.

The strategy aims to deliver four desired outcomes:

1 Parthenium weed is prevented from spreading to and impacting on new areas.

- Protocols are established to reduce the movement and spread of parthenium weed
- Infestations are detected and recorded through a surveying and mapping program
- New and existing infestations are eradicated outside core infestation areas
- Enforcement is used as a management tool

2 The community is aware of parthenium weed and provided with quality information and skills to assist in its detection and reduction.

- Raise the community's ability to recognise parthenium weed, know of its impacts and have the skills required for its management
- Increase stakeholders' commitment to parthenium weed management

3 The impacts of established parthenium weed infestations are reduced.

- Best practice parthenium weed management is developed and adopted by all sectors
- The resources required for parthenium weed management are assessed

4 Parthenium weed management is co-ordinated at a national level.

- Manage implementation of the strategy
- Monitor implementation of strategy
- Coordinate communication about the strategy

The extent to which these outcomes are met will be evaluated as part of a five-year cycle of review and will determine the success of this strategy.

THE CHALLENGE

Parthenium weed (*Parthenium hysterophorus)* was first introduced to Queensland only forty-five years ago. In a short period it advanced from isolated outbreaks to establish core infestations across the central highlands of Queensland into New South Wales and the Northern Territory. It has the potential to increase in extent and density in northern and eastern Australia. The plant reaches maturity rapidly and produces large quantities of seed that are easily transported by vehicles, machinery, animals, fodder, pasture seed, stock feed and water.

Parthenium weed causes an estimated loss of $16 million per year for Queensland pastoralists due to reduced production and increases in management costs. It also affects cropping systems to the tune of $6 million per year and significant costs are expended on roadside controls. The environmental and social costs of parthenium weed have not been well quantified, however, in Queensland it has been shown to impact significantly on the biodiversity of the Einasleigh Uplands bioregion and the central highlands. An important issue is that frequent contact with the plant or its pollen can produce serious allergic reactions: dermatitis, hay fever and asthma. It has been suggested that some landholders do not treat parthenium weed for fear of allergic reactions.

While the greatest impacts to date have been on land used for animal grazing, parthenium weed has the potential to become a major weed of cropping areas, as occurs overseas. To prevent this from happening, it is imperative to contain parthenium weed within its current distribution, to eradicate it where possible, and to raise awareness and commitment in cropping industries.

Progress has been made on the control of parthenium weed. It can be managed with a combination of methods depending on the site, including biological control agents, pasture management, cultivation and chemicals. Nationally, the emphasis must be on establishing detection/monitoring procedures and stopping the spread of parthenium weed via vehicles and as a contaminant from Queensland. In Queensland, the challenge is to further improve integrated control including the impact of biocontrol agents and economically feasible management practices that complement biocontrol to reduce the impact of this weed. Management practices aimed at preventing further spread will be to no avail unless the opportunities for establishment of new infestations in clean areas are radically reduced. Unless effective and efficient management is implemented and maintained, parthenium weed will continue to impact adversely on agriculture, human health and the environment.

Implementation of the National Parthenium Weed Strategy will contain the spread of parthenium weed in Australia and minimise the impact of established infestations.

A dense parthenium weed infestation

1 BACKGROUND

Parthenium weed is a weed of national significance (WONS) as it is an annual herb that aggressively colonises disturbed sites. It currently infests over 8 million hectares of central Queensland but has the potential to infest all medium rainfall rangelands and summer cropping areas across Australia.

A member of the Asteraceae family, parthenium weed is the only member of the genus brought into Australia. Parthenium weed can be confused, however, with a number of other introduced weeds from the family including: seedlings of cobbler's pegs (*Bidens subalternans*); flowers of bishop's weed (*Ammi majus*) and hemlock (*Conium maculatum*); and the ragweeds (*Ambrosia* spp.).

Parthenium weed plant

1.1 The biology of parthenium weed

Parthenium weed, *Parthenium hysterophorus*, is also known by a large number of other common names including false ragweed, star weed, carrot weed and bastard feverfew depending on the country infested. It is an annual or short-lived ephemeral herb, growing to two metres. Parthenium weed is an aggressive coloniser of areas of poor ground cover and exposed soil such as fallow wastelands, roadsides and overgrazed pastures. It does not usually become established in undisturbed vegetation or in vigorous pastures, and there is a marked inverse relationship between existing plant cover and weed density.

Several aspects of the ecology of parthenium weed contribute to its aggressiveness. These include the size and persistence of the soil seed bank, longevity of seed when buried, fast germination rate, and the innate dormancy mechanism of seed, which makes it well adapted to semi-arid environments and increases the chances of seed burial. In addition, parthenium weed releases allelopathic chemicals that inhibit the germination and growth of pasture grasses, legumes, cereals, vegetables, other weeds, and even trees.

Parthenium weed flower

As parthenium weed does not reproduce vegetatively from plant parts, the only method of reproduction and spread is by seed (Figure 1). Seed spread by wind is limited. Movement in sheet water flow is important as indicated by large colonies along waterways and on drainage floodplains. Most long-distance dispersal of seed is by vehicles and farm machinery, as evidenced by the major spread of parthenium along roads. A period of drought followed by rain provides ideal conditions for spread. Drought reduces pasture cover (competition) and increased movement of stock and stock fodder also aids the spread of seed. In particular, flooding after drought is advantageous to the weed, as flood is a dispersal mechanism for parthenium seed.

