

WEEDS OF NATIONAL SIGNIFICANCE



Fireweed

(Senecio madagascariensis)

Strategic Plan
2012 to 2017

© Commonwealth of Australia and the Australian Weeds Committee, 2012

ISBN [to be completed by secretariat]

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

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, their management committees and copies of the strategy.

This strategy was developed under the leadership of the Bronwen Wicks [Department of Primary Industries], New South Wales] 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: Australian Weeds Committee, Canberra

For further information contact:
Secretariat
Australian Weeds Committee
[Insert contact details of AWC]

Publication date: [Month] [2013]

Copies available from:
NSW Department of Primary Industries
Locked Bag 21
ORANGE NSW 2800

www.weeds.org.au/WoNS/fireweed/

Preferred way to cite this publication:

Australian Weeds Committee (2012) *Weeds of National Significance Fireweed (Senecio madagascariensis) Strategic Plan*. Australian Weeds Committee, Canberra.

Cover design by: TBA

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

CONTENTS

EXECUTIVE SUMMARY	1
VISION /ASPIRATIONAL GOAL	2
1 THE CHALLENGE	2
2 INTRODUCTION	3
2.1 Principles underpinning the plan	3
2.2 The current situation	5
2.3 Strategic plan development	6
2.4 Relevance to other strategies	6
3 STRATEGIC GOALS AND OBJECTIVES	8
3.1 GOAL 1: New fireweed infestations are prevented from establishing	10
3.2 GOAL 2: Established fireweed infestations are under strategic management	12
3.3 GOAL 3: Capability and willingness to manage fireweed is increased	14
4 STAKEHOLDER ROLES AND RESPONSIBILITIES	18
5 MONITORING EVALUATION REPORTING AND IMPROVEMENT	21
5.1 Targets and Measures	21
5.2 Program Logic Model	24
6 TECHNICAL BACKGROUND	25
6.1 Fireweed and its identification	25
6.2 Fireweed biology and ecology	25
6.3 Fireweed distribution and spread	26
6.4 Control options	26
6.5 Chemical and physical control	26
6.5.1 <i>Biological control</i>	27
6.5.2 <i>Other control options</i>	27
6.6 Quarantine and legislation	28
7 APPENDICES	30
7.1 Weed control contacts	30
7.2 The WoNS Program and its phases	31
7.3 Other information sources	32
7.4 Glossary	32
7.5 References and Further Reading	32

EXECUTIVE SUMMARY

Fireweed has recently been identified as a Weed of National Significance (WoNS). This National Fireweed Strategic Plan has been developed in response to the WoNS listing and provides a national framework designed to support the coordination and effectiveness of all our efforts to reduce the impact of fireweed and limit its further spread.

Fireweed has been listed as a WoNS because of its invasiveness, potential to spread, impact on the grazing industry (including toxicity to livestock) and the environment and socio-economic costs. Fireweed is a serious pasture weed of temperate and subtropical coastal areas of southeast Australia, first collected in the lower Hunter Valley of New South Wales in 1918.

Since introduction fireweed has spread throughout coastal New South Wales, Queensland, with sightings in East Gippsland in Victoria, Atherton Tablelands in Queensland and the Monaro, Central and Northern Tablelands in New South Wales. It is able to grow on most soil types, in all aspects. Fireweed seeds prolifically and grows to maturity quickly, germination to flowering and seed set can occur between six to 10 weeks. The weed can spread very quickly as seeds are small and can germinate immediately after dispersal. This rapid development may enable several generations of fireweed per growing season and makes long-term eradication very difficult.

The plant contains pyrrolizidine alkaloids, which are toxic to livestock and can cause liver damage.

Several key challenges have been identified in developing this strategy, including:

- The rapid rate of spread of fireweed once it is identified in a new region
- Different perceptions of fireweed by stakeholder groups – ranging from being a major community concern in areas with more recent incursions, to being accepted as part of standard agricultural practice in areas with long-term fireweed
- Stakeholder groups require access to different management information depending on whether fireweed is a new incursion, established long-term in the district, land capability and location
- The perception that biological control may provide the silver bullet for managing fireweed
- In areas where fireweed has reached the limit of its range the weed management emphasis is to reduce the impact and density to an acceptable level via best practice agronomic, grazing and integrated weed management approaches.

This national strategy seeks to address these issues by identifying actions to:

- Support and enhance the identification and control of new fireweed incursions as soon as possible
- Investigate ways to actively engage governments, organisations and land managers in best practice management of fireweed
- Develop accessible and appropriately targeted best practice information materials, including specific fact sheets, and make available to land managers
- Acknowledge fireweed concerns can be symptomatic of much broader and challenging land management, economic and social issues that will require all stakeholders to work together and a long-term commitment
- Support the continuation of biological control research for fireweed.

The strategic plan aspires to deliver on three key outcomes:

1. New fireweed infestations are prevented from establishing
2. Existing fireweed infestations are under strategic management
3. Increase capacity and willingness to manage fireweed

Vision /Aspirational Goal

The vision of this strategy is :

To prevent further establishment of fireweed and minimise the negative impact of fireweed on primary production, the environment and land managers.

1 THE CHALLENGE

Fireweed is regarded as a nationally significant weed because of its invasiveness, potential to spread, impact on the grazing industry (including toxicity to livestock) and the environment and socio-economic costs. Fireweed is a serious pasture weed of temperate and subtropical coastal areas of south-east Australia, and is able to grow on most soil types and in all aspects. It seeds prolifically and grows to maturity quickly – germination to flowering and seed set can be 6 - 10 weeks. Fireweed can spread very quickly; seeds are small and can be wind-blown, or spread by machinery, livestock or feed. Seeds can germinate immediately after dispersal. This rapid development may enable up to four distinct generations of fireweed per growing season and makes long-term eradication very difficult.

The plant contains pyrrolizidine alkaloids (PAs) which are toxic to livestock and can cause liver damage. Horses and cattle are most affected, while goats and sheep seem better able to tolerate the toxin. Fireweed is also very similar in appearance to several native *Senecio* species, such as *S. pinnatifolias*, which also contain alkaloids.

The potential range of fireweed (based on best available modelling) includes a significant expansion of range into inland NSW, and potential major spread into Queensland and Victoria. (See Map 2 in the appendices).

The continuing spread and impact of fireweed is a cause a major community concern, especially in areas with more recent incursions of fireweed, such as the Bega Valley and Dorrigo tableland (NSW), south-east Queensland and East Gippsland (Vic). The fireweed concerns in these areas are symptomatic of much broader and challenging land management, economic and social issues that require all stakeholders to work together, including all levels of government, farmers/land managers and the community in general.

In other coastal areas, where fireweed has been established for several decades, it is in the main considered to be part of the agricultural landscape and its management incorporated into regular production activities. The range of different perceptions of fireweed by stakeholder groups is a key challenge for engaging organisations and land managers in best practice management of fireweed.

Once fireweed spreads into a new region it can move rapidly, increasing its spread and distribution, due to its rapid maturity and opportunistic response to environmental conditions. Most easily identified by its characteristic yellow flower, fireweed is difficult to treat at this stage with herbicide, and is already capable of producing viable seed for future germination. Emphasis on increasing awareness of fireweed and its early identification are critical components of a national strategy to limit the rate of spread. A key challenge is to identify and control new fireweed incursions as soon as possible.

In coastal or other regions where fireweed has reached the limit of its distribution the objective is to decrease the impact of fireweed by best practice agronomy, grazing strategies and other land management approaches to maintain groundcover and enhance competition. The challenge in these areas is to have accessible and appropriately targeted best practice information materials, available to all land managers. Research into potential biological control agents is important to ensure all management options are fully investigated.

2 INTRODUCTION

The National Fireweed Strategic Plan has been developed to provide a framework for the coordinated management of fireweed (*Senecio madagascariensis*) across Australia. The plan provides a five year time frame to achieve the priority actions necessary to help prevent further spread, reduce its impact and increase the capacity of stakeholders to manage fireweed. The plan seeks to complement existing weed management strategies and initiatives from a local to national level, including the Australian Weeds Strategy.

2.1 Principles underpinning the plan

The Weeds of National Significance (WoNS) Strategic Plans provide a framework for the coordinated management of WoNS species. These plans represent the shared vision of all stakeholders, including States/Territories and the Australian Government, and form a critical component of the national weed management effort. The WoNS program 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 are allocated to the achievement of more strategic management outcomes.

The Australian Weeds Strategy (AWS) sets the national direction with relation to weeds. WoNS strategic plans are based on recognition and acceptance of seven principles outlined in the AWC (NRMMC 2006).

This strategic plan is based on the seven principles of the Australian Weeds Strategy:

1. 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
2. Combating weed problems is a shared responsibility that requires all parties to have a clear understanding of their roles
3. Good science underpins the effective development, monitoring and review of weed management strategies
4. Prioritisation of and investment in weed management must be informed by a risk management approach
5. Prevention and early intervention are the most cost-effective techniques for managing weeds
6. Weed management requires coordination among all levels of government in partnership with industry, land and water managers and the community, regardless of tenure
7. Building capacity across government, industry, land and water managers and the community is fundamental to effective weed management.

