

WEEDS OF NATIONAL SIGNIFICANCE

Rubber vine

**(*Cryptostegia grandiflora* Roxb. ex
R.Br.)**

strategic plan 2012–17

This publication is produced as part of the Weeds of National Significance initiative, a joint initiative between the Commonwealth of Australia and each of the Australian states and territories.

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An unpublished draft of the revised strategic plan has guided national coordination of this Weed of National Significance for the past two years. Before publishing the revised plan, the Australian Weeds Committee altered it because some actions had been completed, and then agreed to include a uniform monitoring, evaluation, reporting and improvement (MERI) template for all phase-3 Weeds of National Significance.

Supporting information about the Australian 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 and copies of the strategy. Comments and constructive criticism are welcome as an aid to improving the process and future revisions of this strategy.

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Summary

Rubber vine (*Cryptostegia grandiflora*) is one of northern Australia's worst weeds—its environmental impacts are significant. It is a perennial vine that aggressively colonises native vegetation—forming thickets and impacting river ecosystems—and has the potential to destroy all deciduous vine thickets in north Queensland. It is estimated to cost primary production more than \$18.3 million each year by decreasing pasture production and hindering mustering.

Large infestations of rubber vine occur along the river systems of southern Cape York and the Queensland Gulf country, along the Burdekin and Burnett rivers, and around Rockhampton. It could infest large areas of the Northern Territory and Western Australia.

The major challenges for the management of rubber vine are early detection of new infestations, managing extensive infestations, and the uptake and integration of management practices, including fire and chemical methods with or without the effects of biocontrol agents.

The three goals of this plan are:

- 1 Contain rubber vine to and within the containment line
 - Prohibit propagation, cultivation and sale across Australia.
 - Manage *Cryptostegia madagascariensis*.
 - Maintain detection mechanisms.
 - Raise community awareness of rubber vine and its management.
 - Maintain a national containment line.
 - Implement active eradication programs outside the containment line.
 - Use compliance as a management tool.
- 2 Reduce the adverse impacts of rubber vine
 - Foster regional and local containment planning.
 - Promote and adopt best-practice rubber vine management.
 - Maintain strategic management programs.
 - Investigate social, environmental and economic impacts of rubber vine.
- 3 Maintain the national commitment to rubber vine
 - Maximise the availability and use of resources.
 - Manage the implementation of the strategy.
 - Monitor the implementation of the strategy.

Vision

Rubber vine is confined within the national containment line where infestations continue to be reduced.

1 Challenge

Rubber vine (*Cryptostegia grandiflora*) remains one of Australia's worst weeds. It has received national attention because of its impacts in north-eastern Australia where it forms impenetrable thickets, smothers native vegetation and hinders primary production.

Rubber vine is native to Madagascar. It was imported into Queensland as an ornamental around the 1860s, and was touted as a source of rubber during the 1940s. It is now a major weed that densely infests 700 000 hectares in tropical and subtropical Queensland, and is estimated to have been found across 20% of the state. Most of northern Australia, from the Pilbara in Western Australia to northern New South Wales, appears to be climatically suitable for rubber vine and must be considered as potentially under threat from this weed. There is urgency to prevent the weed spreading into the coastal regions of the Gulf of Carpentaria and Arnhem Land in the Northern Territory, and to eradicate infestations in Western Australia.

Annual costs to the grazing industry are estimated to be \$18.13 million due to decreases in carrying capacity and increases in management costs. The environmental costs are immense, with the potential to destroy many unique ecosystems, such as gallery forest and dry rainforest.

Rubber vine impacts on 4 vulnerable animal species, 13 threatened plant communities, one Ramsar site, 13 important wetlands and 48 reserve areas in Queensland. Unless effective and efficient management is implemented and maintained, rubber vine will continue to impact adversely on biodiversity, agriculture, tourism, other industries and Aboriginal land use across northern Australia.

Prevention of spread is difficult as wind, water and man easily and rapidly disperse rubber vine. Large new infestations can rapidly arise and, once established, the economic and control costs remain very high. Early detection and control is therefore required to prevent new infestations before they establish.

Progress continues to be made in controlling rubber vine. Rubber vine can be managed using a combination of fire, biological control, mechanical and chemical measures. The rubber vine rust is having a significant impact on the species; however, results are variable, dependant on seasonal and site conditions. Control techniques and associated costs may be significant, and must be weighed against the value of land to be protected (uninfected country with potential to be infected). Work is ongoing to effectively extend the outcomes of the integrated control to land managers. Implementation of the Rubber Vine Strategic Plan 2012–17 aims to contain the spread of rubber vine nationally and reduce the impact of established infestations within the containment line in Queensland.

2 Background

Rubber vine is a twining vine capable of smothering vegetation, with impacts on biodiversity, native ecosystems, primary industries and tourism. Large infestations of rubber vine occur in Queensland, with small infestations under effective management in the Kimberley region of Western Australia. Rubber vine poses a significant risk to a large part of northern Australia.

Rubber vine is quite distinct from most other plants, although it may be confused with *Cryptostegia madagascariensis*, which is a close relative and has also been classed as a weed in Western Australia. In Madagascar, *C. grandiflora* and *C. madagascariensis* are known to hybridise. *Cryptostegia* has no species native to Australia—*Gymnanthera* is the closest genus.

2.1 The biology of rubber vine

Rubber vine is a self-supporting, scrambling, many-stemmed, woody vine that grows to 2 m tall and has long, trailing whips. A milky sap oozes from stems, leaves and seedpods when they are cut or broken. Leaves are dark green and glossy, 6–10 cm long, 3–5 cm wide and in opposite pairs. Roots have been found at a depth of 13 m in mine shafts. Roots of seedlings are twice as long as shoots.

The growth form of rubber vine differs depending on the surrounding conditions. In most locations it forms dense canopies of overlapping plants with long whips. It can form towers as high as the native trees (30 m). The plants are freestanding shrubs in the absence of other supporting vegetation.

Rubber vine tends to be deciduous, with leaf drop commencing with the onset of winter and/or the availability of soil moisture.

Flowers are large and showy, with five white to light purple petals forming a funnel. Rubber vine can flower in less than a year after germination under ideal conditions but normally takes two to three wet seasons to flower.

The seedpods grow in pairs at the end of a short stalk, are rigid, 10–12 cm long, 3–4 cm wide and contain 340–840 seeds. Each seed has a tuft of long, white, silky hairs. In a reasonably dense infestation of rubber vine, potential seed production exceeds 8 million seeds per hectare per year. More than 95% of seeds are viable, and most will either germinate or perish within a year of release (Bebawi et al. 2003). Availability of soil moisture is often the main factor controlling seed germination (Figure 1).

The major method of pod dispersal is water. Investigations have shown that pods will float in salt water for up to 40 days before becoming waterlogged. Seeds of waterlogged pods retain 60% viability. This suggests a risk of pod dispersal by floods and tidal flow. Wind is the primary mechanism for spreading seed. Although 85–90% of seed lands close to the parent plant, some may be spread large distances by storms and other significant weather events.