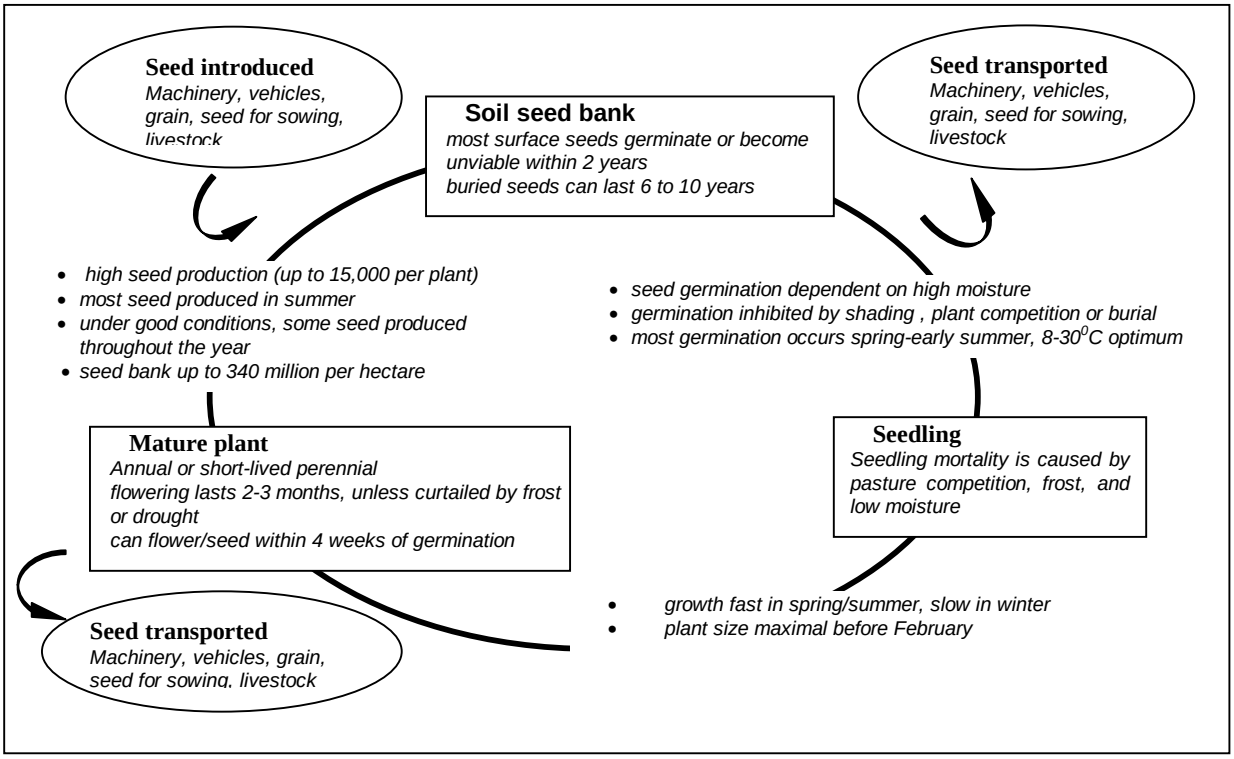

Figure 1. *The life cycle of parthenium weed*

In summer, plants can flower and set seed four weeks after germination because they are stressed and small. Buried seeds have been found to last much longer than seed on the soil surface. Timing of chemical control is critical so that parthenium weed is removed when plants are small and have not produced seed, and when grasses are actively growing and seeding to recolonise the infested area (eg in early summer). Studies suggest that after six years, 50% of seed buried 5cm below the surface are still viable. However, unlike other weed species, there is no critical point where intervention is required, as parthenium weed can produce flowers and seed at any time of the year under favourable conditions.

1.2 History of spread

Parthenium weed is native to the sub-tropical areas of South and North America. It has been introduced to many countries in Africa, Asia and the Pacific and has become a major weed in India and Australia. The first occurrence of parthenium weed in Australia was reported at Toogoolawah near Esk in southern Queensland 1955. It is believed American aircraft landing at a local airstrip transported it. In 1964, another introduction of parthenium weed, apparently in contaminated pasture seed, occurred near Clermont in central Queensland. Largely unrecognised and untreated, parthenium weed flourished under good growing seasons with seed subsequently spread by vehicles, machinery, animals, fodder, pasture seed, stock feed and water. Expansion of the parthenium weed infestation was most apparent along the State's road systems and in areas cleared during the land-clearing program called the “Brigalow Scheme”.

The current distribution of parthenium weed in Queensland is plotted in Figure 2. The core area of infestation in central Queensland has been estimated at 8.2 million hectares. Scattered infestations occur from Cook shire in the north to Longreach in the west and south to the border river towns of Mungindi and Goondiwindi. Infestations of parthenium weed have been found in northern and central New South Wales since 1982, particularly in Moree Plains Shire. Roadside infestations have occurred along a number of roads leading out of Queensland, as far south as Jerilderie and Deniliquin near the Victorian border. Nevertheless, the extent of parthenium weed in NSW has been significantly reduced in recent years. All roadside infestations have been suppressed and all infestations on private land are under active control. In the Northern Territory, parthenium weed has been eradicated from previous infestations on the Roper River, at Katherine, and in the Gulf of Carpentaria. No

regrowth has been observed for several years. The species is occasionally recorded in WA.

The potential distribution of parthenium weed in Australia was modelled using CLIMEX. Parthenium weed is best suited to areas with a summer rainfall greater than 500 mm/annum and could potentially grow in all States of Australia (Figure 3). It has the potential to become a serious weed of medium rainfall rangelands and summer cropping areas. It is unlikely to become a major weed in winter-rainfall areas as seedling growth is reduced when night temperatures fall below 5°C, although established plants are able to withstand at least one light frost (-2°C). Parthenium weed grows on a wide range of soil types from sand to heavy clays, it favours the latter but growth is reduced on acid soils.