In addition to the AWS, WoNS strategic plans are also aligned to the 2012 Intergovernmental Agreement on Biosecurity (IGAB; COAG 2012), which outlines national invasive species management objectives. IGAB aims to enhance Australia's biosecurity system by fostering a collaborative approach to minimise the impact of pests across the biosecurity continuum, including 'a national management framework to ensure that nationally significant pests and diseases established in Australia are contained, suppressed or otherwise managed.' WoNS can contribute to this aim by facilitating coordinated, strategic management of nationally significant weeds.

IGAB principles highlight the importance of managing invasive species across the biosecurity continuum. The 'One Biosecurity' report (Beale et al. 2008) also recognises that weeds and other invasive species are biosecurity threats that are most effectively managed in a collaborative manner across this continuum. This includes a 'spatial continuum' of pre-border,

border and postborder, as well as a 'management continuum' that spans prevention, eradication, containment and asset protection, depending on the scale of weed invasion.

In most instances, complete control of widespread weeds (i.e. eradication) of long-established weeds and other invasive species is unachievable. However, well researched, strategic and coordinated management approaches can reduce current and potential impacts and provide a good return on investment. Effective widespread weed management requires an approach that spans the biosecurity continuum (Figure 1).

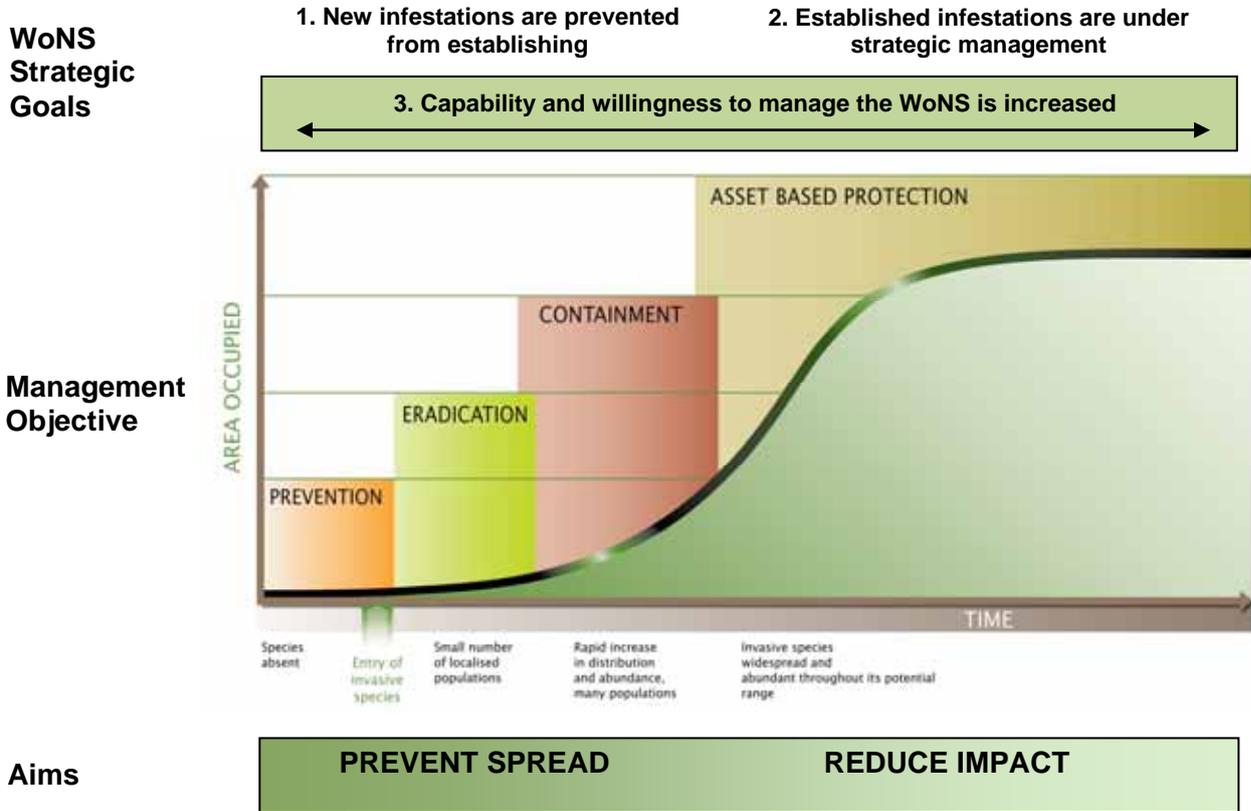


Figure 1. Biosecurity continuum - Stages of weed invasion with corresponding goals, management objectives and actions at each stage. Modified from Hobbs and Humphries (1995) and DPI (2010).

This includes spread prevention practices and eradication of outlying infestations to protect environments where the weed has not yet taken hold, establishment and defence of containment lines to halt or reduce the rate of spread; and the identification and protection of key environmental, social and economic assets in areas where the weeds are already widespread. Paired with these efforts is the need for strong education, extension and capacity building programs, and support mechanisms to ensure on-ground outcomes are achieved.

A Monitoring, Evaluation, Reporting and Improvement (MERI) framework (see section 5) outlines some of the key areas of evaluation for fireweed.

The program logic diagram in section 5.2 outlines how the actions within this plan will contribute to the attainment of medium to long term outcomes. The logic model also identifies the foundational activities required to build a successful national fireweed program where results can be measured and reported on.

2.2 The current situation

Fireweed was first introduced to Australia in the Hunter Valley region of New South Wales around 1918. By the 1980's the weed had spread north and south in coastal NSW and southern Qld, establishing in temperate and subtropical pastures. Since the 1980's, the weed has invaded grazing areas along the far south coast of NSW around Bega, the southern and northern tablelands of NSW and in northern Qld on the Atherton tablelands. Isolated occurrences have also been reported in East Gippsland in Victoria (see Figure 2).

It is predicted that fireweed will continue to spread into cooler southern and highland regions of temperate Australia (see Figure 3). New incursions are being found regularly in the NSW tablelands and to a lesser extent in bordering Victoria.

Figure 2 : Recorded distribution of fireweed in Australia (2012)

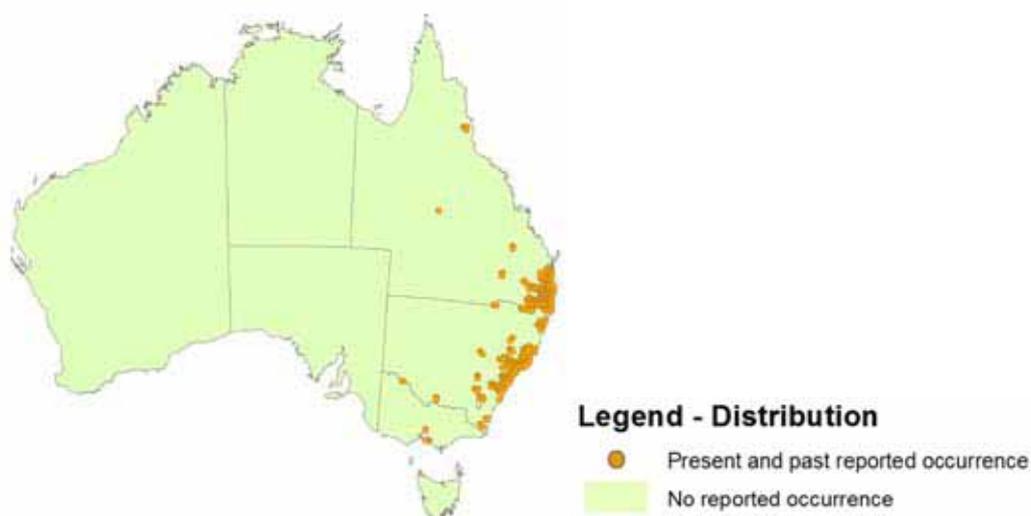
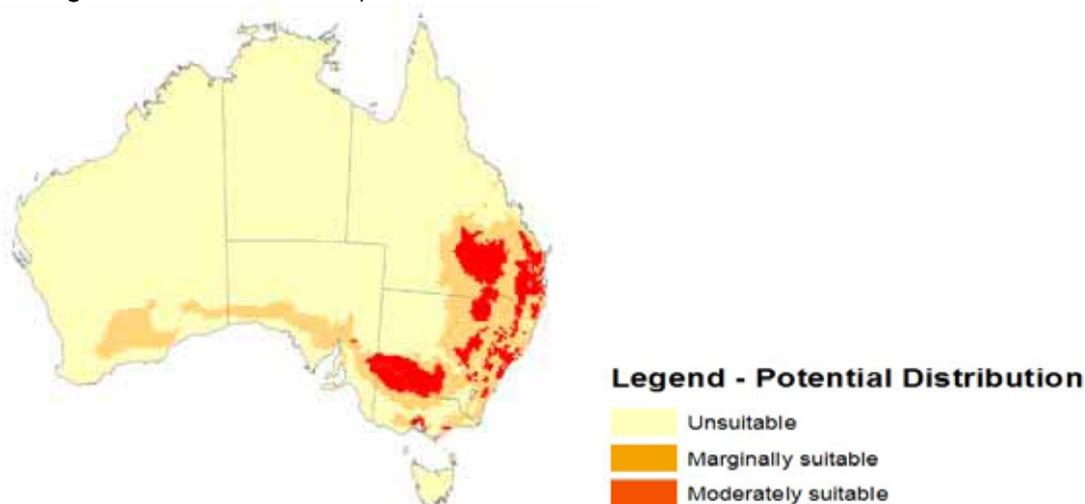


Figure 3 : Potential distribution of fireweed in Australia (map generated with Climatch modelling from ABARES, 2012)



There is a wide range of views amongst stakeholders about the importance of fireweed as a weed issue and the extent of impact that fireweed has on pastures and agricultural production. Communities are generally concerned about fireweed in regions where fireweed has spread more recently -- such as Bega in southern NSW, Dorrigo in northern NSW, East Gippsland in Victoria and south-east Queensland. Farmers and extension advisors in areas with longer-term established fireweed populations (e.g. since the 1950's) in general see its management as part of standard agricultural practice.