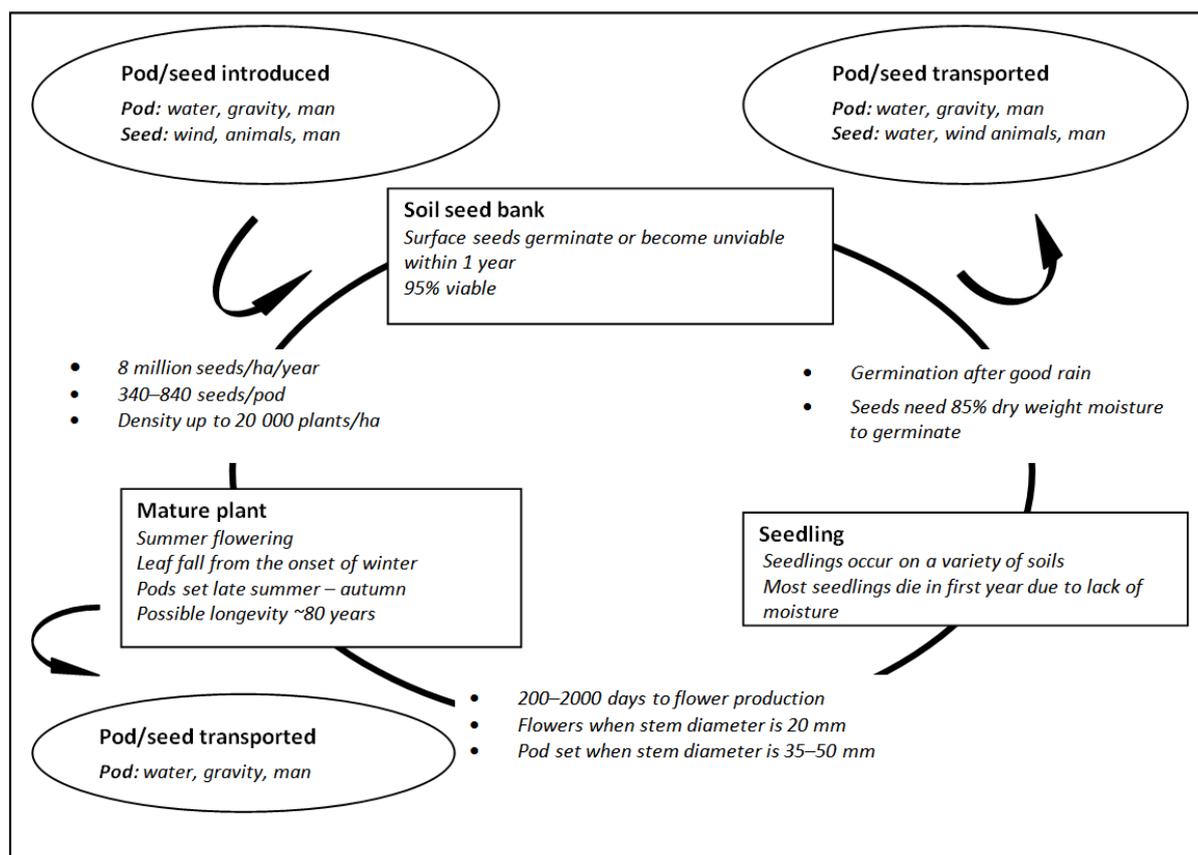


Figure 1 Life cycle of rubber vine

2.2 History of spread

Rubber vine is a native of south-west Madagascar but is now relatively widespread across the tropical regions of the world. The exact date of its introduction into Australia is not known, but it was around the 1860s. Rubber vine was used as an ornamental in mining towns of north Queensland and quickly became naturalised. By 1917 there were major infestations around Rockhampton, Charters Towers and Georgetown. During the Second World War, efforts were made to grow rubber vine as a rubber source and although this was not successfully developed it may have led to further spread.

Rubber vine has been recorded across 34.6 million hectares, or 20% of Queensland (Chippendale 1991). It is distributed from Gatton in the south to Longreach and Blackall in the south-west, to the coast in the east and Massacre Inlet in the north-west, approximately 25 km from the Northern Territory – Queensland border. The core distribution is 700 000 hectares along the river systems of southern Cape York, the Queensland Gulf country, the Burdekin region, Burnett River and around Rockhampton.

Two infestations of rubber vine have been found in Western Australia: Lissadell station, south of Kununurra in 1997 and Willare, near Derby in 2005. Both infestations are under effective management programs and on track to meet the eradication timeframe of 2015. One small site of less than a hectare was been found in the Barkly region of the Northern

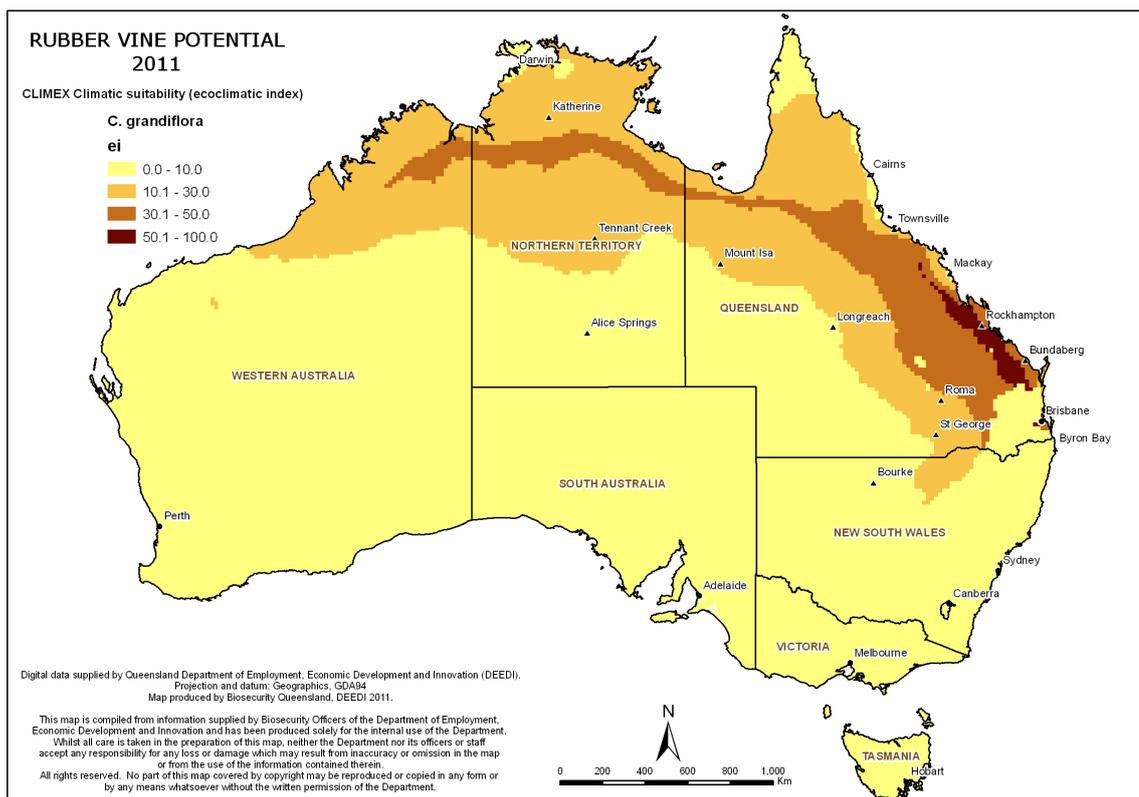
Territory in 2012. This site has been treated and is subject to ongoing monitoring activities to achieve eradication.

Ocean currents and tidal influence along the Gulf of Carpentaria coast represent a major avenue of rubber vine invasion to the Northern Territory. Surveys of the area (1998, 1999, 2000, 2004, 2009 and 2012) confirm that rubber vine occurs within 25 km of the Northern Territory – Queensland border.

2.2.1 River and creek infestations

The heaviest infestations of rubber vine occur along rivers and creeks, completely choking riparian ecosystems. In some areas it forms impenetrable barriers up to 400 m wide on each side of the riverbanks. The species will then aggressively invade open woodlands and pastures.

The potential distribution of rubber vine in Australia was modelled using CLIMEX¹ from the ecoclimatic characteristics of its native distribution in Madagascar (Figure 2). Most of tropical north Australia is sufficiently suited to rubber vine to suggest that an extensive area—32 000–160 000 km²—may be under threat of invasion from rubber vine.



Source: Data is splined from a CLIMEX climate prediction. Ecoclimatic index <10 indicates potential for permanent population low, ecoclimatic index >50 indicates potential very high

Figure 2 Potential distribution of rubber vine

¹ Simulation modelling system developed by CSIRO

2.3 Summary of impacts

The current impacts of rubber vine on the environment, primary production and tourism are summarised below.

