WEEDS OF
NATIONAL SIGNIFICANCE

Gamba Grass

(*Andropogon gayanus*)

Strategic Plan
2012 to 2017

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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 Nathan March, National Gamba Grass Coordinator, Department of Agriculture, Fisheries and Forestry, Queensland with full cooperation of all the States, Territories and Commonwealth of Australia.

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

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EXECUTIVE SUMMARY

Gamba grass (*Andropogon gayanus*) is a Weed of National Significance that threatens economic, environmental and cultural values throughout northern Australia. Infestations are present in the Top End of the Northern Territory, Kimberley region of Western Australia and the Cape York, Atherton Tablelands and coastal areas of North Queensland.

Varieties of *A. gayanus* were introduced for pasture production in the 1930's with the cultivar Kent registered in 1986. However, the risks posed by gamba grass and its actual and potential impacts have only been officially recognised and studied in since the 1990's.

Gamba grass invades tropical savannas where it can become the dominant grass species and will also invade woodlands, forests and vine forest edges. Infestations replace a range of native plants (including native pastures) resulting in a decline in the diversity and abundance of native fauna and flora directly through competition and indirectly through increased fire intensity and fire frequency. When not intensively managed, fire risk from gamba grass also poses a major threat to infrastructure and culturally important sites. Altered fire regimes associated with gamba grass invasions has resulted in significant increases in fire management costs in the Northern Territory.

Gamba grass is utilised for pasture production benefits in some regions and there is a challenge to contain existing plantings and the movement of seed from these sites. The diversity of communities affected by gamba grass; the sometimes remote areas in which it occurs; varied mapping, planning and coordination status; and, spread via transport and riparian corridors pose particular challenges for future management.

The strategy aims to deliver three goals and their associated objectives:

1. **New infestations are prevented from establishing**

    - Invasion vectors, sources and pathways are identified and managed to prevent or reduce spread
    - Surveillance and response mechanisms are ensuring timely detection of infestations (both new and previously undetected)
    - Outlier infestations are eradicated where possible or otherwise contained

2. **Established infestations are under strategic management**

    - Implement strategic (risk based) management to contain the spread of gamba grass where it is widespread
    - Minimise gamba grass fuelled fire impacts on life and property
    - Minimise gamba grass impacts on cultural assets and activities
    - Improve the ecological understanding of gamba grass and the impacts of invasion in order to prioritise management activities
    - Minimise gamba grass impacts on the environment
    - Refine and promote best practice weed control and management methodologies
    - Assess gamba grass as a potential biological control target and undertake related research (if appropriate)

3. **Capability and willingness to manage gamba grass is increased**

    - Appropriate policies, legislation and enforcement support risk based management objectives
    - Develop cooperative management arrangements and planning frameworks
    - Enhance capability and motivation to manage gamba grass through education and awareness activities
    - Develop and use maps at various scales to guide, plan and evaluate gamba grass management
    - Stakeholders are committed to effective delivery of the strategic plan

VISION

Through national commitment, the spread of gamba grass is minimised and its adverse impacts to Australia's economic, environmental and cultural assets are reduced.

1 THE CHALLENGE

Gamba grass is an invasive weed that can have significant economic, environmental and cultural/social impacts. It was introduced as a pasture species with widespread plantings in the pastoral and agricultural areas of the Northern Territory Top End and later plantings in Queensland and Western Australia. Gamba grass has proved to be highly invasive with the ability to negatively impact tropical savanna landscapes when not adequately managed.

It is estimated that infestations currently total 1–1.5 million hectares, but this represents only 2% of its potential range in Australia. While strategic management is occurring in some areas, infestations continue to increase through short-distance incremental spread from existing infestations and through long-distance seed movement aided primarily by riparian corridors and transport networks.

Gamba grass invasion impacts different stakeholders in different ways, although the impacts of associated changes in fire regime following invasion is a common factor. Peri-urban and rural communities are endangered by intense gamba grass fuelled fires with significant losses having already occurred. Physical and spiritual connectivity of traditional owners to land and culturally important sites have been affected by dense infestations. The ecological structure and biodiversity values of the environment have also been changed in invaded areas. Changed fire regimes threaten major fire management programs being funded to minimise carbon emissions across northern Australia.

In conjunction with these impacts is the recognition that some gamba grass pastures are well managed and used as a productive pasture (although this can be difficult, requires sustained effort and is not without risk to adjoining properties). Reconciling ongoing use of the pasture benefits in some areas while achieving overall weed management objectives will require a collaborative approach between the grazing industry, community and government.

Northern Australia has several current and emerging invasive grasses as shown by the listing of gamba grass together with four other grasses as a Key Threatening Process (KTP) under the Federal Environment Protection and Biodiversity Conservation Act 1999. To improve progress being achieved with gamba grass, a coordinated approach will be required which incorporates holistic weed management, including appropriate site restoration practices following control.

Planning, prioritising and resourcing the differing management objectives associated with gamba grass infestations will be a major challenge to implementing this plan. Other challenges presented by gamba grass include how to: reduce human associated seed movement; address infestations and spread along transport networks; prevent the establishment of new infestations and effectively manage outliers. While management options for gamba grass are available, it is likely that infestations in remote and hard to access areas will pose particular difficulties to control and monitor.

Legislative and policy frameworks are in place across Australia's north but require improved coordination, complementary programs and evaluation. In particular, current national mapping of gamba grass is inadequate but is a critical initial step for broad level planning and management. Improved awareness and early detection is also needed to complement surveys and mapping programs.

Implementation of the National Gamba Grass Strategic Plan will result in the spread of gamba grass being contained while reducing its adverse impacts.

2 INTRODUCTION

Gamba grass was determined as a Weed of National Significance in 2012 – formally acknowledging it as one of Australia's worst weeds. This strategic plan and associated objectives and actions are based on the aspirations of stakeholders seeking to limit and reduce the adverse impacts of gamba grass on the economy, environment and society. The aim of the plan is to outline a co-ordinated, evidence-based approach to the

management of gamba grass throughout Australia. The Plan is supported by current ecological knowledge, legislative and policy requirements, and plans from local to national level.

2.1 Principles underpinning the plan

This Plan provides an overarching framework for the management of gamba grass in Australia. Although it is considered to be an 'aspirational' strategy, all objectives and actions have been carefully vetted to ensure they are both reasonable and achievable given the five-year Plan timeframe. However, this is a collaborative plan and the active involvement of all stakeholders and at all levels (national, state, regional and local) is necessary to ensure its success.

While the Plan is national in scale, regional benefits are also expected through a range of outcomes, including increased community awareness and knowledge, spread prevention or the protection of priority assets that are valuable to both the national and local community. The fine detail of local and regional gamba grass management cannot be captured within the plan but this should not preclude or dissuade groups from planning and undertaking management actions at a more local scale for regional benefit.

In addition, the Plan recognises that gamba grass management alone will seldom result in ecosystem recovery and it is important that site management plans are designed and delivered in a holistic manner, with the emphasis on site recovery rather than simply weed removal.