Many of the concerns about fireweed and its spread reflect much broader and challenging land management, economic and social issues that require all stakeholders to work together and persist over the longer-term.

Some farmers and community groups consider more weed regulation is an answer to effective fireweed control, on the assumption that people will control their weeds when threatened, or issued with a weed notice. This emphasis can further divide communities and may do very little for weed management in the long-term. This view, however, voices the frustration of farmers who are good managers being affected by the inaction or poor action of their neighbours. It raises the perennial issue with effective weed management of how to engage all stakeholders/ land managers in better management and move from information into action.

In areas where fireweed has reached the limit of its range the broader issue is to reduce the impact and density to an acceptable level via best practice agronomic, grazing and integrated weed management approaches. In areas which have potential for fireweed the issue is to raise awareness of fireweed, support early surveillance, increase identification skills and support good land management practices such as agronomic, grazing and integrated weed management approaches.

Personal anecdotal experiences with fireweed can spread quickly in this age of social media and new technologies. The challenge for extension services and information products is to enter into this space appropriately and to provide well targeted and accessible information. Best practice information needs to be accessible. This presents a further challenge with decreasing public funding of agricultural extension services.

Fireweed is a declared noxious weed in parts of New South Wales, Queensland and the Australian Capital Territory.

2.3 Strategic plan development

The first draft of the National Fireweed Strategic Plan was developed by the national coordinator after a review of existing literature combined with a strategic planning workshop which was held on the 1 and 2 May 2012 in Coffs Harbour. This workshop brought together 10 representatives from key fireweed stakeholder groups from New South Wales, including farmers, local government, state government (DPI – policy and agronomy; LHPA - veterinary) and researchers, and included agronomic, veterinary, farm business and weed control and coordination perspectives. Many other people with an interest in fireweed were contacted during the course of organising the workshop, and their views were noted and also taken into account when developing the strategy.

Additional stakeholder contributions were obtained through joint WoNS regional/state workshops and consultation sessions held in NSW, Queensland and South Australia. A draft strategy was submitted to the Australian Weeds Committee for comment by all States and Territories in July 2012, prior to being made available for public comment and contribution via a 30-day public consultation period. All comments received during the public consultation phase were considered and reviewed, with changes being made to the strategy where this added constructively to the document. The revised plan was endorsed by the Australian Weeds Committee in 2013.

Copies of this national strategy are available via the www.weeds.org/WoNS/fireweed website.

2.4 Relevance to other strategies

The Australian Weeds Strategy (AWS) provides national direction on weed management issues. Weeds of National Significance (WoNS) are a significant component of the

implementation of the AWS, and actions in the National Fireweed Strategic Plan. While this strategic plan directs national action for one WoNS, objectives in this strategy are common to all WoNS and many actions will be common across WoNS strategic plans. These actions will be more effectively implemented through collaborative, strategic efforts by all stakeholders, supported through national coordination.

Successful implementation of the National Fireweed Strategic Plan relies on the alignment of actions and objectives with those of national to local level strategies and plans, and coordination with relevant weed plans at other levels of government and planning (state, regional and local).

The table below (Table 1) briefly summarises the planning context that the national strategy sits within.

Table 1. Relevance to other weed-related strategies – the national context

Scale	Strategies and Plans
National	Intergovernmental Agreement on Biosecurity Australian Weeds Strategy 2007 National Fireweed Strategic Plan
State	State/territory pest management invasive species and biosecurity strategies. Biosecurity strategies
Regional or Catchment	Regional weed management plans. NRM weed or invasive species plans.
Local	Local government weed or pest management plans, weed control plans, landcare.
Property	Property Pest/weed Management Plans

3 STRATEGIC GOALS AND OBJECTIVES

Three high level strategic goals have been identified and applied across all the new Weeds of National Significance (WoNS). The goals, listed below, reflect best practice understanding of strategic weed management and have been applied successfully and refined in previous WoNS national strategies.

1. **New infestations are prevented from establishing.**
2. **Established infestations are under strategic management.**
3. **Greater capability and commitment to manage fireweed**

These goals align with the key weed management actions described in the biosecurity continuum – prevention; eradication, containment; and asset protection (see figure 1), and acknowledge the need to manage fireweed across the biosecurity continuum.

Table 2. Strategic goals and objectives

Strategic Goal	Objectives
1. New fireweed infestations are prevented from establishing.	1.1 Invasion vectors, sources and pathways are identified and managed to prevent or reduce spread
	1.2 Surveillance and response mechanisms are ensuring timely detection of infestations (both new and previously detected)
	1.3 Spread from the core is reduced and priority outlier infestations are contained or eradicated
2. Established fireweed infestations are under strategic management. ** Priority assets defined to include: agricultural, other productive land-use, water catchment/s, rural life style /recreation.	2.1 Priority assets** are benefiting from long-term strategic weed control programs
3. Greater capability and commitment to manage fireweed	2.2 Integrated weed and land management practices are improving sustainable production and community wellbeing
	3.1 Infestations are mapped to national standards and to a level which is sufficient to inform decision making
	3.2 Best practice management delivers efficient, effective & long-term control
	3.3 Capability & motivation to manage are enhanced by education & awareness
	3.4 Research priorities are identified, promoted, addressed & informing prevention and management (Goals 1 & 2)
	3.5 Local to national planning incorporates strategic priorities for WoNS
	3.6 Stakeholders are committed and able to effectively deliver the strategic plan
	3.7 Appropriate policies, codes of practice, legislation & enforcement are supporting strategic management objectives
3.8 The national strategic plan is relevant & effective	

Actions in this plan have been prioritised according to the following criteria:

Priority 1 - Critical to the success of the strategy;

Priority 2 - Highly beneficial and will contribute significantly to success of the strategy;

Priority 3 - Desirable, still beneficial, but not critical to success of the strategy.

Whole of WoNS activities

Some actions in the plan may be relevant for other WoNS species. Whilst there may be a species specific component to the action there is scope to work collaboratively/cross WoNS on some actions. These actions are identified with an asterisk (*) in the following tables.

Collaborative decision making by responsible partners

Aspirational objectives in this plan are supported by strategic actions that identify how the objectives can be achieved. In most cases, further work will be needed to refine the actions and/or develop a means of implementing the actions. This work will be done in a consultative manner with all responsible partners.

Decisions regarding national priority actions will be led by a national management group, in collaboration with responsible partners and other relevant stakeholders. For most actions, these decisions are yet to be made and will rely on further collation of distribution data, risk assessment and due consideration of relevant legislation and policy. Final endorsement of priority actions will occur via the Australian Weeds Committee.

Acronyms used throughout

AWC = Australian Weed Committee

LCA = Local control or weed authorities

NFMG = National fireweed management group

NRM = Natural resource management

RWC = Regional weed committee's

3.1 GOAL 1: New fireweed infestations are prevented from establishing

Prevention and early detection are the most effective way to manage and control weeds. While WoNS are, by definition, widespread in Australia, there are significant areas that remain free of fireweed. Goal 1 aims to protect these clean areas by preventing further spread of fireweed and encouraging a rapid response to new incursions. This includes identifying and managing pathways of spread, determining risk of future invasion and implementing targeted hygiene and surveillance programs to prevent spread. A range of early detection tools are available to help build capabilities of weed managers and the community to monitor weeds.

The first strategic goal also contains actions to address new incursions and outlier infestations, as well as preventing spread from core infestations, through eradication or containment programs.

Note: Some of these actions have been progressed to some degree as part of broader weed programs.

Objective	Actions	Priority	Responsible Partners
1.1 Invasion vectors, sources and pathways are identified and managed to prevent or reduce spread	1.1.1 Review, update and prioritise pathways of spread for fireweed.	1	State/ Territory govt, NFMG, RWC, LCAs, research
	1.1.2 Ensure fireweed is incorporated into hygiene materials/protocols, and develop where needed, a hygiene protocol which include: hay/silage issues, farm hygiene principles, internal quarantine of livestock and feed, use of declarations, movement between farms and within farms.	2	State/ Territory govt, NRM, industry, research, NFMG, LCAs
	1.1.3 Establish education and awareness programs that target high risk pathways and vector of spread, and cover good hygiene practices for weed management. Target groups include: <ul style="list-style-type: none"> • contractors • absentee landholders • full time farmers • small farms • turf producers Also include native plant nurseries & propagators to avoid confusion as a 'native' daisy.	1	State/ Territory govt, agronomists, NRM, industry, NFMG, LCAs
	1.1.4 Collate existing information and promote better understanding of fireweed seed dispersal and its spread – the role of wind, animals & vehicles – to assist surveillance activities.	1	Research
	1.1.5 Investigate developing a code of practice for farm and earth-moving contractors to cover general weed (including fireweed) spread risk issues.	2	State/ Territory govt, NFMG, RWCs, LCAs, research