2.3.1 Environmental

- Threatens 4 vulnerable animal species, 13 plant communities, 1 Ramsar wetland, 13 wetlands and 48 reserve areas in Queensland (Queensland Parks and Wildlife Service, *pers. comm.*, 2012).
- Extremely aggressive invader of woodlands and riparian ecosystems. It is a vigorous climber that will smother and kill plants, and shade out the ground layer
- Potential to destroy all deciduous vine thickets in north Queensland, leading to the loss of unique ecosystems. The Big Mitchell Creek gallery forest infestation led to the disappearance of the rufous owl (*Ninox rufa*) and Bower's shrike thrush (*Colluricincla boweri*)
- Increased soil erosion due to loss of grasses and other ground cover species.
- Changes to water flow and watercourses.

2.3.2 Primary production

- Estimated cost in terms of lost beef production in north Queensland due to loss of pasture is in excess of \$18 million per year.
- Increased difficulty and expense of mustering stock.
- Increased fencing costs to keep cattle out of dense rubber vine areas.
- Impedes access of stock to water.

2.3.3 Tourism

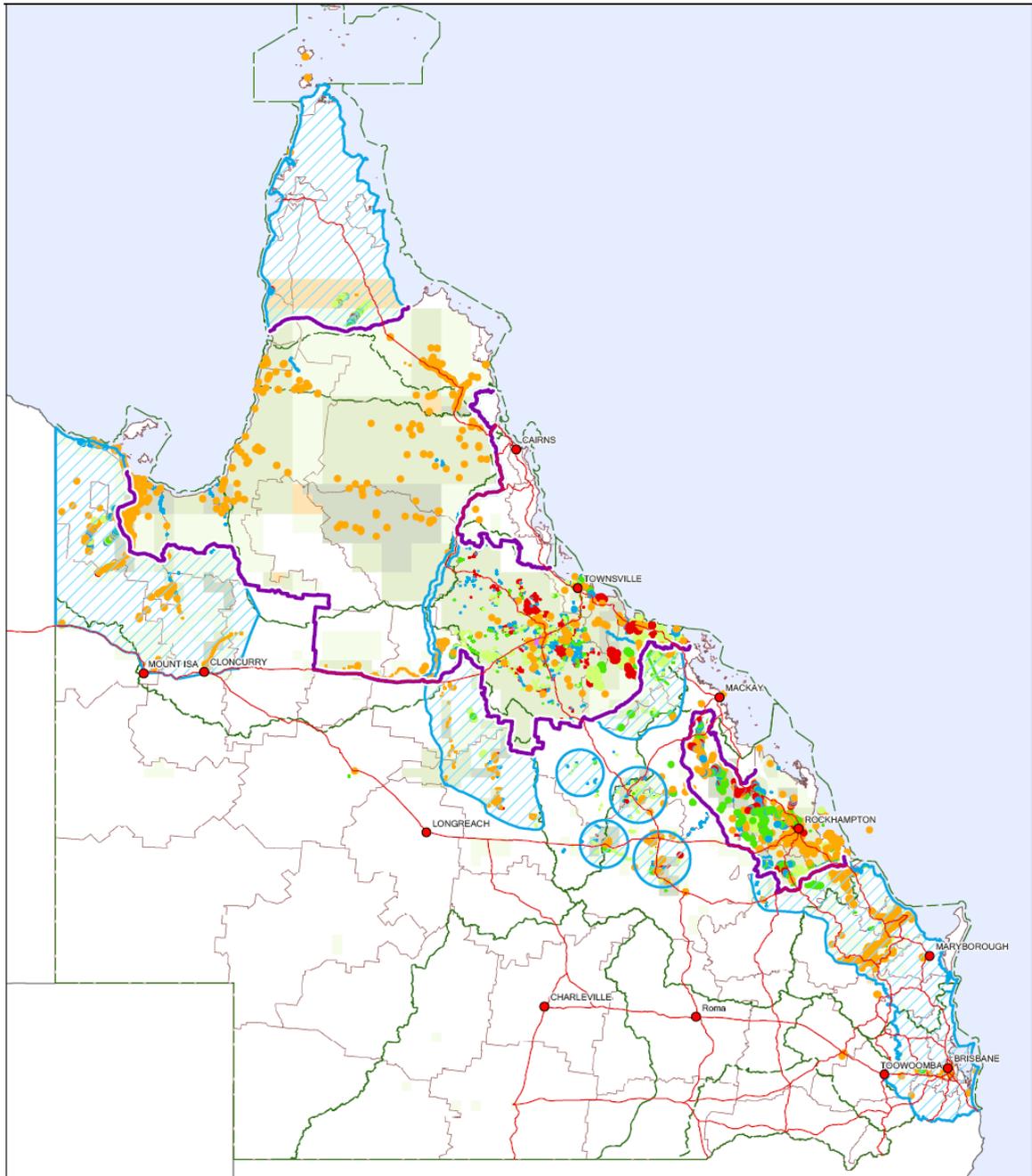
- Potential to seriously threaten the World Heritage areas of northern Australia.
- Several national parks in north Queensland are affected by rubber vine invasion, thus reducing native wildlife, reducing biodiversity values and decreasing the appeal of these attractions.

2.4 History of management

Despite extensive control efforts the plant is well established and has become a long-term problem. Further control efforts must continue to prevent further western spread of the weed. Research to develop integrated control approaches has continued over a long period through the work of the Queensland Government and CSIRO.

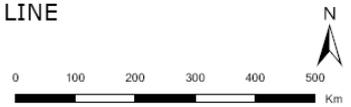
2.4.1 Rubber vine containment line

Several major on-ground projects have been undertaken since 1995 to support spread prevention and affect strategic management of rubber vine throughout Queensland. Initiatives include the Queensland Government's Strategic Weed Eradication and Education Program (SWEEP), Blueprint for the Bush and Pest Offensive, and the Australian Government's Natural Heritage Trust (1 and 2) and Caring for our Country. These programs operate in partnership with landholders, local governments, regional natural resource management bodies and key stakeholders where there is a wide community benefit. The rubber vine containment line was established in 1999 and reviewed in 2008 to include key priority areas (Figure 3). It provides for improved strategic planning and implementation. Emphasis is placed on infestations outside the line, which are targeted for eradication, while integrated management is proposed for infestations inside the line to minimise impacts on environmental, cultural and economic assets.



**QUEENSLAND RUBBERVINE CONTAINMENT LINE
JULY 2008**

- | | |
|--|-------------------------------|
| Rubbervine distributions: current and historical | |
| Rubbervine (Density, var. dates) | Annual Pest Dist. Survey 2006 |
| Unknown | Unknown |
| High | Low |
| Medium | Medium |
| Low | High |
| Scattered | |
| Controlled | |
| Rubbervine containment lines and mgt areas | |
| Rubber Vine Containment Line 2008 | |
| Priority Management Areas | |
| Local Government Boundary | |
| Other geographic information | |
| Town | |
| Road | |
| Natural Resource Mgt group boundary | |
| Local Government Boundary | |



Digital data supplied by Queensland Department of Primary Industries and Fisheries.
 Projection and datum: Geographics, GDA94
 Map produced by the Pest Information Group, Biosecurity Queensland, Primary Industries & Fisheries.

This map is compiled from information supplied by officers from the following agencies:

Biosecurity Queensland DP&F	Bauhinia Local Government Authority
Environmental Protection Agency	Bigglands Local Government Authority
Australia Virtual Herbarium	Calliope Local Government Authority
Greening Australia	Emerald Local Government Authority
Burnett Shire Regional Group	Fitzroy Local Government Authority
Fitzroy Basin Association	Gayndah Local Government Authority
Southern gulf Catchments	Idalia Local Government Authority
Desert Channels Queensland	Townsville City Local Government Authority
Barcoo Local Government Authority	Whitsunday Regional Local Government Authority

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Figure 4 Rubber vine containment line and priority areas for Queensland, 2008

2.5 Control methods

2.5.1 Biological control

Biological control is the most cost-effective method for managing dense infestations of rubber vine. The rubber vine moth *Euclasta gigantealis* was released in 1995 by the Queensland Department of Natural Resources. It is more prevalent in the dry season and has been responsible for extensive defoliation of rubber vine in some seasons. However, it has not been as effective in recent years because a microsporidian disease and parasitism of the moth by two flies appear to have substantially reduced rubber vine moth populations.