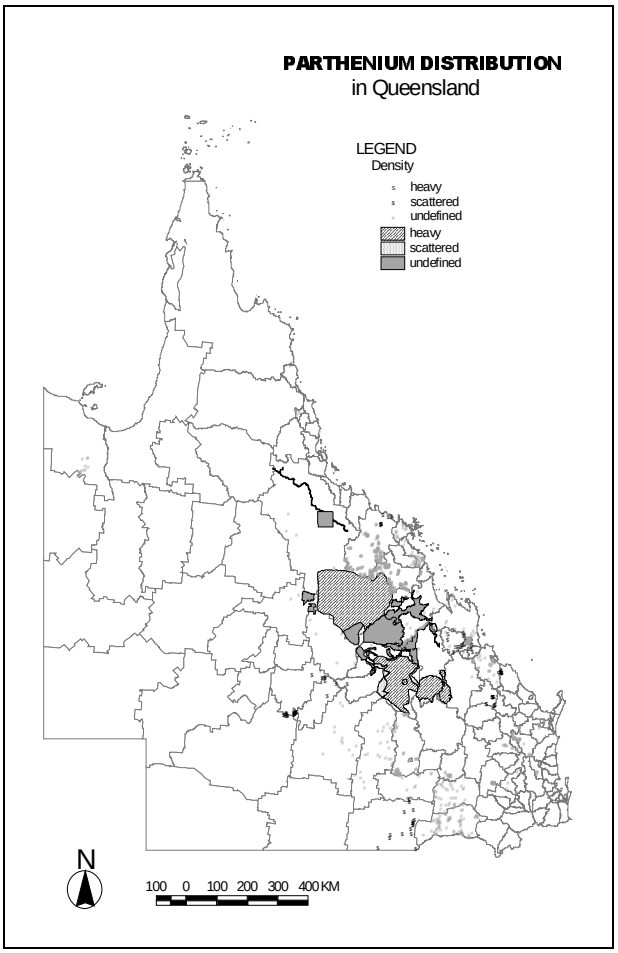

Figure 2. *Current distribution of parthenium weed in Queensland.*

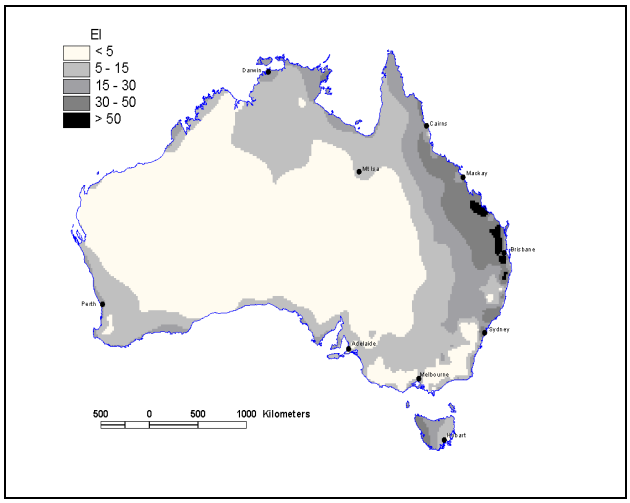

Figure 3. *Potential distribution of parthenium weed.*
(Data is splined from a CLIMEX climate prediction. EI=Ecoclimatic Index: EI<5 potential for permanent population low, EI>50 potential very high).

1.3 A weed of national significance

Parthenium weed currently impacts on a range of land uses as summarised below.

Primary production:

- Reduced pasture production by excluding beneficial forage plants, resulting in a non-nutritious monoculture; estimated cost $16 milion per year (1992)
- Meat from livestock that eat the weed is badly tainted and unfit for the table
- Toxic to cattle, may cause death after 30 days if significant amounts consumed
- $1.8 million is spent annually by producers/government on the chemical control in central Queensland
- Increased costs in cropping both in-crop control and headland management
- Property devaluation
- Allelopathic exudates effect plants
- Depreciation of the value of livestock, pasture seed, grain and hay through contamination
- Reduce marketing options.

Health:

- Frequent contact with the plant or pollen can produce serious allergic reactions such as dermatitis, hay fever and asthma
- In one study, 10% of workers on parthenium infested properties developed visible skin allergies to parthenium weed

- It has been suggested that some landholders do not treat parthenium weed for fear of allergic reactions, while others have had to leave parthenium-infested production areas due to impacts on their health.

Environmental:

- It is present in 23 reserves and two listed wetlands in Queensland
- This weed and rubber vine are considered to be the two weeds of greatest threat to biodiversity in the Einasleigh Uplands bioregion (Sattler and Williams, 1999)
- It is described as a significant threat to the native grasslands of the central highlands of Queensland (Fensham 1999)
- Disturbances, such as floods, can kill native vegetation and allow parthenium weed to establish in otherwise undisturbed native vegetation sites in native-grasses and open woodland communities.

Beneficial use:

- Can be used for biogas production and green manure
- Extracts have been used or trialed as a flea-repellent and a herbicide
- A tea/poultice is used in the Caribbean and Central America, where the population has been somewhat desensitised to allergic effects of parthenium weed
- These uses are generally not feasible in Australia because of the comparatively high cost of labour and low population density, and susceptibility of the population to allergic reactions.

1.4 Legislative controls

Parthenium weed is declared in most States and Territories, except the Australian Capital Territory and Western Australia where it is declared north of 26^{o}S latitude.