Objective	Actions	Priority	Responsible Partners
1.2 Surveillance and response mechanisms are ensuring timely detection of infestations (both new and previously detected)	1.2.1 Identify priority and high risk regions for fireweed monitoring and surveillance. <Links to 3.1 mapping>	1	State/Terr govt, NFMG, RWCs, LCAs, research
	1.2.2 Develop and distribute an awareness program for high risk fireweed areas, including: <ul style="list-style-type: none"> An identification and 'alert' kit to communities/networks in high risk regions. 	1	NFT, State/ Territory govt, NRM, agronomists, LCAs
	1.2.3 Encourage implementation of complementary regional inspection/ surveillance programs across all states.	1	State/ Territory govt, RWCs
	1.2.4 Build capacity of existing weed, NRM and community networks to assist weed reporting.	2	State/ Territory govt, LCAs, RWCs
1.3 – Spread from the core is reduced and priority outlier infestations are contained or eradicated	1.3.1 Identify and define priority outlier fireweed populations, and prioritise based on risks of further spread, potential impacts and management feasibility.	1	State/Territory govt, NRM, RWCs, LCAs, NFMG
	1.3.2 Develop and support implementation of control and reduction of spread programs for high priority outlier sites.	1	State/Territory Govt, LCAs, NRM
	1.3.3 Scope and investigate fireweed climatic and agronomic 'triggers' – such as late rainfall, dry summers, poor pasture cover – that may predict a serious year for fireweed infestations. (A trigger year may stimulate pre-emptive agronomic and extension action/s.)	2	Research
	1.3.4 Collate and develop web based information and make available on website/s (WoNS & state DPI's); utilise new information technologies where relevant. (Include photos of all growth stages, leaf variations, similar species.)	1	State/Territory govt, agronomists, research, NFMG
	1.3.5 Scope, and review for case-studies, successful approaches and techniques to reducing fireweed infestations. (Include land management context, property planning, economic impact, not just reliance on herbicides.) <links to 3.2>	2	NFMG, State/Territory govt, agronomists, research

Priority

- 1 = critical to the success of the strategic plan
2 = highly beneficial and will contribute significantly to success of the strategy
3 = desirable, still beneficial, but not critical to success of the strategy

DPI = Dept of Primary Industry/s
LCA = Local control authorities
NFMG = National fireweed management group
NRM = Natural resource management
RWC = Regional weed committee's
WoNS Coord = national WoNS coordinator/s or WoNS coordination role (post 30 June 2013)

GOAL 2: Established fireweed infestations are under strategic management

This goal aims to reduce the impact of fireweed within its core distribution. Where infestations are established, a strategic and targeted approach is required to best direct available resources effectively. Large, un-eradicable infestations, also known as 'core' infestations, are areas where fireweed cannot be eradicated and weed control programs shift focus to protecting assets and reducing impacts of fireweed, rather than containing spread and eradication. Identifying priority assets and developing cross-tenure plans and partnerships to protect these assets are key actions needed to achieve this Goal. For the purpose of this strategy priority assets are defined as including: agricultural assets, other productive land-use, water catchment/s, rural life style /recreation assets as well as environmental assets. Integrated weed and land management practices to reduce the impact of fireweed, and improve sustainable production and community wellbeing are another important aspect of this goal.

An effective asset protection approach requires better understanding of the impacts of current fireweed control technologies on the asset.

(Note: Biological control research is included under Objective 3.4 of this strategy.)

Objective	Actions	Priority	Responsible Partners
2.1 Priority assets** are benefiting from long-term strategic weed control programs <i>**assets include: agricultural, other productive land-use, water catchment/s, rural life style /recreation.</i>	2.1.1 Define, identify (where able) priority assets under threat from fireweed, predominantly agricultural and productive assets. <links 2.2>	1	NFMG, State/Territory govt, NRM groups, LCA's, community, land managers
	2.1.2 Develop a prioritisation process for assets at risk to guide investment and management for core infestations.	1	NFMG, State/Territory govt, NRM groups, LCA's, community, land managers
	2.1.3 Engage and/or support stakeholders, including land managers and community groups, to develop and implement management plans to protect high priority assets.	1	NFMG, State/Territory govt, NRM groups, LCA's, community, land managers
	2.1.4 Undertake long-term monitoring of asset condition (bench-marking) over a range of years, to enable the benefit of actions to be assessed.	2	State/Territory govt, NRM groups, LCA's, RWC
2.2 Integrated weed and land management	2.2.1 Collate, and promote, current control options, agronomic and integrated weed management approaches for fireweed.(Include herbicide registration)	1	State/Territory govt, agronomists, research.

Objective	Actions	Priority	Responsible Partners
practices are improving sustainable production and community wellbeing	2.2.2 Provide education and investigate incentives to assist land holders and managers implement integrated weed and landscape management practices, e.g.:		State/Territory govt, NRM groups, LCA's, RWC, NFMG.
	<ul style="list-style-type: none"> Better understanding of role of sheep in managing fireweed and the pasture, fencing & husbandry requirements <Fact sheet> 	1	
	<ul style="list-style-type: none"> Investigate thresholds of benefit (both economic and environmental) for herbicides and other management options. (E.g.: 'when do I spray?') 	1	
	<ul style="list-style-type: none"> What is an acceptable population of fireweed? And in what area?? 	1	
	<ul style="list-style-type: none"> Plain English information on the biology of fireweed. 	1	
	Investigate incentives such as free disposal of fireweed at tips.	2	
	2.2.3 Review and analyse pyrrolizidine alkaloids (PA) literature. Provide information in accessible easy-to-read format, such as FAQs. Include:	2	Research, State/Terr govt, national coordinator/s.
<ul style="list-style-type: none"> Toxicity to humans, Impacts on livestock -horses, cows, sheep & goats. 			
2.2.4 Support the development and publicise grazing strategies to maximise effectiveness, reduce fireweed but support the pasture base by farm/land-use type. (To include cattle/sheep/goats.)	2	Research, State/Terr govt, (agronomy)	
2.2.5 Support the development and publicise optimal herbicide strategies – to kill weed and stop seed production – by region, land-use and climatic/ land type context.	2	Research, State/Terr govt	
2.2.6 Support development of strategies to reduce seed production and spread	2	Research, State/Terr govt	
2.2.7 Engage local industry groups (including dairy) to assist with information distribution.	3	State/Terr govt, LCAs, Industry	

Priority

- 1 = critical to the success of the strategic plan
2 = highly beneficial and will contribute significantly to success of the strategy
3 = desirable, still beneficial, but not critical to success of the strategy

DPI = Dept of Primary Industry/s
LCA = Local control authorities
NFMG = National fireweed management group
NRM = Natural resource management
RWC = Regional weed committee's
WoNS Coord = national WoNS coordinator/s or
WoNS coordination role (post 30 June 2013)

GOAL 3: Capability and willingness to manage fireweed is increased

The third strategic goal sets an agenda to support the capability and willingness of stakeholders to effectively and efficiently implement the first two goals. This includes the provision of best practice management information, national mapping, education and awareness, identification and promotion of priority research and research findings, and more. This goal also provides means to support the progress of broader actions which don't easily fit into either Goal 1 or Goal 2, such as promoting development of biological control options for core infestations.

Goal 3 aims to build the capacity and willingness to manage fireweed. National mapping will improve our understanding of distribution and will serve as an important decision support tool. The development and provision of best practice materials are key components of building the skills base required for effective fireweed management. Research into improved control methods and other key areas will help develop more effective and affordable control options. Finally, integration of the key priorities of this plan into state and regional weeds and NRM plans will help build commitment and effective use of resources.

Objective	Actions	Priority	Responsible Partners
3.1 Infestations are mapped to national standards and to a level which is sufficient to inform decision making	3.1.1 Encourage survey and mapping of outlying populations of fireweed (at national scale) to ensure correct identification and enable prioritisation.	1	LCA's, herbarium/s, research
	3.1.2 Refine/ produce revised national distribution maps that include strategic management actions (eg eradication targets or containment zones).	1	NFMG, State & Territory Govts, Aust Govt.
	3.1.3 Support utilisation of national weed information, mapping systems, and national mapping parameters (including density/area, unusual management issues) for mapping fireweed. (NOTE: Mapping parameters need to be flexible to cover the range of high and low density fireweed years.)	2	State & Territory Govts, LCAs, RWC, land managers
	3.1.4 Support development of distribution maps of native <i>Senecio</i> species to aid identification.	3	State & Territory Govt, NFMG, herbariums
	3.1.5 Review and revise existing national potential distribution fireweed map to ensure it provides the best science-based projection.	2	Research.
3.2 Best practice management delivers efficient, effective & long-term control	3.2.1 Collate and review current control options and identify key knowledge gaps (for both Goal 1 and 2).	1	State & Territory Govts, research, national coordinator/s
	3.2.2 Review existing fireweed extension/ information resources to assess whether they meet on-ground information, inspection and ease of delivery needs. <Identify gaps for delivery of best practice extension. (links 3.3) >	1	State & Territory Govts, LCAs, RWC, land managers, national coordinator/s