The imported leaf rust *Maravalia cryptostegiae*, also released in 1995, is having significant impacts on rubber vine across Queensland. It is a Madagascan fungus that parasitises the leaves of the host rubber vine. Released as a biological control agent by the Queensland Department of Natural Resources, it rapidly spread across areas of north Queensland. Field studies in 1999 indicated that the rust was:

- reducing pod numbers by 85%
- reducing above ground biomass by 74%
- reducing plant height by 42%
- reducing leaf cover by 73%
- reducing flower production by 48%
- delaying the onset of flowering and other developmental stages of the plant.

A 10-year field study on the impacts of the rust across five sites in Queensland supported the 1999 results, finding (W Vogler, pers. comm., 2010):

- 20–80% reduction in rubber vine plants where a heavy rust infestation regularly occurred
- seed production was reduced to negligible levels
- soil seed bank was reduced to zero or near zero
- almost no establishment of new rubber vine plants.

Where rust infections were low, seed and seedlings were produced and plant population increased.

2.5.2 Routine management

The constant defoliation of rubber vine results in reduced ground cover that enables forbs and grasses to grow under the rubber vine canopy. The increased grass growth provides fuel to carry fires up to the trunks of rubber vine plants and the defoliated leaves provide fuel for fire management. Reduced seed production should also lessen seedling establishment and therefore slow the rate of new infestations.

Fire, together with biological, chemical and mechanical methods, can be used in an integrated control program for rubber vine, and all methods may be effective in particular situations (Mackey et al. 1996). Fire is the most effective management tool, but caution is required in riparian zones to minimise impacts on the ecology. The economics of using fire in

open areas is improved by the impacts of the leaf rust. The use of fire for rubber vine control and the manner in which other methods are integrated into management should be determined by site-specific circumstances. Consequently, it is recommended that land managers refer to the manual *Rubber vine management* (Anon. 2004) for more detailed information.

2.6 Socioeconomic factors affecting management decisions

The time and costs associated with rubber vine control effect management decisions, levels of control activity and ability to limit the weed's impacts. Land managers in Queensland surveyed in 2005 (Anon. 2005) indicated that the major limiting factors or challenges they faced in managing rubber vine were cost of control (71%), time (60%) and knowledge of control methods (39%). This survey represented a random section of the community involved in managing this weed; barriers to control are likely to be similar across other areas.

2.7 Quarantine and legislative controls

Rubber vine is declared in all Australian states and territories, with restrictions concerning plant introduction, distribution and control being the responsibility of the landholder (Table 1). It was declared a noxious plant in Queensland in 1955 where it is now a declared Class 2 plant. The Australian Quarantine and Inspection Service (now Biosecurity Australia) prohibits the introduction of weed species but does not regulate rubber vine importation. The *Environment Protection and Biodiversity Conservation Act 1999* may also consider rubber vine as a key threatening process or its listing in regulations controlling non-native species.

Table 1 Legislation related to rubber vine

Jurisdiction	Legislation	Declaration	Action
Australian Capital Territory	<i>Pest Plants and Animals Act 2005</i>	Included on the declared pest plant list	Prohibited
New South Wales	<i>Noxious Weeds Act 1993</i>	Class 1 statewide	The plant must be eradicated from the land and the land must be kept free of the plant
Northern Territory	<i>Weeds Management Act 2001</i>	Class A and Class C for all of the Territory	Class A—to be eradicated Class C—not to be introduced.
Queensland	<i>Land Protection (Pest and Stock Route Management) Act 2002</i>	Class 2 statewide	Supply or sale prohibited Landholders to control the weed on the land and waters under their control. A local government may serve a notice upon a landholder requiring control
South Australia	<i>Natural Resource Management Act 2004</i>	Class 11, Category 3 statewide	Control is not required
Tasmania	<i>Weed Management Act 1999</i>	Declared weed	The importation, sale and distribution of rubber vine is prohibited
Victoria	<i>Catchment and Land Protection Act 1994</i>	Restricted weed	Must not buy, sell, possess for sale, display, plant, propagate, deposit on land, bring into or transport around Victoria
Western Australia	<i>Agricultural and Related Resources Protection Act 1976</i> The legislative arrangements are currently in a transition from the <i>Agriculture and Related Resources Protection Act 1976</i> to the <i>Biosecurity and Agriculture Management Act 2007 (BAM Act)</i>	P1 and P2 statewide.	P1—introduction of the plant into, or movement of the plant within, an area is prohibited P2—plant to be eradicated in the area

2.8 Principles underpinning the plan

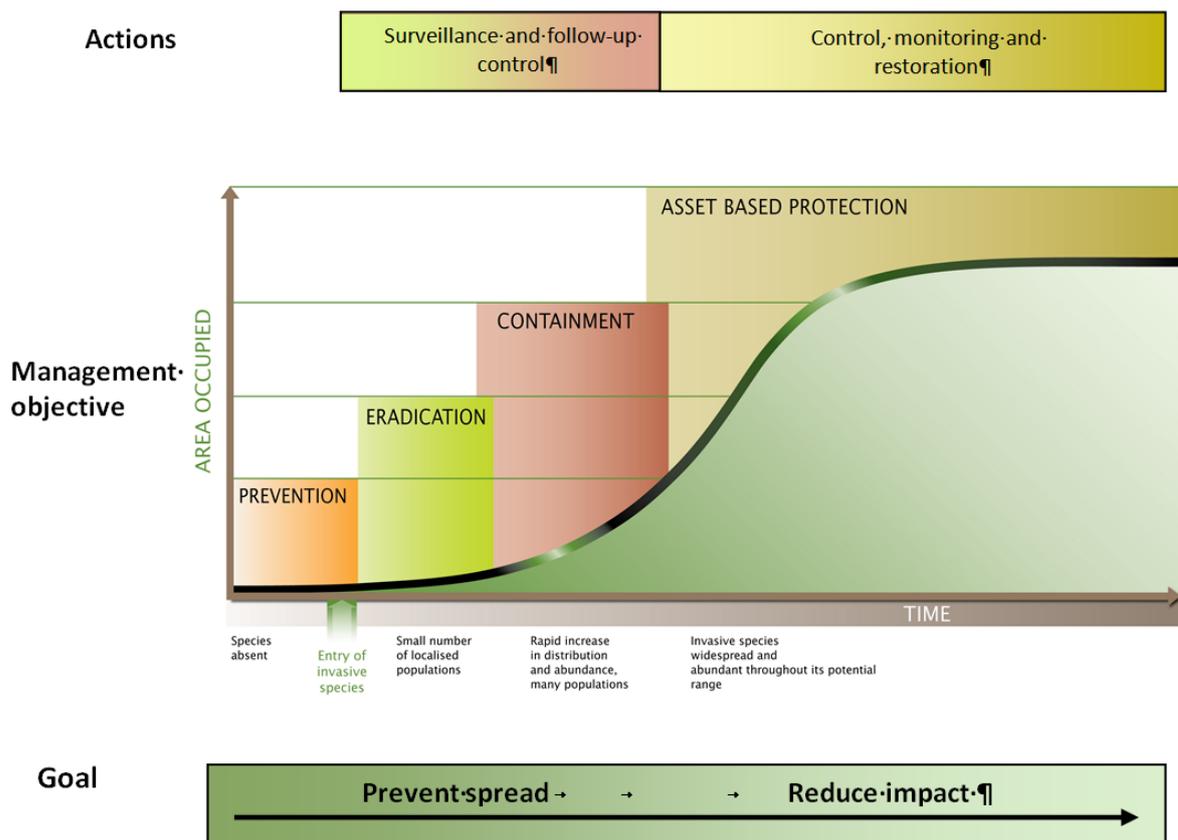
This strategy is based on the seven key principles outlined by the National Weeds Strategy (NRMMC 2007):

- Weed management is an essential and integral part of the sustainable management of natural resources for the benefit of the economy, the environment, human health and amenity.
- Combating weed problems is a shared responsibility that requires all parties to have clear understanding of their roles.
- Good science underpins the effective development, monitoring and review of weed management strategies.