The Australian Quarantine and Inspection Service prohibit the introduction of parthenium weed as nursery stock or seed into Australia. Cleaning is required when goods or vehicles are found contaminated with the species.

1.5 Control to date

Parthenium weed management operations have been ongoing since the 1970's. Measures undertaken to prevent, contain and eradicate parthenium infestations include: awareness raising activities by local governments, industry, community and State government; provision of vehicle washdown facilities (over $300,000 over 3 years costs shared by QDNR and local governments); provision of free herbicides to landholders and local governments ($120,000 in 1998/99); roadside spraying programs; and distribution of biological control agents. These actions have reduced the rate of spread of this species, especially along transport corridors. The successful control of known infestations is indicated by a reduction in the area infested by parthenium weed, even though the number of new infestations is increasing. However, this also suggests that prevention measures are currently not adequate or not effective enough to prevent new infestations.

Pasture Management

Control of parthenium weed infestations in pasture should revolve around pasture management and timely herbicide treatment. Maintenance of correct stock numbers maintains the vigour of pastures, thereby preventing establishment and helping to smother existing plants. It is the most useful method of controlling large-scale parthenium weed infestations and preventing new infestations in clean areas. Ploughing-in of parthenium weed before plants reach flowering stage, followed by establishment with pasture species may be effective.

Parthenium weed is generally not a problem in competitive crops. It is normally ploughed in before crops are planted, although heavy infestations may need to be reworked. It can be treated with pre-emergent herbicides, but some wheat and sorghum crops may require a later herbicide application. Cropping industries incur $6 million in control costs per year made up of additional herbicides and cultivation due to parthenium weed. The extra harvesting costs associated with restrictions on header movements are not included in these costs.

Use of herbicides for control is generally restricted to roadsides and new infestations due the widespread nature of the weed, cost of chemicals and concerns about chemical residues.

Biocontrol

The Queensland government has spent nearly $9 million to date on the biocontrol program (1977 – 1999). Research and release of agents is ongoing and the levels of control achieved are encouraging. An economic analysis of the insect biocontrol program resulted in a calculated benefit-cost ratio of 2.09. Two recent rust releases may provide additional reductions in impact. The summer rust research project received significant funds from the Meat and Livestock Australia ($450,000). Assessment of the impact of the pathogens on weed density is required.

The Parthenium Action Group Inc. (PAG) is a community group formed in the Queensland central highlands. It is base funded by Natural Heritage Trust ($300,000) to promote Best Practice in the Fitzroy Basin Grazing Lands.

The New South Wales government spends approximately $100,000 per annum to eradicate isolated infestations and prevent the establishment of parthenium weed in the State. The single largest expense is the border inspectors whose main job is to inspect for cattle ticks; the extra time and training required to also inspect for parthenium weed are estimated at $40,000 per annum. A sum of $43,400 is allocated for the 1999/2000 financial from the Noxious Weeds Grant for parthenium weed control works and inspection of roads and properties. Local governments match this amount.

At the beginning of each wet season, the Northern Territory government monitors sites of previous parthenium weed infestations for regrowth. No regrowth has been found for 3 to 4 years.

1.6 Socio-economic factors affecting management

Efficient and effective management of parthenium weed requires the support and cooperation of many stakeholders. This strategy identifies incentives and disincentives to carrying out management. For example, common law actions are an incentive for landholders and producers to control parthenium weed, so as not to be held responsible for spread.

Parthenium weed is affecting landholders' livelihoods through reduced sale prices for produce and livestock, retraction of markets, property devaluation and health impacts. Unlike other weeds that have some economic benefit (eg prickly acacia, hymenachne), management of parthenium weed is made easier by the fact that there are currently no benefits to keeping the plant and significant benefits to be gained by eradicating it. The benefits are obvious and immediate.

Allergic Reactions

A significant challenge is to overcome landholders' fear of allergic reactions from parthenium weed. Research to date has shown conflicting results, therefore, it is important to conduct further research and convey the results to those in contact with parthenium weed. Other measures include reducing the risk by wearing protective clothing, control methods that minimise contact and desensitising injections.

The costs of control are significant and funds must continue in order to guarantee effective national management. In New South Wales, one landholder spent $105,000 over four years on control of a small infestation. Grain harvesters estimate that one clean down of their machinery costs about $2000, mostly due to the time required (1.5 days). Other high-risk vehicles are not currently treated in the same way; adoption of property hygiene protocols may reduce the burden on these grain contractors.

1.7 Principles underlying the plan

This strategy is based on the recognition and acceptance of four principles outlined by the National Weeds Strategy:

1. Weed management is an essential and integral part of the sustainable management of natural resources and the environment, and requires an integrated, multidisciplinary approach.

2. Prevention and early intervention are the most cost-effective techniques that can be employed against weeds.
3. 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 the community.
4. The primary responsibility for weed management rests with landholders/land managers but collective action is necessary where the problem transcends the capacity of the individual landholder/land manager to address it adequately.

1.8 Process Followed

The National Parthenium Weed Strategy is based largely on the *Queensland Parthenium Strategy 1999-2004*. This strategy was developed to incorporate the outcomes of several stakeholder workshops, the most recent held in Roma, March 1999. This workshop included 50 attendees with representatives from New South Wales and Northern Territory governments and industry.

This strategy takes in account feedback from over thirty stakeholders who commented on drafts as well as input from the management group and interested parties.

The Queensland Parthenium Weed Management Group (PWMG) was established subsequent to the workshop. Its membership consists of a wide group of representatives (Appendix 1). The group's mission is to coordinate awareness and management of parthenium weed and it will oversee the implementation of the state and national strategies. This group will be expanded to create a national management group after the endorsement of the national strategy.