Objective	Actions	Priority	Responsible Partners
	<p>3.2.3 Develop best practice manual or materials for fireweed management. Key focus topics are:</p> <ul style="list-style-type: none"> • Integrated weed management • Agronomy for better pasture management • Promote a farming systems approach • Factual review & analysis of PAs • Role of sheep in management (2.2) • Thresholds of benefit (2.2) • Biology of fireweed • Realistic goals for management • Impact on other environments/ biodiversity 	1	State & Territory Govts, research, agronomists, national coordinator/s, NFMG
	3.2.4 Document, develop and promote education materials (such as case studies) of successes for different regions, management approaches and industries.	1	State & Territory Govts, LCAs, RWC, national coordinator/s
	<p>3.2.5 Develop & promote realistic goals and key messages for management of fireweed:</p> <ul style="list-style-type: none"> • What can be achieved – for given land capability & intensity of infestation. • Total eradication is not possible. • Need to acknowledge what is an 'acceptable population'. 	1	State & Territory Govts, agronomists, NRM
3.3 Capability & motivation to manage are enhanced by education & awareness	3.3.1 Identify gaps for delivery and uptake of best practice extension materials. (links 3.2)	1	State & Territory Govts, LCAs, RWC, land managers, national coordinator/s
	<p>3.3.2 Coordinate and promote extension events, such as:</p> <ul style="list-style-type: none"> • demonstration sites, • information days • kits for weeds officers, eg for shows and other events 	1	State & Territory Govts, LCAs, RWC, land managers, national coordinator/s
	3.3.3 Ensure information delivery is achieved. (literature review of best practice, and delivery of extension material).	2	State & Territory Govts, Industry, LCA, national coordinator/s
	3.3.4 Investigate weed awareness to schools as part of education package.	3	National coordinator/s s
3.4 Research priorities are identified, promoted, addressed & informing prevention and management (Goals 1 & 2)	3.4.1 Continue biological control studies & better understanding of the impacts of insects and diseases already on fireweed.	1	Research
	3.4.2 Investigate the difference in impact of fireweed and other native <i>Senecio</i> species (e.g. <i>S. pinnatifolia</i> and <i>S. brigalowensis</i>) (native species occurs widely in SA & Qld.)	2	Research.
	3.4.3 Investigate how many years of 'no seed production' is needed to run down on farm fireweed seed bank.	3	Research

Objective	Actions	Priority	Responsible Partners
3.5 Local to national planning incorporates strategic priorities for WoNS	3.5.1 Integrate, where possible, national strategic objectives and priorities into state and regional plans.	1	National coordinator/s, State & Territory Govt, RWC's, NRM groups, LCA's
	3.5.2 Support/develop management plans and/or processes for cross-tenure, multiple partner control programs.	1	National coordinator/s, State & Territory Govt, RWC's, NRM groups, LCA's
	3.5.3 Investigate the effectiveness of incentive programs to influence effective management outcomes.	1	National coordinator/s, State & Territory gov't, NRM groups
3.6 Stakeholders are committed and able to effectively deliver the strategic plan	3.6.1 Establish a National Fireweed Management Group (NFMG) to provide advice and oversee implementation of the strategic plan (resource dependent)	1	NSW DPI
	3.6.2 Actively communicate and promote the national strategic plan objectives for fireweed (and WoNS program) to enhance exposure.	1	National coordinator/s, NFMG
	3.6.3 Engage with and contribute to existing networks, such as 'Small Farms', both existing and starting up, as a vehicle for distributing weed control information and engagement.	2	State & Territory Govt, landcare, community, LCAs, National coordinator/s.
	3.6.4 Review available information and delivery for specific stakeholder groups (for both Goals 1 & 2): <ul style="list-style-type: none"> New land-holders (including ID information on all growth stages), successful control, 'triggers' for good seasons, Absentee land-holders Small and new farmers (farm enterprises need to incorporate weed management as core business) Coordinate development and distribution of revised information resources, where needed.	2	State & Territory Govt, LCAs, RWCs, NRM, landcare, community, national coordinator/s.
	3.6.5 Review training and education programs for providers of weed extension and regulation functions, with view to updating and broadening skills and knowledge.	2	State & Territory Govt, LCAs, RWCs, NRM, landcare,
3.7 Appropriate policies, codes of practice, legislation & enforcement are supporting strategic management objectives	3.7.1 Review current declaration status and consider pros/cons where necessary to improve management. (include non-Fireweed states)	1	NFMG, State/Territory govts

Objective	Actions	Priority	Responsible Partners
3.8 The national strategic plan is relevant & effective	3.8.1 Coordinate, monitor and review implementation of the national plan. Review of national plan to include consultation with stakeholders in: <ul style="list-style-type: none"> Established fireweed areas Relatively new areas Potential areas. 	1	NFMG
	3.8.2 Report progress to Australian Weeds Committee and other stakeholders.	1	National coordinator/s, NFMG, with contributions from all stakeholders
	3.8.3 Evaluations of the national plan to be available in the public domain.	1	AWC, NFMG

Priority

- 1 = critical to the success of the strategic plan
2 = highly beneficial and will contribute significantly to success of the strategy
3 = desirable, still beneficial, but not critical to success of the strategy

DPI = Dept of Primary Industry/s
LCA = Local control authorities
NFMG = National fireweed management group
NRM = Natural resource management
RWC = Regional weed committee's
WoNS Coord = national WoNS coordinator/s or WoNS coordination role (post 30 June 2013)

4 STAKEHOLDER ROLES AND RESPONSIBILITIES

While land owners and managers are ultimately responsible for the control of fireweed on their land, the effective implementation of this strategy requires the involvement of a range of stakeholders. It is also noted that stakeholders responsibilities may vary between jurisdictions and that some may be optional while others are prescribed by legislation.

The successful achievement of strategy objectives relies on the development and maintenance of partnerships between community, industry and government and a recognition of the roles of each stakeholder. Suggested responsibilities to assist in achieving these are:

Australian Government

- Ensure quarantine controls to prevent importation (DAFF Biosecurity)
- Provide governance processes for the effective delivery of the WoNS initiative
- Promote the status of fireweed as a WoNS, its impacts and the importance of management
- Undertake strategic fireweed control on all Australian government managed lands

Australian Weeds Committee

- Provide a mechanism for identifying and resolving weed issues at a national level
- Facilitate coordination between jurisdictions
- Provide advice to Standing Council on Primary Industries (SCOPI) on weeds issues
- Provide planning, coordination and monitoring of the implementation of the Australian Weeds Strategy
- Oversee the implementation of the activities described in the WoNS strategic plans
- Promote the importance and benefits of the WoNS initiative to all levels of government.

State and territory agencies

- Maintain appropriate legislation and policies to achieve state and territory based objectives for managing fireweed.
- Coordinate fireweed control and management at a jurisdictional level to complement the management and delivery of the National Fireweed Strategic Plan.
- Work closely with local governments, communities and other stakeholders to prevent and minimise fireweed impacts.
- Identify strategic management areas and associated objectives
- Promote consistency with this Strategy in jurisdictional pest management plans
- Facilitate the inclusion of strategic fireweed management in pest management planning processes with secondary stakeholders
- Contribute to priority research initiatives
- Source funding for strategic management programs and research
- Implement monitoring and reporting protocols in line with the MERI plan and provide relevant information to the national taskforce and/or Australian Weeds Committee
- Develop and implement communication and extension plans where appropriate
- Facilitate state and territory level mapping and contribute to national mapping initiatives
- Ensure, where appropriate, participation on the National Fireweed Management Group or similar national taskforce.

National Fireweed Management Group (or similar taskforce)

- Ensure a diversity of community and agency views are represented for effective strategy implementation
- Provide guidance, direction and policy advice for the management of fireweed through the delivery of the strategic plan
- Monitor, evaluate, report and improve strategy implementation
- Assist in the development and implementation of programs and initiatives which support strategic actions

- Maintain and build partnerships with key stakeholders to improve strategic fireweed management
- Identify funding sources and provide independent advice for prospective applicants for projects consistent with the needs of the WoNS strategy.

Research institutions

- Applied research to address priority national strategic requirements
- Identify research gaps and seek innovative solutions for the management of fireweed
- Seek new and on-going funding and support for research requirements

Local governments

- Incorporate national fireweed objectives in relevant pest management plans and monitor implementation
- Administer and enforce legislation where applicable
- Undertake surveying and mapping particularly in relation to outlying fireweed infestations
- Establish local management policies to contribute to strategic control, containment and/or asset protection objectives
- Improve community awareness of impacts and identification; and promote early detection
- Control fireweed on local government managed or owned land
- Source funding and/or contribute to strategic control programs

Natural resource management regions (catchment management authorities)

- Contribute local and regional perspectives to fireweed management
- Contribute to the development, implementation and/or review of local and regional pest management plans
- Promote and contribute to local and regional containment and/or management programs in partnership with relevant stakeholders
- Administer and enforce legislation where applicable (e.g. in SA)
- Support and/or develop fireweed related funding submissions in line with national priorities
- Participate in local and regional mapping initiatives and contribute to state, territory and national map production
- Promote awareness and best practice management through event coordination and product distribution.

Community, conservation and other interest groups

- Contribute local and regional perspectives to fireweed management
- Contribute to the development, implementation and/or review of local pest management plans
- Support and/or develop fireweed related funding submissions in line with national priorities
- Participate in local and regional mapping initiatives and contribute to state, territory and national map production

Industry

- Promote and adopt best practice management of fireweed
- Identify gaps and issues associated with implementation of the fireweed national strategy
- Contribute to research and development of management practices to support industry members
- Ensure awareness of sale and movement restrictions of fireweed within industry members
- Improve community awareness of impacts and identification; and promote early detection.