- Prioritisation of, and investment in, weed management must be informed by a risk management approach.
- Prevention and early intervention are the most cost-effective techniques for managing weeds.
- Weed management requires coordination among all levels of government in partnership with industry, land and water managers, and the community, regardless of tenure.
- Building capacity across government, industry, land and water managers, and the community is fundamental to effective weed management.

The Weeds of National Significance (WoNS) initiative establishes national priorities and facilitates action where there is a significant national or cross-jurisdictional benefit to be gained. These strategic plans do not specifically address resourcing; however, they aim to identify efficiencies and ensure existing resources can be allocated to achieve the most strategic management outcomes.

Effective broadscale management of WoNS and other weeds requires an integrated approach that includes prevention and eradication programs, establishment and implementation of management zones, and the protection of key environmental, social and economic assets in areas where the weeds are already widespread (Figure 4).



Source: Modified from Hobbs & Humphries (1995) and DPI (2010).

Figure 4 Stages of weed invasion with corresponding goals, management objectives and actions at each stage

2.8.1 The national program—progress to date

The first WoNS rubber vine strategic plan was published in June 2001 and a coordinator was appointed in 2002.

In 2009, the Natural Resource Management Ministerial Council (Resolution 15.7, 21 May 2009) endorsed a three-phased approach to national management of WoNS species (Appendix 1). In September 2009, a panel from the Australian Weeds Committee reviewed implementation of the strategy (Anon. 2010) and identified key achievements:

- Involvement of Western Australia and the Northern Territory with Queensland to enable a coordinated national approach to rubber vine management.
- Development of a range of national extension products on best-practice management,
- Surveillance and eradication programs for outliers in Western Australia, Northern Territory, New South Wales, and southern and western Queensland.
- Contraction of the national containment line within Queensland
- Development of a multi-WoNS network across northern Australia, with strong collaboration between agencies, including regional natural resource management groups.
- Decreased biomass and recruitment of rubber vine as a result of using the rust fungus as a biological control.
- National mapping of management actions and occurrence (Appendix 2).

The review also identified barriers to achieving the strategies goals, including:

- inability to gain consistent and long-term support from all stakeholders (i.e. state agency, natural resource management groups, local government, landholders) to eradicate strategic outliers and maintain the national containment line
- inability to engage Indigenous support for nationally strategic infestations
- lack of quantitative data on economic and ecological impacts of rubber vine and the benefits of control
- reliance on Australian Government funds for long-term eradication
- poor procedures for national monitoring of the effectiveness and current status of control programs.

The review recognised that there is a need for ongoing national coordination of rubber vine control programs, with a particular focus on:

- effective monitoring and evaluation systems for surveys and control works, including economic, social and environmental effects of control
- assessment of progress towards eradication
- restoration of riparian ecosystems invaded by rubber vine to prevent other weeds invading
- research (e.g. remote sensing to detect rubber vine, socioeconomic barriers to adoption of best-practice management)
- a framework and engagement with Queensland stakeholders on how to use compliance consistently and practically

- control on coastal parts of the Gulf of Carpentaria in Queensland because of the risk of ocean movement carrying rubber vine Cape York and eastern Northern Territory
- whether *Cryptostegia madagascariensis* poses a significant weed risk.

Consequently, the review recommended a revision of the strategic plan, which was drafted by Peter Austin (Queensland Department of Agriculture, Fisheries and Forestry) in consultation with the National Rubber Vine Management Group (NRVMG) representatives from local and state governments, industry bodies, natural resource management groups and the community.

2.9 Relevance to other strategies

The Rubber Vine Strategic Plan 2012–17 has been developed to provide a framework for coordinated management of rubber vine across the country. Complementary links can be found in a range of existing resource management initiatives at all jurisdictional levels, as shown in Table 2.

Table 2 Strategies and plans for the management of rubber vine

Scale	Natural resource management	Pest management	Weed species management
National	<i>Environment Protection and Biodiversity Conservation Act 1999</i>	Australian Weeds Strategy 2007	WoNS Rubber Vine Strategic Plan
	National Strategy for Conservation of Australia's Biological Diversity 2010	Weeds of National Significance	
	National Strategy for Ecological Sustainable Development 1992	Caring for our Country Business Plan	
State	State biodiversity and natural resource management strategies	Western Australia State Weeds Plan (2001)	West Kimberley Rubber Vine Eradication Plan (2011–2015)
	Forest policies	Northern Territory Weed Management Strategy	Northern Territory rubber vine weed risk assessment
		State agency pest management plans (Queensland)	
Regional	Regional NRM plans	Regional NRM investment strategies	Specific weed control plans and threat abatement plans
Local	Landcare plans	Regional pest management plans	
	Conservation corridor plans	Local government pest management plans (Queensland)	Local weed control plans (New South Wales)
	Riparian vegetation management plans		
Property	Bushcare plans		
	Property management plans	Property pest management plans	Property weed management plans
		National park weed management strategies (Queensland)	

3 Strategic goals

Revised actions to confine and reduce rubber vine are outlined in Sections 3.1–3.3 against each of the three strategic goals.

3.1 Goal 1: Confine rubber vine to, and within, the containment line

The objectives and strategic actions to achieve goal 1 of the strategic plan, and the action level and responsible partners for each action, are shown in Table 3.

Table 3 Objectives and strategic actions to achieve goal 1 of the Rubber Vine Strategic Plan 2012–17

Objectives	Strategic actions	Action level ^a	Responsibility
1.1 Maintain an appropriate legislative framework for management of rubber vine	Maintain declaration of rubber vine (<i>C. grandiflora</i>) to prohibit propagation, trade and distribution in all states and territories	1	State and territory agencies, nursery industry
	Promote landholder awareness of their responsibilities under legislation	2	State and territory lead agencies, local government
	Encourage the use of enforcement where necessary to complement eradication objectives, protect control investments and/or restore environmental and cultural assets	2	State and territory lead agencies, local government
1.2 Manage <i>C. madagascariensis</i>	Undertake weed risk assessment of <i>C. madagascariensis</i>	3	State and territory agencies
1.3 Maintain detection mechanisms	Prioritise areas at risk of introduction and establishment:		
	• Make available a map of catchments and regions at risk of rubber vine invasion, including the impact of climate change	2	State and territory agencies
	• Implement surveys of identified high-risk (priority) areas outside the containment line, as appropriate	2	State and territory agencies, local government and regional NRM bodies
	Investigate the potential of remote sensing systems to identify and map rubber vine	3	State and territory agencies, industry
	Investigate risks of ocean current movement of rubber vine seed in the coastal parts of the Gulf of Carpentaria to Cape York and eastern Northern Territory	3	State and territory agencies, research Institutions
Establish a monitoring, reporting and evaluation program for surveillance	1	State and territory agencies, local governments	

Objectives	Strategic actions	Action level ^a	Responsibility
1.4 Raise community awareness and knowledge of rubber vine and its management	Implement and promote a tailored extension and awareness program for rubber vine	1	State and territory agencies, local government, industry and regional NRM bodies
1.5 Maintain a national containment line	Review the national containment line in 2012	2	State and territory agencies
	Review criteria for determining areas inside and outside the containment line, based on zonal approach of prevention, eradication, containment and asset protection zones		
1.6 Implement active eradication programs outside the containment line	Incorporate rubber vine prevention and control into regional and local government pest management plans for all 'at risk' areas	2	State and territory agencies, regional NRM bodies, local government
	Maintain and support rubber vine eradication objectives/programs for all states and territories		State and territory agencies, local governments, regional NRM bodies, landholders
	Eradicate rubber vine outside the national containment line		

NRM = natural resource management

a The Australian Weeds Committee (AWC) applied three action levels that reflect jurisdictional commitment to implementing actions:

Level 1 = Highly beneficial as a national action that is critical to success of the WoNS revised strategic plan and all relevant AWC jurisdictions have committed resources to implementing this action.

OR

Highly beneficial to a particular jurisdiction and the responsible party/ies have committed resources to implement this action.

Level 2 = Highly beneficial at national and/or jurisdictional level, but implementation will be subject to resource availability and investment priorities.

Level 3 = Desirable and still beneficial to improving uptake and efficiency of on-ground action, but not critical to success.