The WoNS Program

The Weeds of National Significance (WoNS) Strategic Plans provide a framework for the coordinated management of the 32 Weeds of National Significance. These plans represent the shared vision of all 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 can be allocated to achieve the most strategic management outcomes.

The WoNS Strategic Plans are based on the recognition and acceptance of seven principles outlined in the Australian Weeds Strategy (AWC; Natural Resource Management Ministerial Council 2006):

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 post-border, 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 (or eradication) of widespread weeds is unachievable. However, well researched, strategic and coordinated management 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).

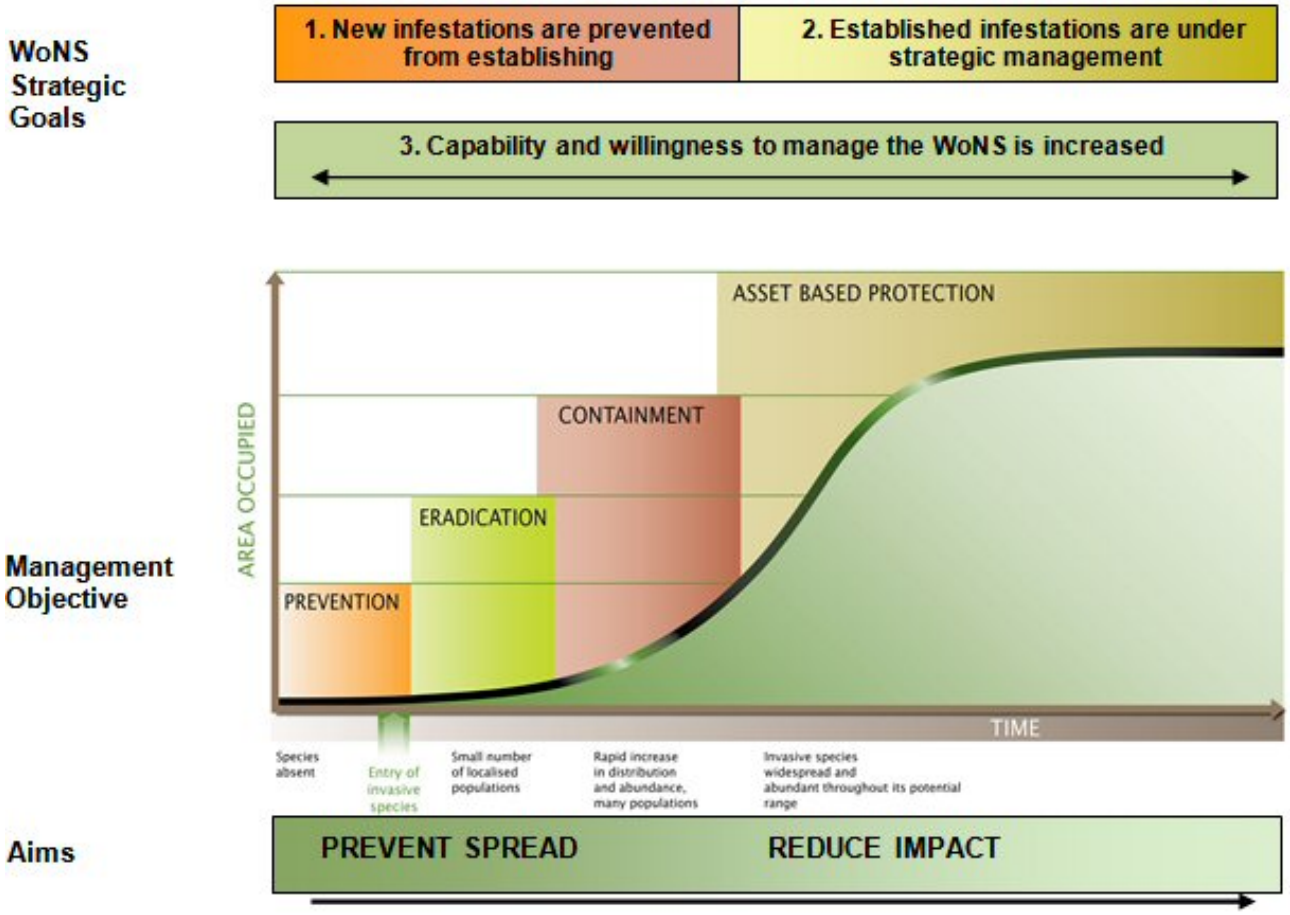


Figure 1. *Stages of weed invasion with corresponding goals, management objectives and actions at each stage. Modified from* DPI 2010, *Invasive Plants and Animals Policy Framework*, State Government of Victoria, Melbourne

This includes spread prevention practices and eradication of outliers to protect environments where the weed has not yet taken hold, establishment and defence of containment areas 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. Underpinning all of this is the need for strong education, extension, capacity building and support mechanisms to ensure on-ground outcomes are achieved.

2.2 The current situation

Gamba grass occurs in the Northern Territory, Queensland and Western Australia. Major infestations occur in the Northern Territory 'Top End' and Queensland's Cape York and Atherton Tablelands and limited occurrences in Western Australia. Further details of distribution are provided in section 5.3.