Private land owners

- Manage and control fireweed on private lands in accordance with State/Territory or local government legislation and policy
- Improve knowledge of the identification, impacts and best practice impacts of fireweed

- Identify fireweed and other weeds threatening the property
- Implement best practice management
- Implement weed hygiene and other management practices to minimise spread of fireweed.

5 MONITORING EVALUATION REPORTING AND IMPROVEMENT

This monitoring, evaluation, reporting and improvement (MERI) framework lists the **minimum** reporting information that should ideally be collected for the life of the strategic plan – including during Phase 3 delivery (see section 7.2). This will ensure that sufficient data is collected to identify successes and failures and provide the opportunity for improvement where outcomes are not being achieved. In addition to these minimum requirements, an annual MERI plan will be developed to measure progress against actions and objectives in more detail.

5.1 Targets and Measures

Strategic Plan Goals	Key Evaluation Questions	Data/Evidence Required	Consider
1. New infestations are prevented from establishing.	To what extent have new infestations been prevented from establishing?	<u>1.1 National distribution data</u> <ul style="list-style-type: none"> 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/info stored? Do they capture national priorities?
		<u>1.2 New infestations</u> <ul style="list-style-type: none"> Number of new outlier infestations¹ recorded. Percentage of known infestations actively controlled. <p>¹ New infestations should be an outlier, outside existing distribution of WoNS</p>	<ul style="list-style-type: none"> Are any new outlier 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? And threats minimised?
		<u>1.3 Eradication & containment programs</u> <ul style="list-style-type: none"> 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? Can include examples using case studies.

		<u>1.4 Legislation</u> <ul style="list-style-type: none"> • Have there been any legislation or policy changes for this species? • Has a need for legislative change been identified by stakeholders? 	<ul style="list-style-type: none"> • Are minimum requirements being maintained (e.g. ban on sale, trade, movement)? • Is control required throughout or in part of jurisdiction? • Is compliance actively enforced?
		Overall progress rating	
2. Existing infestations are under strategic management.	To what extent is integrated weed management effectively managing core infestations?	<u>2.1 Integrated Weed Management</u> <ul style="list-style-type: none"> • How effective are IWM programs? 	<ul style="list-style-type: none"> • Are existing tools providing adequate control of WoNS? • Have new advances/technologies been developed and are they incorporated into BPM 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?	<u>2.2 Asset protection</u> <ul style="list-style-type: none"> • Number of priority assets identified as 'at risk' from WoNS? • Percentage of priority assets being protected (eg assessed against relevant Threat Abatement Plans)? • Percentage of state/regional invasive species plans that identify priority assets at risk from WoNS? 	<ul style="list-style-type: none"> • Response should include status report on progress towards asset protection programs. • 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?
		Overall progress rating	
3. Greater capability and commitment to	To what extent has the capability and commitment to manage WoNS	<u>3.1 Community engagement & awareness</u> <ul style="list-style-type: none"> • What is the status of best practice information? • Are partnerships being maintained to ensure 	<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

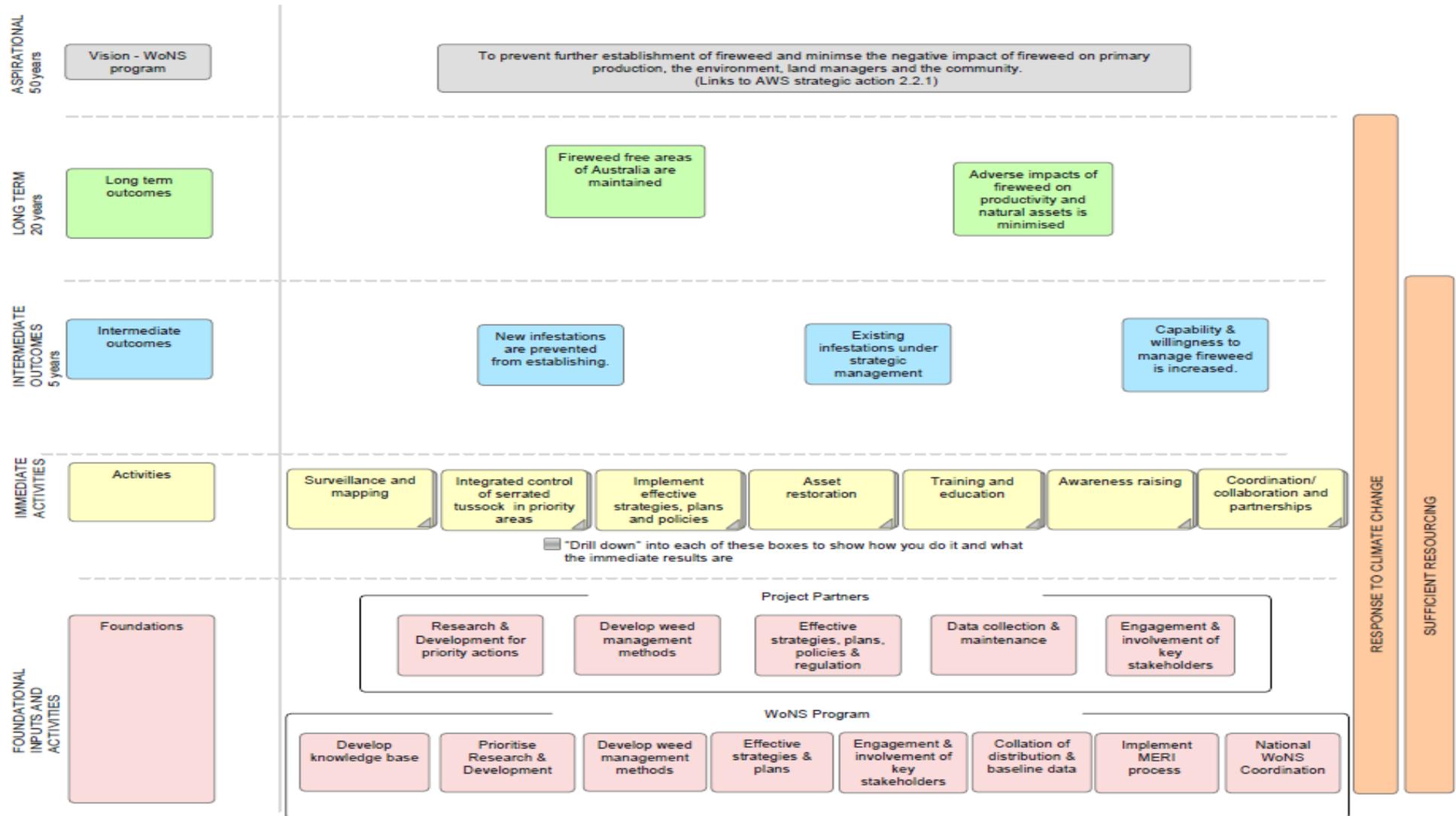
manage WoNS.	increased?	<p>collaboration on WoNS?</p> <ul style="list-style-type: none"> Number and type of media activities. 	<p>priority regions.</p> <ul style="list-style-type: none"> Is training being delivered to meet the needs of weed managers (including the community)? Are networks/groups being supported (e.g. through dissemination of research outcomes, funding opportunities, control options etc)? Has awareness and engagement in WoNS management been raised effectively?
		<p><u>3.2 Resourcing</u></p> <ul style="list-style-type: none"> From what sources are programs being funded? 	<ul style="list-style-type: none"> Number of projects funded by Commonwealth, jurisdictions, industry, etc
		<p><u>3.3 Policy & Planning</u></p> <ul style="list-style-type: none"> Are the objectives of the strategy being integrated into commonwealth/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. WRA, 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 & awareness raising, research projects.
		Overall progress rating	
Continuous improvement	Are there any unexpected outcomes that have been identified through implementation of strategy?	<p><u>4.1 Barriers</u></p> <ul style="list-style-type: none"> Have any other management issues or impediments been identified? 	

How to score progress rating

- 1- Insufficient evidence to score
- 2- No progress against 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

5.2 Program Logic Model

WoNS Program Logic for Fireweed National Strategy



6 Technical Background

6.1 Fireweed and its identification

Fireweed is a member of the daisy or Asteraceae family, which shares the characteristic daisy flower. The genus *Senecio* is widespread throughout the world, with many *Senecio* species native to Australia. Fireweed itself is native to Madagascar and south-east South Africa, and, in addition to Australia, is currently a problem weed in Hawaii, Japan and parts of South America. Recent molecular studies have shown Australian fireweed is most closely related to populations in the Kwa-Zulu Natal province of South Africa.

It is most often found in open country and areas of bare soil, along roadsides, pastures (particularly over-grazed or failed pastures) and open forests, with heavy infestations being common on cultivated or disturbed land. Fireweed does not grow well in shaded areas.

Native plants in the same genus (such as *Senecio pinnatifolius* or *S. bristolowensis*) may be confused with fireweed. However the native species are mainly found either in geographically separate areas or locations where the weedy fireweed is unlikely to occur, such as woodlands, bushlands and undisturbed sites. The number of flower petals, bracts and shape of leaf can be used to help distinguish species.

How to identify fireweed

Fireweed is a daisy-like plant that grows from 10 to 60 cm high, with conspicuous bright yellow flowers 1 – 2 cm in diameter. Each flower will commonly have 13 petals and 21 bracts (green petal-like structures) forming the 'cup' under the flower.