3.2 Goal 2 Reduce the adverse impacts of rubber vine

The objectives and strategic actions to achieve goal 2 of the strategic plan, and the action level and responsible partners for each action, are shown in Table 4.

Table 4 Objectives and strategic actions to achieve goal 2 of the Rubber Vine Strategic Plan 2012–17

Objectives	Strategic actions	Action level ^a	Responsibility
2.1 Foster regional and local containment planning	Incorporate actions from the rubber vine national strategy with or to state, regional NRM and local government pest management plans: <ul style="list-style-type: none"> Facilitate stakeholder involvement in the catchment, natural resource and local government pest management planning processes 	1	State and territory agencies, local government and regional NRM bodies
2.2 Promote and adopt best-practice rubber vine management	Promote best-practice rubber vine management to maximise benefits of rubber vine control	1	State and territory agencies, regional NRM bodies, local governments, industry
	Promote and adopt the use of property pest management planning Review and update the rubber vine best-practice management manual by including: <ul style="list-style-type: none"> case studies control techniques (fire) assessment of the spread and impacts of the rubber vine rust 	2	State and territory agencies
2.3 Maintain strategic management programs	Maintain strategic management activities inside the rubber vine containment line to reduce the risk of spread: <ul style="list-style-type: none"> Support and encourage adoption of best-practice rubber vine management techniques 	2	State and territory agencies, regional NRM bodies, local governments, industry groups
2.4 Investigate social, environmental and economic impacts of rubber vine	Undertake cost–benefit analysis of rubber vine management and control options and rubber vine impacts	3	Research institutions, state and territory agencies
	Assess impacts of rubber vine and rubber vine management practices on land sustainability (including biodiversity and water quality)	3	Research institutions, state and territory agencies, industry
	Support investigation to maximise the effectiveness of aerial ignition on rubber vine	1	Queensland Department of Agriculture, Fisheries and Forestry, Etheridge Shire, regional NRM bodies, local government
	Identify and address disincentives for rubber vine management	3	State and territory agencies

Objectives	Strategic actions	Action level ^a	Responsibility
	Develop post-treatment guidelines for the management of rubber vine–infested sites in riparian ecosystems	2	State and territory agencies

NRM = natural resource management

a The Australian Weeds Committee (AWC) applied three action levels that reflect jurisdictional commitment to implementing actions:

Level 1 = Highly beneficial as a national action that is critical to success of the WoNS revised strategic plan and all relevant AWC jurisdictions have committed resources to implementing this action.

OR

Highly beneficial to a particular jurisdiction and the responsible party/ies have committed resources to implement this action.

Level 2 = Highly beneficial at national and/or jurisdictional level, but implementation will be subject to resource availability and investment priorities.

Level 3 = Desirable and still beneficial to improving uptake and efficiency of on-ground action, but not critical to success.

3.3 Goal 3: Increase the capacity and commitment to manage rubber vine

The objectives and strategic actions to achieve goal 3 of the strategic plan, and the action level and responsible partners for each action, are shown in Table 5.

Table 5 Objectives and strategic actions to achieve goal 3 of the Rubber Vine Strategic Plan 2012–17

Objective	Strategic actions	Action level ^a	Responsibility
3.1 Maximise the availability and use of resources	Maintain the profile of rubber vine as a significant issue for all stakeholders in all states and territories, and engender the support required to manage it effectively	1	State and territory agencies
	Undertake joint actions where appropriate with other WoNS strategies	2	State and territory agencies, local government, regional NRM groups
3.2 Monitor, evaluate and communicate implementation of the strategy	Collate strategic plan milestones and report on progress towards implementation of the plan annually to the Australian Weeds Committee and key stakeholders	1	State and territory agencies
	Establish an ongoing evaluation methodology for the strategy against the phase 3 monitoring, evaluation, reporting and improvement strategy	1	State and territory agencies
	Conduct communication activities to ensure awareness of the strategy, opportunities and achievements	2	State and territory agencies, regional natural resource management bodies

a To help set priorities the Australian Weeds Committee (AWC) described three action levels that reflect jurisdictional commitment to implementing actions:
 Level 1 = Highly beneficial as a national action that is critical to success of the WoNS revised strategic plan and all relevant AWC jurisdictions have committed resources to implementing this action.
 OR
 Highly beneficial to a particular jurisdiction and the responsible party/ies have committed resources to implement this action.
 Level 2 = Highly beneficial at national and/or jurisdictional level, but implementation will be subject to resource availability and investment priorities.
 Level 3 = Desirable and still beneficial to improving uptake and efficiency of on-ground action, but not critical to success.

4 Monitoring, evaluation, reporting and improvement framework

The Australian Weeds Strategy (NRMMC 2007) gives the Australian Weeds Committee (AWC) responsibility for monitoring and evaluating the management of national priority weeds, including WoNS. The AWC is therefore responsible for monitoring and reporting on progress under this strategic plan.

This strategic plan is subject to a five-year review; however, mechanisms must also be put in place to allow the goals and actions to be evaluated throughout this period. This enables ongoing assessment of progress towards intermediate and long-term outcomes and, ultimately, helps to determine the effectiveness of individual actions. It also helps to identify program improvements and provides evidence to stakeholders and funding bodies that they are getting value from their investment.

Individual jurisdictions and/or organisations responsible for weed management and conservation will need to develop their own monitoring strategies. They should, where possible, coordinate actions to implement this plan, and monitor and evaluate progress towards its goals in conjunction with existing state, regional or local plans. While individual actions should be monitored at the jurisdictional level, data or evidence collected as a part of state, regional and local activities or plans should be provided to the AWC and collated so that it can be assessed each year within the national context. This will help build a comprehensive overview of the plan's delivery. Table 6 lists key evaluation questions that should be assessed by the AWC each year at the national level to ensure progress against strategy goals, and which should be used to provide the basis for an annual report to the AWC.

This monitoring, evaluation, reporting and improvement (MERI) framework lists the basic reporting information that should be collected for the life of the strategic plan—including during phase 3 delivery (see Appendix 1). This will ensure that sufficient data are collected to identify successes and failures, and provide the opportunity for improvement where outcomes are not being achieved. Annual MERI plans may be developed to follow activities in more detail.

Although performance indicators or other ways of measuring progress are not provided in this strategic plan, a scoring system could be appropriate.

A generic program logic model (Appendix 3) was developed by WoNS coordinators in 2010. This shows the relationship between strategic actions and the objectives and goals they achieve. The program logic is one way to communicate the links between activities, their intermediate and long-term outcomes, and the vision of the strategic plan.

Table 6 Suggested monitoring and evaluation questions to measure progress under the phase 3 WoNS Rubber Vine Strategic Plan 2012–17

WoNS:		Jurisdiction:	Date:
Goal	Key evaluation questions	Data or evidence required	Consider
1 Prevent new infestations from establishing	To what extent have new infestations been prevented from establishing?	1.1 National distribution data: Has the national distribution map been reviewed and/or updated? Has the Priority Management Action spreadsheet been updated?	<ul style="list-style-type: none"> • Are these documents publicly available? • Have stakeholders been advised of any changes? • Where is this data or information stored? • Does this information capture national priorities?
		1.2 New infestations: Number of new infestations recorded Percentage of known infestations actively controlled	<ul style="list-style-type: none"> • Are any new infestations occurring in areas identified as a high priority in the national strategy? • How were infestations detected (passive or active surveillance, community reporting etc.)? • Have high-risk pathways been adequately identified? • Have threats been minimised?
		1.3 Eradication and containment programs: Percentage of eradication and/or containment programs being maintained	<ul style="list-style-type: none"> • What percentage of programs identified in the national strategy are being actively managed? • Is there a plan in place for ongoing management? • How is progress being monitored and reported to stakeholders? <p>(Examples using case studies can be included)</p>
		1.4 Legislation: Legislation or policy changes for this species Legislative change has been identified by stakeholders	<ul style="list-style-type: none"> • What legislative changes have been made? • Are minimum requirements being maintained (e.g. ban on sale, trade, movement)? • Is control required throughout or in part of the jurisdiction? • Is compliance actively enforced?
			Score:

Table 6 *continued*

WoNS:		Jurisdiction:		Date:
Goal	Key evaluation questions	Data or evidence required	Consider	
2 Strategically manage existing infestations	To what extent is integrated weed management effectively managing core infestations?	2.1 Integrated weed management: Effectiveness of integrated weed management programs	<ul style="list-style-type: none"> Are existing tools providing adequate control of WoNS? Have new advances or technologies been developed and are they incorporated into best-practice management information? Are there barriers to adoption of best-practice management? Are research programs addressing any observed gaps (e.g. herbicide trials, biocontrol, restoration requirements post-control)? 	
	To what extent are assets being protected through strategic management?	2.2 Asset protection: Number of priority assets identified as 'at risk' from WoNS Percentage of priority assets being protected (e.g. assessed against relevant threat abatement plans) Percentage of state and regional invasive species plans that identify priority assets at risk from WoNS	<ul style="list-style-type: none"> Methods by which assets are being protected (e.g. targeted annual spray programs, high-risk pathway surveillance, strategic plans) Are long-term monitoring programs in place to detect change? To what extent is management leading to an improvement in asset condition? <p>(Response should include status report on progress towards asset-protection programs)</p>	
				Score:
3 Increase capability and commitment to manage WoNS	To what extent has the capability and commitment to manage WoNS increased?	3.1 Community engagement and awareness: What is the status of best-practice information? Are partnerships being maintained to ensure collaboration on WoNS? Number and type of media activities	<ul style="list-style-type: none"> Is best-practice information up to date and readily available? Is this information and/or advice being targeted to priority regions? Is training being delivered to meet the needs of weed managers (including the community)? Are networks and groups being supported (e.g. through dissemination of research outcomes, 	

Table 6 *continued*

WoNS:	Jurisdiction:	Date:	
Goal	Key evaluation questions	Data or evidence required	Consider
			funding opportunities, control options etc.)? <ul style="list-style-type: none"> Has awareness and engagement in WoNS management been raised effectively?
		3.2 Resourcing: From what sources are programs being funded?	<ul style="list-style-type: none"> Number of projects funded by Australian Government, jurisdictions, industry, etc.
		3.3 Policy and planning: Are the objectives of the strategy being integrated into Australian Government/state/regional plans, policies and programs? Has cross-border collaboration occurred?	<ul style="list-style-type: none"> How are priorities reflected in planning and policy approaches (e.g. weed risk assessments, invasive species plans, asset-protection plans, district plans, weed spread prevention activities, management programs, incentive programs, state working groups)? How are national priorities being maintained (e.g. containment lines, eradication targets, training and awareness raising, research projects)?
			Score:
Continuous improvement	Are there any unexpected outcomes that have been identified through implementation of strategy?	Barriers: <ul style="list-style-type: none"> Have any other management issues or impediments been identified? 	

WoNS = Weeds of National Significance

Scoring:

- 1: Insufficient evidence to score
- 2: No progress has been made against this goal
- 3: Limited progress is being made against this goal
- 4: Reasonable progress is being made against this goal
- 5: Excellent progress is being made against this goal

5 Stakeholder roles and responsibilities

Although landowners have primary responsibility for the control of rubber vine on their land, relevant agencies share responsibility for the actions listed in Sections 3 and 4. The effective implementation of this strategy requires the involvement of a range of stakeholders.

Stakeholders' responsibilities may vary between jurisdictions: some actions may be optional while others are prescribed by legislation. The successful achievement of strategic actions relies on the development and maintenance of partnerships between community, industry and government, and recognition of the roles of each stakeholder. In particular, while the National Rubber Vine Management Group provided oversight for the original strategy, future coordination arrangements will evolve to maintain and build on past achievements. The Australian Weeds Committee, at a national level, and various agencies at the state and territory level will continue to provide a leadership role. Suggested responsibilities for each group are listed below.

Private landholders

- Be able detect rubber vine and recognise its negative impacts.
- Implement best-practice management where necessary.
- Report infestations to support management of rubber vine.
- Undertake duty of care—support weed hygiene practices to prevent weed seed spread.

Natural resource management bodies

- Provide leadership to coordinate extension and education strategies to highlight impacts and best-practice management solutions for rubber vine.
- Incorporate strategic rubber vine control into regional-level NRM planning and investment processes.
- Coordinate and source funding for strategic management programs in partnership with key stakeholders.
- Help coordinate stakeholders by implementing strategic management programs to support rubber vine management zones.
- Support stakeholders who adopt of best-practice rubber vine management.
- Support mapping and reporting of rubber vine infestations.
- Implement monitoring and reporting protocols in line with the monitoring, evaluation, reporting and improvement plan, and provide relevant information to the relevant state government agency for national reporting purposes,

Local governments

- Enforce legislation (where necessary) and establish local management policies to contribute to the management of rubber vine.

- Coordinate and source funding for strategic management programs in partnership with key stakeholders.
- Incorporate strategic rubber vine control into local government planning and investment processes, including promotion of inclusion in property pest management plans.
- Coordinate extension and education strategies to highlight impacts and best-practice management solutions for rubber vine.
- Support implementation of work in priority management areas.
- Undertake duty of care—support weed hygiene practices to prevent weed seed spread.
- Undertake and support mapping and reporting of rubber vine infestations.
- Identify and implement incentive programs.
- Monitor and evaluate management outcomes and strategy implementation in line with monitoring, evaluation, reporting and improvement plan, and provide relevant information to the relevant state government agency for national reporting purposes.

Utility companies, agribusiness, industry and research institutions

- Implement best-practice management and control on land under their management
- Be able to detect rubber vine and recognise its negative impacts.
- Undertake duty of care—support weed hygiene practices to prevent weed seed spread.
- Promote and adopt best-practice management of rubber vine.
- Contribute to extension and education on the impacts of rubber vine.
- Contribute to research and development of alternative rubber vine management practices to support industry members.
- Collaborate with stakeholders to seek ongoing funding and support for research requirements.

Lead agencies, other government departments in states and territories

- Contribute to the management and delivery of the WoNS Program.
- Incorporate strategic rubber vine management priorities into state natural resource management planning and investment processes (i.e. regional NRM management body and local government pest management investment planning and implementation).
- Coordinate and source funding for strategic management programs in partnership with key stakeholders.
- Identify and adopt strategic management areas (i.e. rubber vine management zones).
- Include the strategic control of rubber vine on state lands in agency pest management plans and ensure this translates to on-ground outcomes.
- Introduce and enforce legislation and policy covering strategic management of rubber vine.
- Provide leadership to coordinate extension and education strategies to highlight impacts and best-practice management solutions for rubber vine.

- Implement monitoring and reporting protocols in line with the monitoring, evaluation, reporting and improvement plan and provide relevant information to Australian Weeds Committee for reporting purposes.
- Contribute to priority research areas in support of strategic objectives.
- Develop and implement long-term extension and education programs for target areas and audiences highlighting the impacts of rubber vine.
- Collect and provide a centralised storage and access point for rubber vine mapping information.

Australian Government departments and corporations

- Ensure quarantine controls to prevent importation (Biosecurity Australia).
- Ensure access is available for appropriate and potential resources through funding initiatives such as Caring for our Country.
- Ensure strategic rubber vine control occurs on all federally managed lands.
- Oversee and manage federal funds including Caring for our Country and other future funding programs.
- Provide research support through CSIRO and the Commonwealth Weeds Research Group.

Australian Weeds Committee

- Provides a mechanism for identifying and resolving weed issues at a national level.
- Facilitates coordination between the Australian Government, the states and territories and other agencies.
- Provides advice to the Natural Resource Management Ministerial Council on weeds issues.
- Plans, coordinate and monitors implementation of the Australian Weeds Strategy; builds links between key stakeholders; identifies potential and emerging weed problems; implements consistent approaches to weed management; and develops a communications strategy for increasing the profile of weed issues.