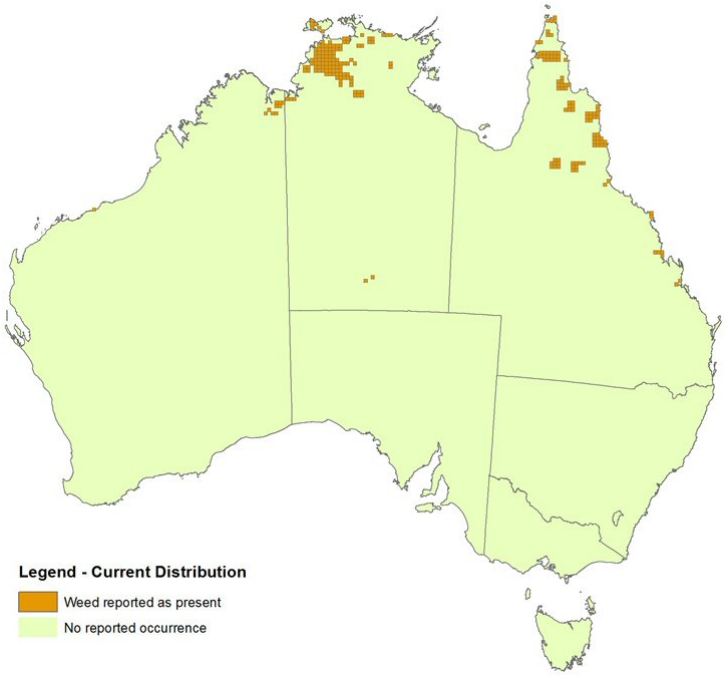


Figure 2. *Distribution of known gamba grass infestations (2011)*

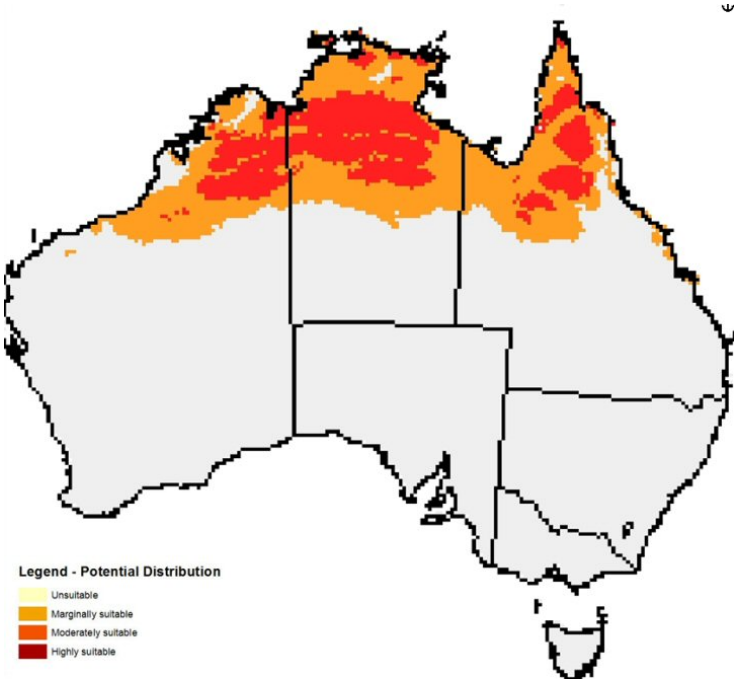


Figure 3. *Potential distribution of gamba grass (ABARES - CLIMATCH 2011)*

Weed risk assessments for gamba grass were undertaken in both Queensland (March 2008) and the Northern Territory (December 2008). These assessments found gamba grass to pose high and very high risks respectively and led to declaration in these jurisdictions. Declaration had earlier (January 2008) occurred in Western Australia.

A statutory weed management plan is in place for the Northern Territory and establishes the objectives, management requirements and management actions to be achieved by land managers and the minimum actions to be taken to achieve these outcomes. The plan also delineates two management zones. A zone with widespread infestations, where land managers are required to control the growth and prevent spread, and an eradication zone (with outlier infestations) where land managers are required to actively identify and eradicate gamba grass infestations and prevent new infestations. In both of these management zones new introductions of gamba grass are not permitted. This includes the sale and transport of gamba grass seed or hay within these zones. Further details related to the gamba grass management plan can be found at: http://www.nretas.nt.gov.au/natural-resource-management/weeds/find/gamba.

In Queensland a state *Guideline for the management of gamba grass* provides operational objectives and a set of actions considered reasonable for the management of gamba grass by land managers. The guideline recognises that while gamba grass is beyond eradication from Queensland every effort should be made to contain gamba grass to existing plantings, control it in strategic areas and eradicate new infestations. The guideline also promotes action in environmentally sensitive areas and on roadsides and other public areas. Further details related to the gamba grass guideline can be found at: http://www.daff.qld.gov.au/documents/Biosecurity_EnvironmentalPests/IPA-Gamba-Grass-guideline.pdf

In addition, a gamba grass management plan has been developed for Cape York and Far North Queensland where some, but not all, local government plans incorporate gamba grass actions. A major management program being delivered by multiple stakeholders, supported by Commonwealth funding, is led by Far North Queensland Regional Organisation of Councils to complement the plan. Outlier control is being progressed at most other North Queensland coastal sites. New occurrences of gamba grass were reported in the Gulf of Carpentaria region in September 2012.

In Western Australia, gamba grass is primarily restricted to a low density infestation encompassing 17km^2 on a pastoral station in the east Kimberley region. This infestation is subject to an ongoing control program led by the Department of Agriculture and Food in conjunction with the station. One minor occurrence has also been detected and controlled near Kununurra and a further site requires confirmation south of Port Hedland in the Pilbara region. The Department of Agriculture and Food WA is progressing a goal to eradicate gamba grass from Western Australia.

2.3 Strategic plan development

This Plan was developed by the National Gamba Grass Coordinator following extensive consultation with stakeholders throughout the distribution range of gamba grass. Key to the development of the Plan was a national workshop held in March 2012. Participation was based on knowledge, experience and/or role in managing gamba grass with the development of strategic action tables and research priorities being major workshop outcomes.

To complement stakeholder consultation, field inspections were conducted in the east Kimberley of Western Australia, the Bachelor and Darwin areas of the Northern Territory, the Mareeba district of Queensland's Atherton Tablelands and Cape York Queensland. Presentations were also made at regional events in North Queensland (Cape York Weeds and Feral Animals Forum and North Queensland Dry Tropics Pest Advisory Forum) to encourage community input.

Discussion occurred with both pastoralists and pastoral industry representative bodies. While the strategy is developed to complement existing legislative and policy frameworks, the implications of the strategic plan for those using gamba grass as a pasture requires further evidence-based discussion.

Public consultation and comment was sought via a 30-day public consultation period in June-July 2012. This included access to the draft through internet publication, email notification and direct contact with key stakeholders and organisations. Feedback was incorporated and the Plan was endorsed by the Australian Weeds Committee in 2013.On-going discussion will occur with all stakeholders through strategy implementation to garner a consistent and cooperative approach to gamba management.

2.4 Relevance to other strategies

Table 1: Links to strategies and plans

Scale	Strategies and Plans
National	Intergovernmental Agreement on Biosecurity (IGAB); Australian Weeds Strategy 2007; National Strategy for the Conservation of Australia's Diversity 2010; Native Vegetation Policy 2001; Threat abatement plan to reduce the impacts on northern Australia's biodiversity by five listed grasses; National Weed Spread Prevention draft action plan, National Weed Spread Prevention Committee July 2006; policies, strategies and plans applied to Commonwealth Lands (e.g. those under the *Environmental Protection and Biodiversity Conservation Act 1999*); requirements of Biological Control Act 1984.
State/Territory	State / territory biodiversity conservation strategies, invasive species and biosecurity strategies including: Building Nature's Resilience: A Biodiversity Strategy for Queensland. Queensland Government (2002). Queensland Weeds Strategy Queensland Government, December (2009) Guideline for the management of Gamba grass (*Andropogon gayanus*) Northern Territory Weed Management Plan for Andropogon gayanus (Gamba Grass) Agency related management plans and strategies eg. national parks, main roads
Regional	Regional/catchment management pest management strategies & plans including: Gamba Grass Management Plan – Cape York Peninsula and Far North Queensland Stage 1, 2011-2014; Burdekin (now North Queensland) Dry Tropics Pest Management Strategy; A Natural Resource Management Plan for the Northern Gulf Region 2008-2011; Fitzroy Basin Weed Management Strategy; Sustaining the Wet Tropics A Regional Plan for Natural Resource Management 2004–2008; Southern Gulf Catchments Regional Pest Management Plan April 2011; Northern Territory Integrated Natural Resource Management Plan 2010-2015; Kimberley Science and Conservation Strategy
Local	Local government pest management plans (Qld); local government service delivery plans - weed control and fire hazard reduction (NT); landcare and community group pest management plans
Property	Property weed management plans

3 STRATEGIC GOALS AND OBJECTIVES

This strategic plan outlines aspirational actions for the period 2012-2017 that will contribute to the vision: Through national commitment, the spread of gamba grass is minimised and its adverse impacts to Australia's economic, environmental and cultural assets are reduced.