1.9 Relevance to other strategies

The Parthenium weed strategy has been established to address the threat of parthenium weed across Australia. The strategy is linked to other national and state resource plans, strategies and groups already involved in parthenium weed management.

Scope Scale	Natural Resource Management	Pest Management	Weed Species Management
National	National Strategy for Conservation of Australia's Biological Diversity National Strategy for Ecological Sustainable Development	National Weeds Strategy	Parthenium Weed - WONS Strategy
State	Queensland Biodiversity and Natural Resource Management Strategy Forest, River, Estuary and Wetland policies	Queensland Weed Strategy Northern Territory Weed Management Strategy New South Wales Weeds Strategy	Queensland Parthenium weed Strategy 1999-2004 NSW Parthenium weed State Management plan
Regional	Regional NRM Plans	Regional Pest Management Strategies	Parthenium APEC Strategy for Southern Queensland
Catchment	Catchment Management Strategies	ICM Pest Management Strategies	
Local	Landcare and Roadside Conservation Plans Road, rail and utility corridor management plans	Local Government Pest Management Plans (Queensland)	
Property	Property Management Plans	Property Pest Management Plans	

2 STRATEGIC PLAN

VISION
Parthenium weed is confined to core infested areas in Queensland and its social, economic and environmental impacts are reduced to a minimum.

2.1 Prevent spread

Desired outcome

Parthenium weed is prevented from spreading to and impacting on new areas.

Background

There is a high risk of intra and interstate spread of parthenium weed by the movement of vehicles, machinery, livestock, grain and other produce, and seed for sowing. Spread can be minimised by the adoption of vendor declarations, stating that efforts have been taken to ensure that vehicles, produce and livestock contained are free from parthenium weed seed, and adoption of inspection and washdown procedures. These actions may decrease the current controls by both New South Wales and the Northern Territory governments who expect machinery from Queensland to be cleaned when leaving parthenium-infested areas. To prevent further spread in Queensland similar action is required in the state. There are eleven washdown facilities in Queensland and contractors from Queensland are required to undertake extensive cleaning of harvesters and other equipment before leaving the state. New South Wales operates four border washdown sites. Border inspectors are trained in inspection procedures for vehicles and machinery and non-staffed border crossings are patrolled during harvest. Interstate and international markets for produce and livestock from Queensland may be affected by concern over parthenium weed. For example, some countries that regulate grain importation from Australia (Malaysia, Indonesia, India, New Zealand, Vanuatu, Brunei, Eritrea and Kenya) require certification that produce is free of parthenium weed seed.

The best quarantine controls cannot reduce the risk of parthenium weed introduction to zero. It is important that actions are taken to ensure on-property hygiene and early detection of new infestations. Information on the distribution of parthenium weed, including where control works have been completed, is critical to support planning and decision-making. The degree of detail required varies with the scale/purpose of the planning e.g. planning for eradication of scattered plants requires knowledge to single plants.

Parthenium weed can be spread unintentionally through flooding and native animal dispersal. Even machinery and livestock that have been cleaned may carry a small amount of seed. Land managers need to be particularly vigilant in monitoring areas close to parthenium infestations and be pro-active in the adoption of best practice management techniques to minimise incursion of parthenium weed into clean areas. It is much cheaper and more efficient to remove small infestations than to wait until parthenium weed begins to have significant impacts.

Containment

Containment programs incorporating roadside spraying and supply of free herbicides to local government have been successful in reducing the impacts and rate of spread of parthenium weed. An aim of the strategy should be that overtime the border inspection line for grain harvesters and other controls should move from the New South Wales/Queensland border to a line further north. Other containment lines may be developed in other areas as well.

Distribution

Parthenium weed is widespread in Queensland. Over 100 small infestations have been identified outside the core area in central Queensland. Eradication of isolated infestations can be achieved by early detection and monitoring procedures. Once weed outbreaks are detected, timely coordinated action and the ability to enforce control requires declaration of parthenium weed throughout all states and territories. In particular, parthenium weed should be declared south of latitude 26^0 in Western Australia, as computer modelling predicts this area to be highly suitable for growth. Declaration of parthenium weed imparts the

responsibility on landholders/land managers to control the weed. New South Wales legislation gives government the power to require inspection and cleaning of vehicles that should decrease the rate of spread. Enforcement should however be used as a last resort. The primary emphasis of the strategy is to encourage landholders through involvement in weed management to have ownership of the issues and consequent outcomes and to coordinate collective action where the problem transcends the capacity of the individual.