It has a variable growth habit and leaf structure, but the most common form of fireweed is a low, heavily branched, annual or short-lived perennial plant. The leaves are generally bright green in colour, slightly fleshy and narrow, 2-7 cm long, alternately arranged on the stem, and generally have serrated margins (though may be entire or lobed).

Small, yellow daisy-like flowers are 1-2 cm in diameter and arranged in clusters at the end of each branch. There can be up to 200 flowers per plant. Seeds are small (1.5 – 2.5 mm long), light and slender with a cylindrical shape. The seeds have a downy surface and are attached to a pappus, fine silky, white feathery hairs that aid in dispersal by wind. Fireweed has a shallow, branched taproot with numerous fibrous roots, 10 – 20 cm deep.

6.2 Fireweed biology and ecology

Fireweed is a well-adapted colonising species, emerging in pasture, roadsides, urban areas and wastelands following a major disturbance. In agricultural areas fireweed occurs more frequently on sites where there is poor groundcover, especially in autumn. Areas with poor groundcover may be where pastures have failed, permanent cattle camping sites, poorly grassed, neglected or heavily grazed pastures and land cultivated during the autumn to spring period.

Fireweed reproduces almost exclusively by seed. Fireweed can alter its germination response, adapting its growing and flowering behaviours to suit changing environmental conditions.

A high proportion of seed is viable when shed. Seed viability is about 4-5 years but buried seed may potentially remain viable for up to 10 years. Seedlings are rapidly recruited from an established seed bank in response to a range of environmental disturbances.

Most seed will fall within 5 metres of the parent plant. However the light fluffy seeds are easily caught by the wind and some seed will be spread greater distances by wind and updrafts. Dispersal beyond a kilometre is likely to be the result of unintentional spread by human activity, including:

- livestock, native or pest animals;
- clothing, vehicles and machinery; and
- contaminated hay, silage and grain products.

6.3 Fireweed distribution and spread

Fireweed is a well-adapted colonising species, emerging in pasture, roadsides, urban areas and wastelands following a major disturbance. In agricultural areas fireweed occurs more frequently on sites where there is poor groundcover and less competition, especially in autumn. Areas with poor groundcover may be where pastures have failed, permanent cattle camping sites, poorly grassed, neglected or heavily grazed pastures and land cultivated during the autumn to spring period.

Distribution

Fireweed currently occurs along the east coast of Australia, in NSW and Queensland, with occasional incursions inland. Plants have also been reported to have been found in East Gippsland in Victoria.

A current distribution map for fireweed is found in Appendix 7.2.

6.4 Control options

Integrated weed management

Long-term management of fireweed requires a thorough and systematic management program, using a variety of appropriate control techniques. The choice of management options will vary according to the type of operation, for example:

- Grazing enterprises may utilise grazing strategies as well as fertiliser application, upgrading pastures and strategic herbicide applications.
- For environmental areas options may include timely hand-pulling and bagging fireweed plants and spot-spraying of herbicide.

Once established, fireweed is extremely difficult to eradicate. Dedication, persistence and on-going follow-up treatments are essential for long-term management. Herbicide rotation is also good practice to lessen the likelihood of herbicide resistance.

Preventing spread and early detection

Learn to identify fireweed and where it is most likely to occur on your property or in your wider community. Early detection is vital to prevent fireweed from becoming established. Act promptly if you find fireweed – there is only a small window of time before viable seed is produced.

Maintaining a dense pasture cover, especially through autumn to spring, is a major step towards fireweed spread prevention.

Good property hygiene practices are very important to reduce the spread of seed. Be aware of the provenance of hay/silage brought into your property and keep feed in one area. Quarantine new stock until seed has passed through their system (normally seven days) and inspect for seed in coats. Regularly walk property boundaries, areas of disturbance (such as stock camp sites, stock yards and cultivated areas), common vehicle tracks and machinery/vehicle car parks.

6.5 Chemical and physical control

Chemicals – are most effective during active growth season

Herbicides are an effective control method when used as part of an integrated fireweed management plan. Use of herbicides does not reduce the need to maintain or establish a competitive pasture.

The aim of herbicide treatment is to minimise the establishment of a large population of fireweed by targeting the usual autumn germination flush. A well-timed herbicide application can be very effective in reducing the density of fireweed infestation. Later in the growing season – through spring and summer – spot spraying may be more suitable.

A number of herbicides are recommended for fireweed control – contact your local chemical reseller or weed authority for up-to-date details.

Hand weeding

Hand weeding (removing individual plants) is appropriate when infestations are small or isolated. It can be a useful form of control, especially in environmental areas. Wear gloves when hand weeding (as a precautionary measure to reduce exposure to the plant alkaloids).

Plants are still toxic to stock when removed from the soil, and may seed if in flower, so plants should be bagged and destroyed appropriately.

Cultivation

For arable areas, cultivation followed by a cropping program with a forage cereal such as oats can be effective as part of a pasture improvement program. Consult an agronomist before using this method to control fireweed, as this approach is likely to stimulate an initial flush of fireweed.

Slashing/mulching

Repeated cutting, typically at less than six week intervals, can reduce, but not eliminate, fireweed production and seeding. This technique is, however, damaging to the pasture and should only be considered where the pasture will rapidly recover and out-compete any seedlings.

Fireweed should not be slashed in late spring or when more than 25% of plants present are still flowering. Mature plants that might otherwise have died may be encouraged to re-shoot and carry on into a second season. The possible further spread of seed via machinery needs to also be considered.

6.5.1 Biological control

There are currently no effective biological control agents for fireweed. Agents that have been tested were either ineffective or had an unacceptably large host range, including the closely related native *Senecio pinnatifolius*.

Various naturally occurring diseases and insects have been found attacking and sometimes destroying fireweed plants. The most damaging insects are the chrysomelid beetle (*Chalcolampra* sp) and two native moths (the magpie moth (*Nyctemera amica*) and the blue stem borer (*Patagoniodes farinaria*). Recent genetic studies indicate Australian fireweed is most similar to plants from the Kwa-Zulu Natal province in South Africa, an area which has not been fully investigated for potential biological control agents.

6.5.2 Other control options

Pasture management and competition

Maintaining a vigorous perennial pasture is part of successful long-term fireweed control. This may require using fertiliser, matching grazing pressure to pasture growth to maintain a dense pasture and grazing management to allow grasses to seed. These measures will help reduce fireweed seed germination and suppress seedling growth. Without competition, fireweed will be able to quickly germinate following rain in autumn and spring, and will grow more rapidly than the pasture species.

In the face of severe ongoing drought, consider reducing overall stocking rates before pastures are overgrazed and the ground laid bare.

The guiding principles of pasture management for fireweed control are:

- maintain groundcover in autumn;
- allow perennial species to recover between grazing periods;
- maintain a competitive edge over fireweed, even during drought times (fireweed growth is also affected by drought); and

- maintain a balance between fireweed and other pasture species so that animals are not forced onto fireweed (or other injurious species) because there is nothing else to eat.

Grazing

Cattle and horses normally avoid eating fireweed (and the pasture below it). This can favour the growth and competitiveness of the weed, increasing infestation. Grazing pressure needs to be matched to pasture growth and availability.

Sheep and goats will eat fireweed – they may preferentially graze the plant – and display a higher tolerance to the toxic alkaloids. Grazing with sheep or goats has proven to be an effective management method. Ideally, land managers should use a new group of animals each year to limit the cumulative effect of fireweed poisoning. At worst, the same group should not be grazed on infested areas for more than two consecutive seasons.

6.6 Quarantine and legislation

Fireweed is a declared noxious weed in parts of NSW, Qld and the ACT.

Fireweed is a Class 4 noxious weed in 14 local government areas of NSW under the NSW Noxious Weeds Act 1993. Its growth and spread must be controlled. Contact your Local Control Authority (Council) to find out if there are district control programs.

In Qld fireweed is a declared Class 2 plant under the Land Protection (Pest and Stock Route Management) Act 2002. A Class 2 pest is one that has already spread over substantial areas of Queensland, but its impact is so serious that it needs to be controlled to avoid further spread onto properties that are still free of the pest.

In the ACT fireweed is a 'notifiable/prohibited' species – when it is found authorities need to be advised of its presence so that immediate and urgent action can be taken with a view to its eradication.

The responsibility for the control of noxious weeds on private land rests with the land owner or occupiers of the land. Check with your local council or state/territory government agency about the latest requirements for fireweed control.

State / Territory	Legislation	Declaration	Goals/Actions
Queensland	<i>Land Protection (Pest and Stock Route Management) Act 2002</i>	Class 2	Where a species has already spread over substantial areas of Queensland, but its impact is so serious that it needs to be controlled to avoid further spread onto properties that are still free of the pest.
New South Wales	<i>Noxious Weeds Act 1993</i>	Class 4 in some Local Government Areas	The growth of the plant must be managed in a manner that reduces its numbers, incidence, spread and continuously inhibits reproduction.
Northern Territory	<i>Weeds Management Act 2001</i>		
Western Australia¹	<i>Plant Diseases Act 1914</i> <i>Biosecurity and Agriculture Management Act 2007</i>	Not currently declared. Prohibited entry to WA.	Not present in WA, would be a target for eradication if found.
South Australia	<i>Natural Resource Management Act 2004</i>		
Victoria	<i>Catchment and Land Protection Act 1994</i>	Not currently declared.	
Tasmania	<i>Weed Management Act 1999</i>		
ACT	<i>Pest Plants and Animals Act 2005</i>	Notifiable/Prohibited	Officially advise authorities of its presence so that immediate and urgent action can be taken with a view to its eradication.