Three goals have been developed which are common to strategic plans for all Weeds of National Significance. The focus of these goals is to limit seed spread in key areas, contain and where possible reduce or eradicate existing infestations and to increase the capacity and commitment of land managers addressing the weed. A number of objectives (Table 2) have been identified that will contribute to the achievement of each goal.

Table 2. Strategic goals and objectives

Strategic Goal	Objectives
1. New 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 undetected)
	1.3 Outlier infestations are eradicated where possible or otherwise contained
2. Established infestations are under strategic management.	2.1 Implement strategic (risk based) management to contain the spread of gamba grass where it is widespread
	2.2 Minimise gamba grass fuelled fire impacts on life and property
	2.3 Minimise gamba grass impacts on cultural assets and activities
	2.4 Minimise gamba grass impacts on the environment
	2.5 Improve the ecological understanding of gamba grass and the impacts of invasion in order to prioritise management activities
	2.6 Refine and promote best practice weed control and management methodologies
	2.7 Assess gamba grass as a potential biological control target and undertake related research (if appropriate)
3. Greater capability and commitment to manage gamba grass	3.1 Appropriate policies, legislation and enforcement support risk based management objectives
	3.2 Develop cooperative management arrangements and planning frameworks
	3.3 Enhance capability and motivation to manage gamba grass through education and awareness activities
	3.4 Develop and use maps at various scales to guide, plan and evaluate gamba grass management
	3.5 Stakeholders are committed to effective delivery of the strategic plan

Actions to achieve these goals and objectives have been determined through strategy development processes and ascribed to what were considered as the most appropriate stakeholder partners. The National Gamba Grass Taskforce and lead agencies will facilitate stakeholder alignment to actions and support their implementation where appropriate.

3.1 GOAL 1: New infestations are prevented from establishing

Gamba grass has only invaded a small proportion of its potential range in Australia. Unless spread is abated and outlier infestations controlled, gamba grass will continue to increase its geographic range and density. To maintain and expand gamba grass free areas, actions to minimise seed production and movement are critical and need to be supported by monitoring, surveying and early detection. An early detection and eradication capacity is also required to address new outbreaks and priority outlier infestations where feasible.

Objectives	Strategic Actions	Priority[1]	Responsible Partners[2]
1.1 Invasion vectors, sources and pathways are identified and managed to prevent or reduce spread	1.1.1 Investigate spread pathways and the relative importance of various dispersal vectors	1	Research organisations
	1.1.2 Refine and use landscape modelling to determine and map areas at most risk of invasion (including climate change implications)	1	Research organisations
	1.1.3 Promote, through education activities, hygiene protocols and practices focusing on high priority spread pathways	1	State & territory agencies, local government, grazing industry organisations, NRM
	1.1.4 Control gamba grass infestations in road, rail and service corridors (eg. power) to limit encroachment to adjoining properties and spread along transport networks	1	State & territory agencies, local government, industry
	1.1.5 Improve seed spread prevention practices associated with major regional and cross regional industry projects eg. pipelines, roads, rail, mine construction and/or exploration activities	2	State & territory agencies, industry
	1.1.6 Review compliance utilisation and strengthen to prevent incidents of deliberate planting and reduce production of contaminated hay and other seed movement activities	2	State & territory agencies, grazing industry organisations, local government, national coordinator/s
1.2 Surveillance and response mechanisms are ensuring timely detection of	1.2.1 Develop and publish identification products and customised extension materials (national, jurisdictional and regional where appropriate)	1	State & territory agencies, local government, NRM, national coordinator/s

[1] **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

[2] Refer to section 4

infestations (both new and previously undetected)	1.2.2 Train key stakeholders in identification of gamba grass including differentiation with other weedy and native grasses	1	State & territory agencies, local government, National coordinator/s
	1.2.3 Undertake mapping and delimitation activities in high priority areas and collate data for both presence and absence	1	State & territory agencies, local government, ranger groups, community groups, landcare and NRM
	1.2.4 Facilitate early detection, identification, reporting and monitoring of new outlier infestations	1	Local government, ranger groups, weed spotter networks, landholders, state & territory agencies and herbaria, National coordinator/s
	1.2.5 Investigate and trial new technologies and methodologies for early detection, surveying and mapping	3	Research organisations, state & territory agencies
1.3 Outlier infestations are eradicated where possible or otherwise contained	1.3.1 Prioritise outlier infestations for control at local, regional and jurisdictional levels using available mapping data	1	National Gamba Grass Taskforce, National coordinator/s, state & territory agencies, local government, NRM
	1.3.2 Assess eradication feasibility and implement control programs for priority outlier infestation areas of Western Australia, the Northern Territory and Queensland	1	State & territory agencies, ranger groups, local government, community groups, landcare, NRM, National coordinator/s
	1.3.3 Support and encourage community involvement in the development of taskforce approaches to eradication programs and other outlier management activities	2	State & territory agencies, ranger groups, local government, community groups, landcare & NRM, National coordinator/s
	1.3.4 Undertake long term monitoring, data analysis and documentation of actions for outlier management sites including the publication of eradication case studies that quantify the cost, effort and success of eradication programs	1	State & territory agencies, ranger groups, community groups, landcare & NRM, research organisations
	1.3.5 Consider targeted enforcement actions for strategic outlier infestation sites where ongoing failure to take reasonable steps to adequately manage gamba grass constitutes a high risk of invasion	1	State & territory agencies, local government

3.2 GOAL 2: Established infestations under strategic management

Large scale established infestations occur in the Northern Territory Top End and parts of Queensland's Cape York and the Atherton Tablelands. Such areas are not feasible to eradicate but should be managed to minimise impacts to infrastructure, culturally important land and sites and to the environment. This will require planning, prioritising and resourcing the differing management objectives and improved availability of best practice information.

Areas used for gamba grass pasture production also require active management to lessen invasion risks to other sites. A collective understanding of gamba grass risks and a collaborative approach to management will be required to ensure this goal is achieved.