Appendix 1 The Weeds of National Significance initiative and its phases²

In 2007, an independent review of the WoNS initiative concluded that the nationally strategic approach of WoNS was highly successful in leveraging consistent multijurisdictional activity on high-priority weed species. This initial review was followed by a detailed review of the inaugural WoNS species by the Australian Weeds Committee (AWC) in 2009–10. The AWC reviewed the implementation of the 20 WoNS national strategies and, in light of achievements for these 20 species, considered the capacity for national coordination of additional WoNS species.

Following the reviews, the Natural Resource Management Ministerial Council (Resolution 15.7, 21 May 2009) endorsed a three-phased approach to national management of WoNS species (Figure 4). This ‘phased approach’ aims to provide the most cost-effective use of limited ‘national coordination’ resources.

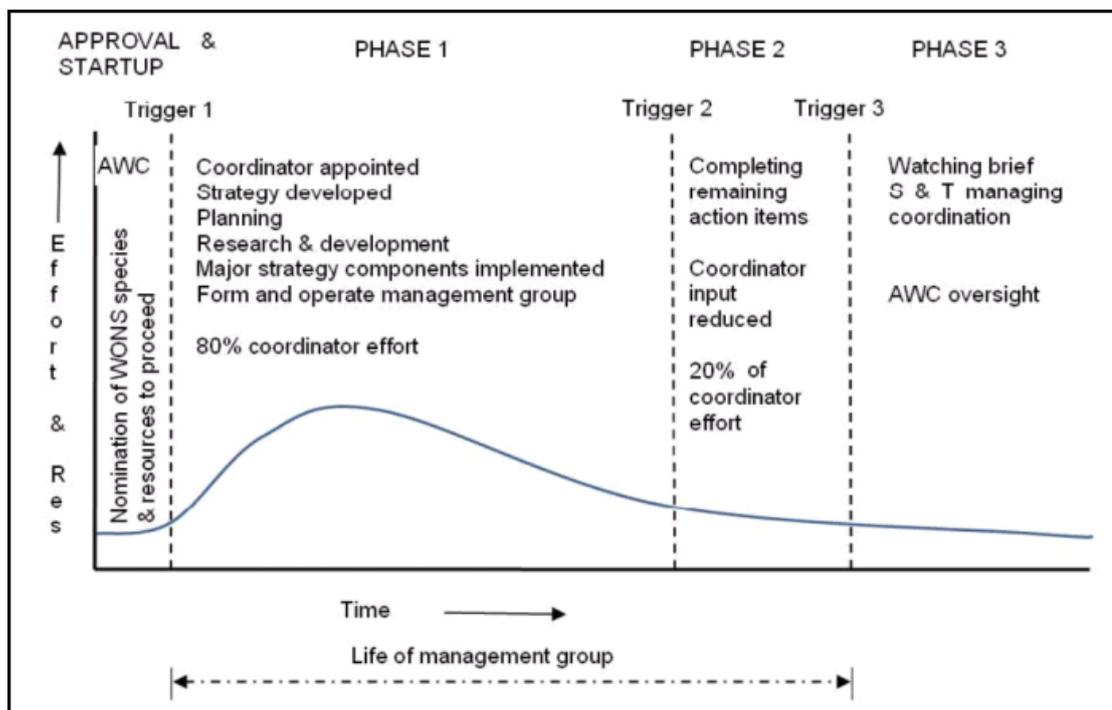


Figure 4 Australian Weed Committee diagrammatic representation of coordinator effort and resource use when implementing a Weeds of National Significance strategy

The phased approach recognises the need for reduced national coordination (‘phasing down’) of WoNS species that are under effective national management, and allows for further weed species to be nominated for consideration as additional WoNS. The AWC is implementing these reforms, and national coordination of the inaugural 20 WoNS species

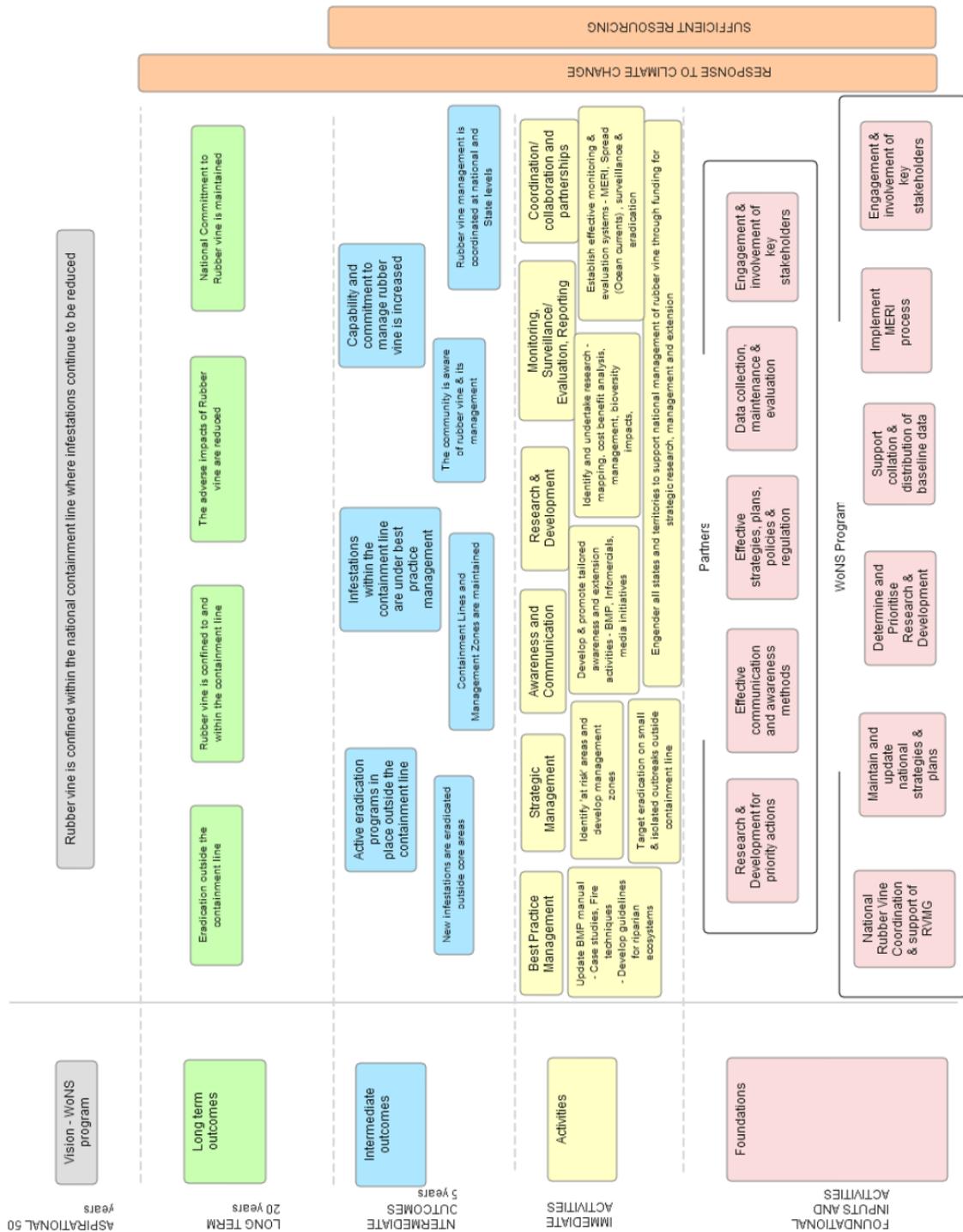
² Adapted from Thorp 2012, *Additional list of Weeds of National Significance*, <www.org.au/WoNS>.

has already transitioned to phase 2 or 3, depending on the species. No species have yet been removed from the WoNS list. The AWC is developing a protocol to guide future decisions about when this should occur on a case-by-case basis.

In 2010, jurisdictions nominated additional candidate WoNS species. These species were independently assessed, and the AWC endorsed 12 additional 'species' to be listed as WoNS. The AWC Chairman, Dr Jim Thompson, announced these additional plant species as WoNS on 20 April 2012. Additional information on the selection of these species and the phased approach is available on www.weeds.org.au/WONS.

Appendix 3 Program logic model for the rubber vine strategic plan

Program Logic for revised Rubber Vine National Strategy



References and further reading

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