Strategy	Actions	Responsibility	Rank
2.1.1 Protocols are established to reduce the movement and spread of parthenium weed	Minimise the spread of parthenium: • Maintain washdown and inspection facilities/procedures • Encourage purchasers to be aware of the source of livestock, produce, seeds for sowing, and equipment	State and Territory agencies, industry	1
	Prevent weed seed spread by high risk vectors: • Encourage adoption of a voluntary vendor declaration to complement controls on grain harvesters in New South Wales • Advise public of hygiene protocols and publicise location of washdown facilities • Implement a system where competent commercial or government authorised inspectors certify that machinery is clean	Industry, State and Territory agencies Government agencies, PCG	1
	Encourage development and adoption of "codes of practice" by producers and agribusiness interests to reduce weed seed contamination and ensure interstate recognition of the standards set	Industry groups, State agencies	1
2.1.2 Infestations are detected and recorded through a surveying and mapping program	Establish procedures for early detection of parthenium weed: • Encourage landholders and other members of the community to report sightings of parthenium weed • Inspect major roads/highways during growing season	LG, State and Territory agencies, landholders	1
	Establish procedures for receiving and responding to reports of infestations – rapid response capability	LG, State and Territory agencies	2
	Maintain detailed records and reports on all outbreaks - maintain a parthenium weed database	LG, State and Territory agencies	3
2.1.3 New and existing infestations are eradicated outside core infestation areas	Develop a system to define the core infestation areas and catalogue along with small or isolated outbreaks outside the core	QDNR, LG, PWMG	1
	Eradicate parthenium weed from small or isolated outbreaks	All stakeholders	1
	Establish a monitoring system for controlled outbreaks • Regularly reinspect outbreaks on private property • Ensure follow-up control treatments	LG, State and Territory agencies, Landholders	2
2.1.4 Enforcement is used as a management tool	Ensure that parthenium weed is declared under relevant legislation throughout all States and Territories (viz. Western Australia and the Australian Capital Territory)	State and Territory agencies	1
	Increase landholder/land manager awareness of responsibility under relevant legislation	Regulatory agencies (government)	1
	Provide training to authorised officers on procedures and guidelines for inspection of properties, machinery and enforcement of legislation	State and Territory agencies	1
	Ensure that the power to inspect and require cleaning of vehicles is available and used by authorised officers	Regulatory agencies	2
	Enforce relevant legislation where appropriate	Regulatory agencies	2

2.2 Awareness and commitment

Desired outcome

The community is aware of parthenium weed and provided with quality information and skills to assist in its detection and reduction.

Background

Coordinated regional, statewide and nationwide awareness campaigns are essential so that the whole community is aware of the significance of parthenium weed. Many groups need to be skilled in its identification, including weed officers in all states and territories. Anyone travelling through infested areas in Queensland may be responsible for spreading seed back to their state of origin. Although strategic washdown and airblast facilities are in place in Queensland there is a need to raise public awareness of hygiene protocols, especially tourists and others that drive through infested areas and may be unaware of parthenium weed. The frequent incidence of new infestations, both in Queensland and in other states, indicates that measures aimed at preventing the spread of parthenium weed are not yet 100% effective. NSWAg has been raising awareness of parthenium weed for 18 years. A very successful TV advertising campaign and accompanying toll-free number have resulted in reports of a number of infestations when they were small enough to easily eradicate. This approach is required for other states including Queensland.

It is important that information delivered is consistent so that the community is not confused by different information. Delivery by members of the community may be more successful in some areas as the community will not always respond to information delivered by government agencies.

Strategy	Actions	Responsibility	Rank
2.2.1 **Raise the community's ability to recognise parthenium weed, know of its impacts and have the skills required for its management**	Develop and implement a targeted national awareness program including; • How to identify the weed and prevent its spread • More technical information on impacts for infested areas	All state agencies, PAG, NWP	1
	Deliver a communication program including; • Television advertising • A range of promotional material (posters, stickers etc)	PAG, PWMG, government agencies, industry	1
	Develop a list of target groups for the awareness program	PWMG	1
	Increase parthenium weed advice and communication in local government areas along the Queensland/New South Wales/Northern Territory borders	State agencies, APEC	1
	Appoint a Parthenium Weed Advisory Officer for NSW/Queensland border region	NSWAg	2
	Collect success stories from the community for use in the awareness program to demonstrate that the community can make a difference	PAG, PWMG, LCMC, industry	2
2.2.2 **Increase stakeholders' commitment to parthenium weed management**	Raise the profile of parthenium weed as a significant issue for all stakeholders in all States and Territories and gender the support required to manage it effectively	RLPB, LCMC, Federal, State and Territory agencies	1
	Train key stakeholder operatives in identification, prevention and management protocols eg. council staff, Main Roads, service providers	PAG, QDNR, NSWAg, NTDPIF	2
	Ensure decision makers understand the importance of parthenium weed management and address the requirements for parthenium weed management during planning and resource allocation cycles	All stakeholders, Industry, Government. agencies	2

2.3 Reduce the impact

Desired outcome

The impacts of established parthenium weed infestations are reduced.

Background

Currently, the largest and longest-established infestations of parthenium weed occur in Queensland. Substantial efforts were required to control outbreaks in the Northern Territory and New South Wales. Parthenium weed appears to have been eradicated from the Northern Territory, while outbreaks occur each year in New South Wales despite preventative measures. A concerted, coordinated effort to manage established parthenium weed infestations is necessary to minimise both the impacts in infested areas, and to minimise the risk of further spread to clean areas. This can be achieved by adoption of best practice management by all sectors. An example of best practice is the use of pre-emergent herbicides in cropping areas to decrease the level of infestations. An adaptive management approach "learning from doing" will ensure those research findings on the impacts and ecology of parthenium weed contributes towards refinement of best practice management principles and procedures. Pasture management is crucial, as parthenium weed germinates readily in areas disturbed by machinery or overgrazed by stock. Community groups such as PAG in Queensland have been at the forefront of delivering extension on best practice and facilitating the spread of biological controls. A revised best management practices manual has recently been released. These actions require support and strengthening. A number of other actions aimed at reducing impact in Queensland are detailed in the *Queensland Parthenium Strategy 1999-2004.*