Objectives	Strategic Actions	Priority	Responsible Partners
2.1 Implement strategic (risk based) management to contain the spread of gamba grass where it is widespread	2.1.1 Review and develop guidelines to support containment objectives at various scales	2	Research organisations, state & territory agencies, local government
	2.1.2 Encourage management of gamba grass to contain, and where possible, to progressively reduce infestations (including at catchment scales)	2	State & territory agencies, local government, industry, Land Councils, NRM, National coordinator/s
	2.1.3 Review the implementation of buffer zones (as a means of containing spread) and research requirements to improve their effectiveness and efficiency	2	Research organisations, state & territory agencies, local government
	2.1.4 Develop mechanisms for prioritising between varying objectives of gamba grass management	2	State & territory agencies, research organisations, NRM
	2.1.5 Review and improve incentive schemes which support property, community and regional plans and consider options for new schemes	2	State & territory agencies, NRM, land councils, ranger groups
	2.1.6 Develop best practice options and processes to prevent the spread of gamba grass between neighbouring properties with different land uses (eg interface between conservation, grazing, indigenous, mining properties and traversing transport corridors)	2	State & territory agencies, local government, industry, Land Councils, grazing industry organisations
2.2 Minimise gamba grass fuelled fire impacts on life and property	2.2.1 Increase the involvement of land managers in strategic control, hazard reduction burning and fire break establishment to reduce gamba grass fire risk where appropriate	2	State & territory agencies (inc. fire agencies), local government, indigenous communities, ranger groups
	2.2.2 Develop and promote fire management practices in gamba grass invaded areas (including use of North Australia Fire Information website)	2	Fire agencies, research organisations

	2.2.3 Identify community assets which are threatened by the proximity of gamba grass infestations (and associated fire risks)	2	Local government, fire agencies, indigenous communities, ranger groups, state & territory agencies, CSIRO
2.3 Minimise gamba grass impacts on cultural assets and activities	2.3.1 Evaluate and determine methodologies for prioritising cultural assets threatened and/or impacted by gamba grass	1	Land Councils, traditional owners, ranger groups, Charles Darwin University, CSIRO, other research organisations
	2.3.2 Identify, protect and/or restore high priority cultural sites from gamba grass impacts	1	Traditional owners, land councils, ranger groups, NRM, research organisations
	2.3.3 Encourage community acceptance and participation of traditional owners to protect their land, cultural sites and other assets from gamba grass impacts	2	Traditional owners, ranger groups, land councils, NRM, state and territory agencies, research organisations
2.4 Improve the ecological understanding of gamba grass and the impacts of invasion in order to prioritise management activities	2.4.1 Undertake benefit-cost analysis of gamba grass management including fire studies and utilisation	2	Research organisations, state and territory agencies, grazing industry organisations
	2.4.2 Undertake seed longevity studies including the effects of deep burial and salt water	3	Research organisations
	2.4.3 Examine greenhouse gas emissions from fires associated with gamba grass and abatement measures	2	Research organisations
	2.4.4 Develop a predictive understanding of above and below-ground carbon sequestration in relation to gamba grass	2	Research organisations
	2.4.5 Improve the understanding of the genetics of gamba grass in Australia	3	Research organisations
2.5 Minimise gamba grass impacts on the environment	2.5.1 Fill critical knowledge gaps of gamba grass impacts on biodiversity and ecosystem structure and function to inform management prioritisation	2	Research organisations
	2.5.2 Identify, protect and restore high conservation sites and at risk native flora and fauna from gamba grass impacts	1	State & territory environment management agencies, land managers, SEWPAC
	2.5.3 Improve utilisation of fire practices to assist gamba grass management and promote	2	Land managers, ranger groups, fire agencies, research

	healthy savanna ecosystems		organisations
2.6 Refine and promote best practice weed control and management methodologies	2.6.1 Review and undertake herbicide trials including: - refinement of timing and it's impact on efficacy; boom spray and aerial application; residual and selective herbicides; treatments suitable for inaccessible areas and alternative herbicides	1	Agro-chemical companies, state and territory agencies, research organisations
	2.6.2 Review, collate and publish best practice management information and practices	1	National coordinator/s, National Gamba Grass Taskforce, state and territory agencies, research organisations
	2.6.3 Promote best practice adoption through field days, demonstration sites, training, property visitation, industry and community events	1	State & territory agencies, local government, community groups, Landcare & NRM, National coordinator/s
	2.6.4 Collate information and develop guidelines to assist site restoration during and following control treatment	1	State & territory agencies, local government, community groups, landcare & NRM
	2.6.5 Develop decision support tools to assist land managers, regional groups and others to plan and prioritise control programs	1	Charles Darwin University, other research organisations
2.7 Assess gamba grass as a potential biological control target and undertake related research (if appropriate)	2.7.1 Consult with state & territory agencies, industry and other stakeholders regarding the implications of gamba grass as a potential biological control target	1	CSIRO, state & territory agencies, AWC
	2.7.2 Conduct overseas searches for biological control agents and test for target specificity in accordance with approved biosecurity processes (subject to completion of 2.7.1)	1	CSIRO, other research organisations
	2.7.3 Undertake surveys to determine dieback presence, identify pathogens, test isolates and conduct trials to demonstrate the capacity of a bioherbicide	1	University of Queensland, DLRM, other research organisations

3.1 GOAL 3: Capability and willingness to manage gamba grass is increased

Infestations of gamba grass are geographically widespread and involve diverse stakeholders. Consequently, management of this weed requires a nationally coordinated approach, high levels of stakeholder engagement and support from a robust legislative and policy framework. Such an approach will be enhanced and informed by national planning, mapping (tools and products) and extension activities. These actions will also enhance the achievements possible through Goals 1 and 2.

Objectives	Strategic Actions	Priority	Responsible Partners
3.1 Appropriate policies, legislation and enforcement support risk based management objectives	3.1.1 Maintain the legislative status of gamba grass in Queensland, Western Australia and the Northern Territory	1	WA, NT and Qld Governments and weed management agencies
	3.1.2 Seek declaration of gamba grass nationally to prevent further sale, trade and movement	1	Australian Government, NSW, SA, ACT, Vic and Tas governments, National Gamba Grass Taskforce, National coordinator/s
	3.1.3 Develop a code of practice to manage gamba grass pasture use within widespread infestation areas	2	Grazing industry organisations, National Gamba Grass Taskforce, National coordinator/s
	3.1.4 Review use of legislative enforcement actions and identify areas requiring support and improvement	2	State & territory agencies, local government, National Gamba Grass Taskforce, National coordinator/s
	3.1.5 Ensure strategic plan actions are linked to other relevant national strategies eg. Threat Abatement Plans, national seed spread prevention, biosecurity, carbon initiatives	2	Australian government agencies, state & territory agencies, Gamba Grass Taskforce, National coordinator/s
3.2 Develop cooperative management arrangements and planning frameworks	3.2.1 Develop collaborative partnerships (eg. research, NRM groups, jurisdictions, resources) to facilitate gamba grass management objectives and actions	1	National Gamba Grass Taskforce, National coordinator/s, state & territory agencies, regional pest advisory groups, research organisations, NRM, local government, community groups, industry, traditional owners, ranger groups, land councils