7 Appendices

7.1 Weed control contacts

State	Department	Phone	Email	Website
ACT	Dept of the Environment, Climate Change, Energy and Water	132281	environment@act.gov.au	www.environment.act.gov.au/environment
NSW	Biosecurity NSW, NSW Dept of Primary Industries	1800 680 244	weeds@dpi.nsw.gov.au	www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds
NT	Dept of Natural Resources, Environment, The Arts and Sport	08 8999 4567	weedinfo.nretas@nt.gov.au	www.nt.gov.au/weeds
QLD	Biosecurity Queensland, Dept of Employment, Economic Development and Innovation	132523	callweb@dpi.qld.gov.au	www.biosecurity.qld.gov.au
SA	Biosecurity SA, Dept of Primary Industries and Regions SA	08 8303 9620	nrmbiosecurity@sa.gov.au	www.pir.sa.gov.au/biosecurity/nrm_biosecurity/weeds
TAS	Dept of Primary Industries, Parks, Water and Environment	1300 368 550	www.dpipwe.tas.gov.au/weeds scroll to the bottom of the page and click on "weeds enquiries"	www.dpipwe.tas.gov.au/weeds
VIC	Dept of Primary Industries	136186	customer.service@dpi.vic.gov.au	http://new.dpi.vic.gov.au/agriculture/pests-diseases-and-weeds
WA	Dept of Agriculture and Food	08 9368 3333	enquiries@agric.wa.gov.au	www.agric.wa.gov.au
Australia wide	Australian Pesticides and Veterinary Medicines Authority	02 62104701	contact@apvma.gov.au	www.apvma.gov.au

7.2 The WoNS Program and its phases¹

In 2007, an independent review of the WoNS program concluded that the nationally strategic approach of WoNS was highly successful in leveraging consistent multi-jurisdictional 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 (Fig. 10). This 'phased approach' aims to provide the most cost-effective use of limited 'national coordination' resources.

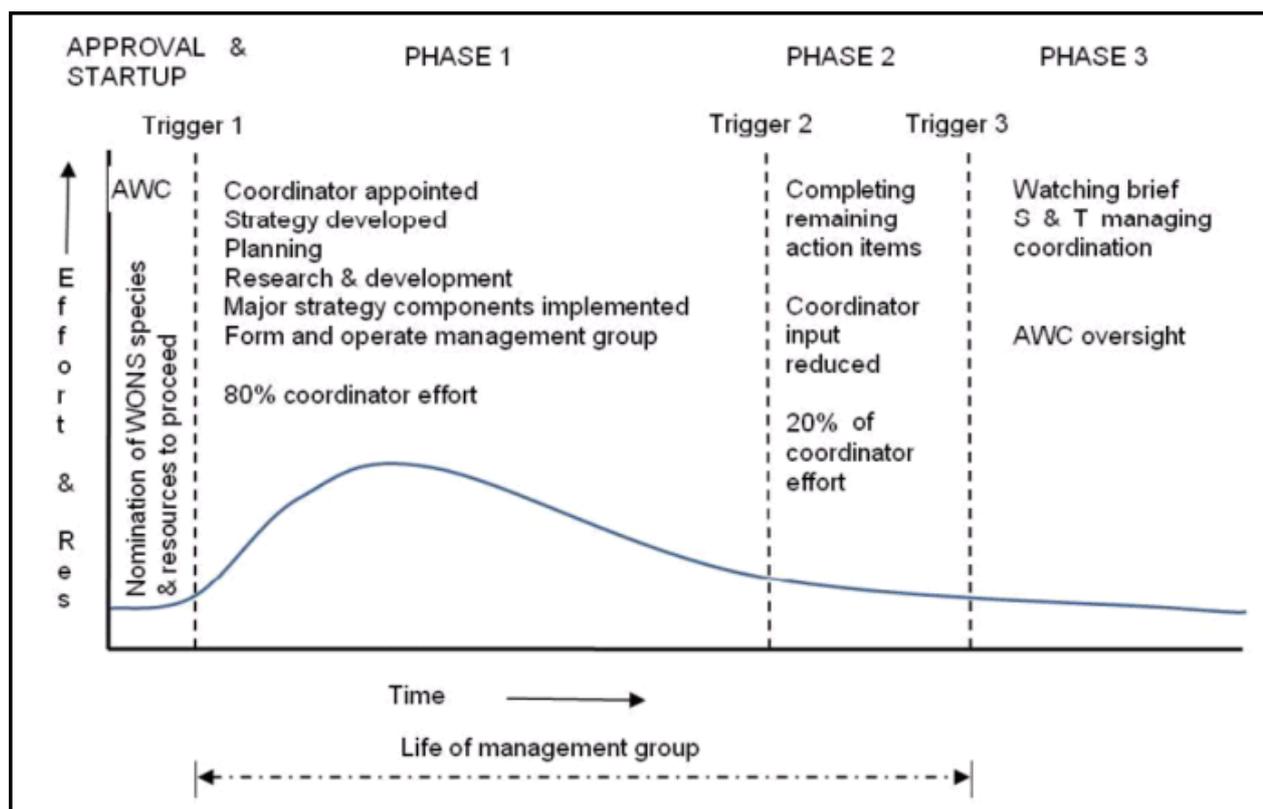


Figure 4. Australian Weed Committee diagrammatic representation of coordinator effort and resource use when implementing a Weeds of National Significance strategy. (S & T refers to States and Territories).

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 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 twelve 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

¹ From Thorp 2012 "Additional List of Weeds of National Significance – April 2012" www.weeds.org.au/WONS.

7.3 Other information sources

Information on all the WoNS species, as well as contact details for WoNS Coordinators is available on the Weeds Australia website at www.weeds.org.au/WoNS. This site acts as a hub for published strategic plans, extension resources, mapping information, priority action tables (annual priorities mapped to regional scale); and monitoring, evaluation and reporting information.

7.4 Glossary

Asset protection – A weed management approach to reduce impact or threat on an asset

AWC – Australian Weeds Committee

Containment - A weed management approach that aims to prevent an increase in the current distribution of a weed, by using weed control procedures to reduce the density of existing infestations and limit the dispersal of propagules. Highly effective containment programs can actually result in a decrease in the current distribution of a weed.

Coordinated control - A strategic weed management program that takes into consideration all occurrences of a weed and involves the application of weed control procedures towards a specific end (e.g., eradication or containment).

Core infestation – weed infestation which is large and non eradicable for a defined scale

Eradication - The elimination of every single individual of a species from an area to which recolonisation is unlikely to occur, including propagules (Myers et al. 1998).

NFMG – National Fireweed Management Group

NRM – natural resource management

NRM Groups – regional Natural Resource Management Groups or Catchment Management Authorities

Outliers – infestation separate from core and may be eradicable

Partner – Person(s) or organisation actively supporting weed management

Priority outliers – feasible to eradicate or contain or reduce / prevent spread

Priority assets – high value (environmental, primary production, cultural and social) assets determined to be at risk – can be applied at varying scales

RWC – Regional Weeds Committee

Stakeholder – person, group or organisation interested in or concerned about weeds and or their management

WoNS – Weeds of National Significance

7.5 Further Reading

Beale, R., Fairbrother, J., Inglis, A., and Trebeck, D. (2008). One Biosecurity: a Working Partnership. Commonwealth of Australia. Canberra.

COAG – Council of Australian Governments. (2012). Intergovernmental Agreement on Biosecurity: An Agreement between the Commonwealth of Australia, state and territory

governments to strengthen the national biosecurity system. COAG, Canberra.
Accessed 6 Aug 2012:
<http://www.coag.gov.au/node/47>

Department of Employment, Economic Development and Innovation, Biosecurity Queensland (2010) Weed risk Assessment: Fireweed (*Senecio madagascariensis*). Queensland Government

Department of Employment, Economic Development and Innovation, Biosecurity Queensland. (2011), Fact Sheet – Declared Class 2 Pest Plant - Fireweed (*Senecio madagascariensis*), PP31 Queensland Government

DPI 2010. Invasive Plants and Animals Policy Framework, State Government of Victoria, Melbourne.

Guidelines and procedures for managing the environmental impacts of weeds on public lands in Victoria 2007. Department of Sustainability and Environment, Melbourne.

Hobbs, RJ and Humphries, SE 1995. An integrated approach to the ecology and management of plant invasions. *Conservation Biology* 9:761–770.

NRMMC Natural Resource Management Ministerial Council (2006). Australian Weeds Strategy – A national strategy for weed management in Australia. Australian Government Department of Environment & Water Resources, Canberra ACT.

Sindel, B. M. (2009) Fireweed in Australia – Directions for Future Research, a report for the Bega Valley Fireweed Association. University of New England

Sindel, B.M., Radford, I.J., Holtkamp, R.H., Michael, P.W. (1998) *Senecio madagascariensis* Poir. in 'The Biology of Australian Weeds', Volume 2. Eds. F.D. Pannetta, R.H. Groves and R.C.H. Shepherd. R.G. and F.J. Richardson, Melbourne. pp. 247-67.

Southern Rivers CMA (compiled by). (2009) Managing Weeds on the Far South Coast of NSW – Fireweed. (Southern Rivers CMA)

Weed Management Unit, Department of Industry & Investment NSW. (2009) Primefacts 126 – Fireweed. (NSW Department of Industry and Investment)