Strategy	Actions	Responsibility	Rank
2.3.1 Best practice parthenium weed management is developed and adopted by all sectors	Parthenium weed management best practice and linkages to the state strategies are included in planning at various levels: • Property (including absentee landlords) • Local government • Catchment and Regional Natural Resource management	All stakeholders	1
	Identify research gaps and undertake research on: • Ecology / pasture management • Control techniques • Environmental impacts • Health impacts • Safe work practices (to minimise health impacts)	UQ, QDNR, QDPI, QEPA	1
	Communicate research findings, especially relating to health impacts and safe work practices, to landholders and others in contact with parthenium weed.	QDNR, PAG, PWMG	1
	Use adaptive management approach to improve best practice management for parthenium weed	QDNR, QDPI, landholders	1
	Carry out assessment of impacts of biological control agents and pasture management on parthenium weed in core areas	QDNR, landholders	2
	Develop an extension program for best practice management techniques	PAG, Government agencies	2
2.3.2 The resources required for parthenium weed management are assessed	Form a working group to investigate current resource requirements for best practice management and future funding options	PWMG	1
	Conduct impact study including impacts on cropping, grazing, health and the environment to capture "true picture"	QDNR, QEPA APEC, PWMG	1
	Determine the benefit and cost of parthenium weed control for best practice management	QDNR, QDPI, PAG	2

2.4 Co-ordinate management

Desired outcome

Parthenium weed management is co-ordinated at a national level.

Background

To ensure that weeds of national significance are effectively managed the National Weeds Strategy outlines the need for the development, implementation and evaluation of a management program for each species.

The planning process outlined in the National Weed Strategy required:

- Involvement of all stakeholders in developing and implementing the strategy.
- Integration of the strategy with other existing, relevant land management programs at all levels.
- Assessment of the suitability, availability, and requirements for integration of all available tools for control and awareness.
- Utilisation of coordinated community action as the delivery mechanism for implementation wherever appropriate.
- Determination of an appropriate funding mechanism for the strategy, including identification of the beneficiaries and their relative capacity to pay.
- Establishment of performance objectives and methods for their evaluation.

The strategy addresses these issues and will provide a tool in the ongoing coordinated management of parthenium weed in Australia.

Strategy	Actions	Responsibility	Rank
2.4.1 Manage implementation of the strategy	Establish and maintain a national Parthenium Weed Management Group (PWMG)	All stakeholders, PWMG, State/territory and federal government agencies	1
	Appoint a national project coordinator		1
	Obtain resourcing for project coordination and management		1
2.4.2 Monitor implementation	Collate strategic plan milestones and report on progress annually to NWSEC, stakeholders and funding groups	Project coordinator	1
	Establish an ongoing evaluation methodology for the strategy	PWMG	1
	• Evaluate projects on outcomes not outputs	All stakeholders	1
2.4.3 Coordinate communication about the strategy	Conduct communication activities to ensure awareness of the strategy, opportunities and achievements	Project coordinator	1
	• Ensure linkages with other strategies to maximise awareness		
	Provide a focus for parthenium weed community groups and investigate ways to increase support for these groups	All stakeholders	2

3 MONITORING AND EVALUATION

This strategy is subject to a 5-year cycle of review. The national Parthenium Weed Management 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 interest groups in a cost efficient manner, possibly a web page. Reports will be forwarded to the National Weed Program, if funds are made available from this source. Monitoring will include review of actions outlined and undertaken in:

- Project plans from this strategy
- State weed strategies
- Queensland Parthenium Weed Strategy
- NSW Parthenium Weed State Management Plan
- Catchment management plans
- Local Government pest management plans (Queensland)
- State of the Environment reporting processes

A set of performance indicators for the plan includes the actions listed below.

- Nationwide declaration of parthenium weed
- Increased awareness of parthenium weed as a weed of national significance
- Clear understanding of the social, economic and environmental impacts of parthenium
- Increased delivery of extension material specific to target groups and sites
- Increased resources for on-ground actions
- Increased surveying, reporting and eradication of isolated infestations
- Decrease in number of new infestations
- Increased awareness and implementation of best management practices
- Decrease in the area of parthenium weed inside and outside the core infestations
- Movement of the quarantine areas north into Queensland
- Adoption of vendor declaration and hygiene protocols by industry and landholder groups
- Legislation supporting weed seed prevention is developed and enacted
- Progress on removal of disincentives for the control and notification of parthenium weed
- Coordination of parthenium weed management at all levels (property, catchment, regional, state) and between all groups involved with parthenium
- Reduction of impact in core areas due to adoption of best management practices

4 STAKEHOLDER RESPONSIBILITIES

Private landholders

To control parthenium weed on their lands:

- Property management plans address parthenium weed control on the property and prevention of spread from the property
- Practice on-property hygiene to reduce seed movement via livestock or stockfeed
- Eradicate small or strategic infestations.

To be aware of the potential for parthenium weed to spread onto their lands:

- Follow good hygiene practices eg. utilise washdown facilities and quarantine paddocks for hay, livestock, machinery
- Ask for and provide a vendor declaration when buying/selling declarable items
- Be able to identify parthenium weed
- Keep an eye out on roadsides, unallocated state land and neighbours' farms for infestations.

Local Governments (Queensland)

To ensure that impacts of parthenium weed are kept to a minimum throughout the council area:

- Ensure that pest management plans include strategic parthenium weed control
- Survey all lands under the council's control including stock-routes, roadsides and town commons, and map location and density of parthenium weed
- Liaise with QDNR and community to undertake strategic parthenium weed control
- Ensure that landholders engage in strategic parthenium weed control activities
- Ensure that washdown facilities are maintained and well signposted
- Administer and enforce the provisions of the *Rural Lands Protection Act* including notices
- Train other sections of council on parthenium weed issues eg. Environmental officers, grader drivers.