	3.2.2 Incorporate gamba grass management in relevant plans at property, local, catchment, regional, jurisdictional and national levels	1	State & territory agencies, NRM, local government, ranger groups, community groups, land managers, National coordinator/s
	3.2.3 Annually update and publish a Priority Management Action spreadsheet identifying national strategic priorities by NRM region	1	National coordinator/s, National Gamba Grass Taskforce
3.3 Enhance capability and motivation to manage gamba grass through education and awareness activities	3.3.1 Develop a national extension and communication plan for gamba grass and develop awareness products and undertake activities in accordance with the plan	1	National coordinator/s, National Gamba Grass Taskforce
	3.3.2 Raise awareness of the threat and impacts posed by gamba grass	1	National coordinator/s, state and territory agencies, NRM, local government, grazing industry organisations
	3.3.3 Build community capacity through delivery of best practice management training	1	National coordinator/s, state and territory agencies, NRM, local government
3.4 Develop and use maps at various scales to guide, plan and evaluate gamba grass management	3.4.1 Develop, review and update distribution maps at national, jurisdictional and regional scales	1	National Gamba Grass Taskforce, Qld, NT & WA agencies, National coordinator/s, NRM, regional pest advisory groups, local government, ranger groups, land councils
	3.4.2 Develop, promote and utilise a national zonal system for gamba grass management objectives using information such as current and potential distribution data, ecological knowledge, control feasibility and capacity	1	National coordinator/s, National Gamba Grass Taskforce, Qld, NT & WA agencies, research organisations, local government, grazing industry organisations, NRM
	3.4.3 Review, update and publish potential distribution maps including those incorporating climate change implications	1	CDU, CSIRO, other research organisations
3.5 Stakeholders are committed to effective delivery	3.5.1 Establish and support a National Gamba Grass Taskforce	1	QDAFF (host agency), DLRM, DAFWA, Australian government, National

of the strategic plan			coordinator/s
	3.5.2 Establish and maintain national gamba grass management networks to facilitate priority actions including project and funding proposals which align with the strategy	1	National coordinator/s, National Gamba Grass Taskforce
	3.5.3 Monitor and evaluate implementation of the strategic plan	1	National coordinator/s, National Gamba Grass Taskforce
	3.5.4 Communicate and report on Strategic Plan implementation progress and evaluation outcomes to the Australian Weeds Committee and other key stakeholders	1	National coordinator/s, National Gamba Grass Taskforce
	3.5.5 Promote strategy implementation outcomes and achievements to all partners and the public	1	National coordinator/s, National Gamba Grass Taskforce
	3.5.6 Undertake a comprehensive review of progress toward Strategic Plan objectives in 2017	1	Australian Weeds Committee

4 STAKEHOLDER ROLES AND RESPONSIBILITIES

While land owners and managers are ultimately responsible for the control of gamba grass on their land, the effective implementation of this strategy requires the involvement of a range of stakeholders. It is also noted that stakeholder responsibilities may vary between jurisdictions and that some may be optional while others are prescribed by legislation. It is therefore important that users of this Plan familiarise themselves with plans and legislative requirements relevant to their areas.

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

Australian Government agencies

- Review quarantine controls to prevent importation (DAFF Biosecurity)
- Ensure access is available for appropriate and potential resources through funding initiatives such as Caring for our Country
- Provide governance processes for the effective delivery of the WoNS initiative
- Promote the status of gamba grass as a WoNS, its impacts and the importance of management
- Implement appropriate actions in the 'Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses'.
- Undertake strategic gamba grass control on all Australian Government managed lands.

Australian Weeds Committee

- Provide a mechanism for identifying and resolving weed issues at a national level
- Provide advice to the National Biosecurity Committee on weeds issues
- Provide planning, coordination and monitoring of the implementation of the Australian Weeds Strategy
- Facilitate coordination between the Australian Government, State and Territory governments
- Provide governance processes for the effective delivery of the WoNS initiative
- Oversee the implementation of the activities described in the WoNS strategic plans
- Promote the importance and benefits of WoNS to all levels of government.

National Gamba Grass 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 gamba grass 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 gamba grass management
- Identify funding sources and provide independent advice for prospective applicants for projects consistent with the needs of the gamba grass strategy.

Research organisations (including CSIRO, universities, government agencies, agro-chemical companies)

- Undertake applied research to address priority national strategic plan requirements
- Identify research gaps and seek innovative solutions for the management of gamba grass

- Seek new and on-going funding and support for research requirements

State and territory agencies

- Maintain appropriate legislation and policies to achieve state and territory based objectives for managing gamba grass
- Administer and enforce legislation where applicable
- Ensure quarantine controls to prevent importation to and movement of gamba grass within States and Territories
- Coordinate gamba grass control and management at a jurisdictional level to complement the management and delivery of the Gamba Grass National Strategic Plan
- Undertake gamba grass management on state/territory lands in line with agreed national priorities
- Work with NRM groups, local governments, communities and other stakeholders to prevent and minimise gamba grass impacts.
- Identify strategic management areas and associated objectives
- Promote consistency with this Strategy in jurisdictional pest management plans
- Facilitate the inclusion of strategic gamba grass 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 Gamba Grass Taskforce
- Undertake strategic gamba grass control on all state and territory managed lands

Local governments

- Incorporate gamba grass objectives in relevant pest management plans and monitor implementation
- Administer and enforce legislation where applicable
- Undertake surveying and mapping particularly in relation to outlying gamba grass 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
- Strategically control gamba grass on local government managed land
- Source funding and/or contribute to strategic control programs

Natural resource management groups (catchment management authorities), landcare, community, and other interest groups

- Contribute local and regional perspectives to gamba grass 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
- Support and/or develop gamba grass funding submissions consistent with national priorities

- Participate in local and regional mapping initiatives and contribute to state, territory and national map production and zonal management objectives
- Promote awareness and best practice management through event coordination and product development and distribution.

Grazing industry

- Promote and adopt best practice management of gamba grass
- Identify gaps and issues associated with implementation of the gamba grass strategic plan
- Contribute to research and development of management practices to support industry members
- Ensure awareness of sale and movement restrictions of gamba grass within industry members
- Improve community awareness of impacts and identification; and promote early detection
- Contribute to the development of a code of practice for managing gamba grass pastures

Private land owners and land managers (includes utility providers, industry, indigenous land managers and indigenous ranger groups)

- Manage and control gamba grass on private or indigenous lands in accordance with State, Territory or local government legislation and policy
- Improve knowledge of the identification, impacts and best practice control and management of gamba grass
- Identify gamba grass and other weeds threatening the property
- Undertake any necessary planning and mapping
- Implement best practice management and control
- Implement weed hygiene and other management practices to minimise spread of gamba grass.

5 MONITORING EVALUATION REPORTING AND IMPROVEMENT

It is acknowledged that many stakeholders are already undertaking activities complementary to this plan and this is expected to both continue and increase as implementation is coordinated within a national context. To improve the effectiveness and efficiency of individual and collective actions, it is important that monitoring and collation of common data attributes be undertaken. Analysis of this data will help to evaluate and measure the extent to which national goals are being achieved, maintain resourcing through reporting of achievements and lead to program improvements.

Monitoring activities should be undertaken by all stakeholders but it is particularly important for: externally funded projects; outlier management and eradication actions; and, where outcomes may affect broader management of the weed. Data will be collated from current reporting processes as well as through targeted surveys, direct discussions with project proponents and other means.

The Australian Weeds Strategy (Natural Resource Management Ministerial Council, 2006) assigns the Australian Weeds Committee with responsibility for monitoring and evaluating the management of national priority weeds including the Weeds of National Significance. To assist in fulfilling these responsibilities, a National Gamba Grass Taskforce will form to oversee the plan and report progress annually.

Regional approaches are a particular focus of strategy implementation and a Priority Management Action Spreadsheet will also be developed annually to guide regional groups, community groups and local government.

5.1 Targets and Measures

The framework below forms the basis for annual reporting and measuring progress towards achieving the strategic goals and actions within this plan. While these data attributes are most important and should be systematically collected, it should not exclude the collation of other information sources on an opportunistic basis.

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 New infestations</u> • Number of new outlier infestations[1] recorded. • Percentage of known infestations actively controlled. [1] New infestations should be an outlier, outside existing distribution of gamba grass	• Are any new outlier infestations occurring in eradication and prevention zones? • How were infestations detected (passive or active surveillance, community reporting etc)? • Have high risk pathways been adequately identified? And threats minimised?
		<u>1.2 Eradication & containment programs</u> • Percentage of eradication and/or containment programs being maintained	• 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? • Are there examples (case studies) that can be used to illustrate the programs?
		Overall progress rating	
2. Existing infestations are under risk-based strategic management	To what extent is integrated weed management effectively managing core infestations?	<u>2.1 Best Practice Management</u> • Have there been improvements in best practice management of gamba grass?	• Are existing tools providing adequate control of gamba grass? • 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 risk-based strategic management?	2.2 Asset protection • Number of priority assets identified as 'at risk' from gamba grass? • Number of priority assets being protected from gamba grass? • Percentage of state/regional/local government invasive species plans that identify priority assets at risk from gamba grass?	• 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 manage gamba grass	To what extent has the capability and commitment to manage gamba grass increased?	3.1 Legislation • Have there been any legislation or policy changes for this species? • Has a need for legislative change been identified by stakeholders?	• 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?
		3.2 Community engagement & awareness • What is the status of best practice information? • Are partnerships being maintained to ensure collaboration on gamba grass? • Number and type of media activities.	• 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/groups being supported (e.g. through dissemination of research outcomes, funding opportunities, control options etc)? • Has awareness and engagement in gamba grass

			management been raised effectively?
		3.3 National distribution data • Has the national distribution map been developed? • Once developed, has the national distribution map been reviewed and/or updated? • Has a zonal management system been developed to reflect broad national objectives? • Has the Priority Management Action spreadsheet for each NRM region been developed/updated?	• Are these documents publicly available? • Have stakeholders been advised of any changes? • Where is this data/info stored? • Do these documents reflect national priorities?
		3.4 Resourcing • From what sources are programs being funded?	• Number of projects funded by Commonwealth, jurisdictions, industry, etc
		3.5 Policy & Planning • Are the objectives of the strategy being integrated into commonwealth/state/regional plans, policies and programs? • Has cross border collaboration occurred?	• 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?	4.1 Barriers • Have any other management issues or impediments been identified?	