Local Governments (New South Wales)

- Raise awareness of parthenium weed
- Survey all lands under the local authorities control and undertake strategic control
- Maintain detailed records on all parthenium weed outbreaks and submit reports to NSWAg
- Inspect all machinery yards, stock food mills and grain elevators
- Ensure landholders practice appropriate parthenium weed management, by gaining written undertakings from landholders and monitoring their management practices
- Administer and enforce the provisions of the *Noxious Weeds Act.*

Utility providers / Agribusiness / Industry

- Develop and utilise hygiene protocols and washdown facilities
- Become involved in management plans in service regions
- Alert agencies of new infestations
- Provide input into mapping exercises.

QDNR / NSWAg / NTDPIF

To ensure the social, economic and environmental impacts of parthenium weed are kept to a minimum throughout the State/Territory:

- Maintain quarantine facilities and measures to minimise interstate spread of parthenium weed
- Provide extension and education services to both rural and urban communities
- Maintain human resource capacity to effect parthenium weed control
- Enforce parthenium weed control under relevant legislation, and support local

government enforcement where necessary

- Liaise with community, industry groups and local governments to coordinate local parthenium weed control activities
- Continue to research efficient, effective, and appropriate control techniques (QDNR).

Other State / Territory government agencies

- Ensure parthenium weed is declared under relevant government legislation
- Ensure awareness and early detection programs
- Eradicate isolated infestations when found
- Assist in development of codes of practice and ensure uptake by Departmental staff to prevent seed spread
- Ensure parthenium weed control is undertaken on all government-managed lands, including national parks and conservation reserves, road reserves, rail reserves and forestry reserves.

Federal government departments and corporations

- Ensure quarantine controls on entry of Parthenium weed (AQIS)
- To ensure uptake by Departmental staff to restrict movement of weeds (agencies that manage land and travel on non-government land)
- To ensure parthenium weed control is undertaken on all federally managed lands (Defence, Environment Australia and other federal 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

Adamson D and Bray SB 1999 The economic benefit from investing in insect biological control of parthenium weed (*Parthenium hysterophorus*). Report for Queensland Department of Natural Resources.

Anon 1998 Parthenium weed. Pest Fact PA2. Queensland Department of Natural Resources.

Chippendale J and Panetta FD 1994 The cost of parthenium weed to the Queensland cattle industry. Plant Protection Quarterly 9: 73-6.

Dhileepan K and McFadyen RE 1997 Biological control of parthenium in Australia: progress and prospects. In First International Conference on Parthenium Management. Ed. Mahadevappa and Patil pp. 40-44 University of Agricultural Sciences, Dharward.

Fensham RJ 1999 Native grasslands of the central highlands, Queensland, Australia. Rangelands Journal 21 (1) pp 82-103.

Navie SC, McFadyen RE, Panetta FD & Adkins SW 1998 *Parthenium hysterophorus* L. The Biology of Australian Weeds, Vol. 2 (edited by Panetta FD, Groves RH and Shepherd RCH). RG and FJ Richardson. pp. 157-176

Navie SC, Panetta FD, McFadyen RE & Adkins SW 1998 Behaviour of buried and surface-sown seeds of *Parthenium hysterophorus*. Weed Research 38, pp 335-341.

Parsons WT and Cuthbertson EG 1992 Noxious Weeds of Australia. Inkata Press, Melbourne. pp. 292-296

Parthenium Action Group Inc. 2000 Parthenium Weed Best Management Practice. DPI and PAG Inc.

Parthenium Action Group Inc. 1998-2000 Weed Screed newsletter PAG Inc.

Sattler P and Williams V 1999 The Conservation Status of Queensland's Bioregional Ecosystems. Queensland Environmental Protection Agency.

Toms B and Bilston LJ 1999 Parthenium Weed - Problem Specification and Planning Workshop. Roma 16-17 March 1999

Walton C 1999 Queensland Parthenium Strategy 1999-2004. Queensland Department of Natural Resources.

White GG 1993 Parthenium weed workshop report. Rockhampton 12-13 October 1993.

6 GLOSSARY

APEC	Parthenium APEC (Awareness, Prevention, Eradication and Containment) Strategy for Southern Queensland
AQIS	Australian Quarantine and Inspection Service
CLIMEX	Simulation modeling system developed by CSIRO
CSIRO	Commonwealth Scientific and Industrial Research Organisation
ICM	Integrated Catchment Management
LCMC	Landcare and Catchment Management Council (Queensland)
LG	Local Government
NRM	Natural Resource Management
NSWAg	New South Wales Agriculture
NTDPIF	Northern Territory Department of Primary Industries and Fisheries
NWP	National Weed Program
NWSEC	National Weed Strategy Executive Committee
PAG	Parthenium Action Group Inc.
PCG	Parthenium Containment Group – Queensland
PWMG	Parthenium Weed Management Group
QEPA	Queensland Environmental Protection Agency
QPWS	Queensland Parks and Wildlife Service
QDNR	Queensland Department of Natural Resources
QDPI	Queensland Department of Primary Industries
QFF	Queensland Farmers Federation
QMDB	Queensland Murray/Darling Basin
UQ	University of Queensland
WONS	Weed of National Significance

Appendix 1 Queensland Parthenium weed Management Group Structure

Mission

To lead and coordinate awareness and management of parthenium weed.

Functions

- Provide a long-term platform for community involvement in parthenium weed management
- Champion education, awareness and communication on parthenium weed
- Monitor and evaluate the progress of the implementation of the strategy
- Identify and access avenues for increased resources including funds
- Continue to improve the strategy over time and ensure it is consistent with other strategies
- Advise the Rural Lands Protection Board on parthenium weed issues.

The group is made up of nominees or representatives of the organisations/groups in the boxes