How to score progress rating

1 - Insufficient evidence to score

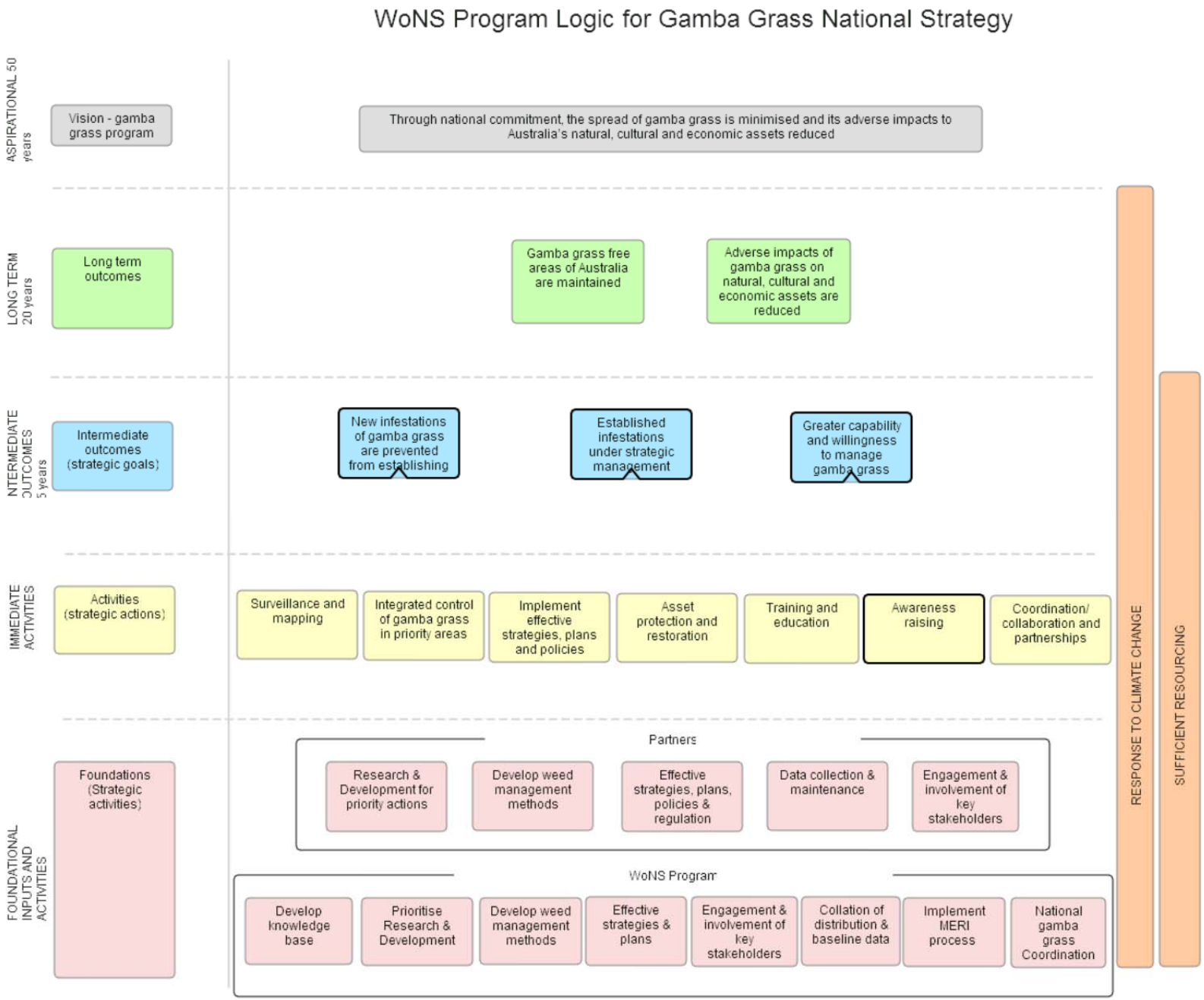
2 - No progress against goal

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 Gamba Grass National Strategy
ASPIRATIONAL 50 years
Vision - gamba grass program
Through national commitment, the spread of gamba grass is minimised and its adverse impacts to Australia's natural, cultural and economic assets reduced
LONG TERM 20 years
Long term outcomes
Gamba grass free areas of Australia are maintained
Adverse impacts of gamba grass on natural, cultural and economic assets are reduced
INTERMEDIATE OUTCOMES 5 years
Intermediate outcomes (strategic goals)
New infestations of gamba grass are prevented from establishing
Established infestations under strategic management
Greater capability and willingness to manage gamba grass
IMMEDIATE ACTIVITIES
Activities (strategic actions)
Surveillance and mapping
Integrated control of gamba grass in priority areas
Implement effective strategies, plans and policies
Asset protection and restoration
Training and education
Awareness raising
Coordination/ collaboration and partnerships
FOUNDATIONAL INPUTS AND ACTIVITIES
Foundations (Strategic activities)
Partners
Research & Development for priority actions
Develop weed management methods
Effective strategies, plans, policies & regulation
Data collection & maintenance
Engagement & involvement of key stakeholders
WoNS Program
Develop knowledge base
Prioritise Research & Development
Develop weed management methods
Effective strategies & plans
Engagement & involvement of key stakeholders
Collation of distribution & baseline data
Implement MERI process
National gamba grass Coordination
RESPONSE TO CLIMATE CHANGE
SUFFICIENT RESOURCING

6 Technical Background

Information and extracts on the technical aspects of gamba grass have been sourced from:

- Csurhes, S. and Hannan-Jones, M. (2008) Plant Risk Assessment: Gamba grass (*Andropogon gayanus*). Biosecurity Queensland, Department of Primary Industries and Fisheries, Queensland.
- NT Weed Risk Assessment Report: *Andropogon gayanus* (Gamba Grass) December 2008. Department of Natural Resources, Environment, the Arts and Sport
- Weed Management Plan for *Andropogon gayanus* (Gamba Grass) 2010 Department of Natural Resources, Environment, the Arts and Sport.

6.1 Gamba grass identification

Gamba grass can be distinguished from native and other grasses on the basis of its growth habit – it is usually tall (up to 4.5m) and has dense and erect tussocks (up to 70cm diameter). The flowering stems may extend 2.2m above the height of leaf foliage. The leaves have a distinctive white mid-rib and are covered with soft hairs (the latter noticeable when holding rain water and dew). The ability of gamba grass to remain green (late curing) into the dry season also distinguishes it from other grasses.

1. Gamba grass infestation in northern Cape York, Queensland. **2.** V-shaped flower heads. **3.** Seeds. **4.** Leaves with soft hairs and a distinctive white mid-rib (Images: Nathan March, QDAFF)

6.2 Gamba grass biology and ecology

Gamba grass is a large, perennial, tussock grass native to tropical and subtropical savannas of Africa. It occurs from Senegal on the west coast to Sudan on the east coast, south to Mozambique, Botswana and South Africa. Gamba grass grows best in the seasonally dry tropical savannas. While it can persist in areas with 400-3000mm annual rainfall, it prefers 750-1500mm rainfall per annum and a distinct 3-7 month dry season. Active growth usually occurs over a 4 to 8 month period, sometimes longer if adequate soil moisture exists.

Reproduction is from seeds with viable seed production starting when the plant is two years old. Gamba grass flowers mainly in April although flowering may continue through to August if conditions are suitable. Seeds are generally formed from May to June and most seeds have been dropped by the end of August. Mature plants can produce between 15,000 and 244,000 seeds annually. This results in soil-seed banks of 600 – 3,500 seeds/m^2. However, seed longevity is short, with rapid decline in seed viability in the dry season and very low seed survival after 12 months.

Germination of seeds occurs whenever sufficient soil moisture is available, from early wet season storms in October through the typical commencement of the wet season in December. Plants which have been burnt or slashed earlier in the year can also flower and form seed in October to December without necessarily any need for rainfall (ie. through root reserves).

Gamba grass can invade a range of habitats, from wetland margins to upland savanna. It is often abundant along riparian and roadside corridors. While capable of surviving in a range of soil types it prefers loams with moderate fertility. It also prefers full sunlight but can persist under light shade.

6.3 Gamba grass distribution and spread

Gamba grass is a major weed in the Northern Territory with infestations primarily in the Darwin and Katherine regions — with 1 to 1.5 million ha affected. Scattered infestations are also known in the Daley River district, Arnhem Land and Barkly Tableland. In Queensland, it affects an estimated 18 000 ha in Cape York Peninsula, with additional populations on the Atherton Tablelands and isolated occurrences in the Georgetown, Doomadgee, Townsville, Proserpine and Mackay areas. A small number of populations exist in the east Kimberley Region of Western Australia. There are herbarium records of isolated gamba grass occurrences at other sites which require verification of their current status.

Most seeds (90%) fall within 5m of the parent plant and less than 1% falls more than 10m away. As a result, spread tends to be incremental although outlier populations can develop via other spread vectors. Seeds can be spread long distances via wind, water (including flooding), livestock and other animals, and via contaminated machinery and hay. Riparian habitats are important spread corridors, particularly into remote locations. Transport corridors also facilitate dispersal as a result of passing traffic, roadside slashing and soil movement.

6.4 Summary of impacts

Gamba grass invades tropical savannas, including riparian habitats, where it can become the dominant grass species. A decline in the diversity and abundance of native fauna and flora can occur directly through competition and indirectly through increased fire intensity.

Research in the Northern Territory demonstrates that intense wild-fires fuelled by gamba grass are reducing tree cover. Being a large tussock grass, gamba grass biomass can be up to 10 times greater than native grasses. Resulting fire intensities can be 3 - 8 times higher than native grass fires. These fires dramatically alter the structure of native vegetation, with woodlands potentially transforming into tree-free grasslands. Gamba grass may also modify soil hydrology through its extensive root system and reduce soil nitrogen levels.

Unless gamba grass is intensively managed, it poses a major fire hazard and causes increased fire management and infrastructure costs. It also causes cultural and social impacts through limiting access to significant cultural sites and the reduced availability of traditional foods and other resources for indigenous people.

Gamba grass impacts have been recognised through its listing with four other grasses as a key threatening process. The Key Threatening Process (KTP) is described as ‘Ecosystem degradation, habitat loss and species decline due to invasion of northern Australia by introduced gamba grass (*Andropogon gayanus*), para grass (*Urochloa mutica*), olive hymenachne (*Hymenachne amplexicaulis*), mission grass (*Pennisetum polystachion*) and annual mission grass (*Pennisetum pedicellatum*).

Within some infestation areas of the Northern Territory Top End and Queensland's Cape York and Atherton Tablelands, gamba grass is utilised for its pasture production benefits. However, these benefits diminish if infestations are poorly managed and such sites may pose invasion risks to adjoining areas.

6.5 Control options

6.5.1 Spread prevention

Spread prevention is the most successful and effective way of managing gamba grass.

Properties with gamba grass should consider a range of seed spread prevention practices. The designation and use of clean down areas will reduce seed spread via machinery and vehicles. Avoiding vehicle movement through infestations, treatment of roadside occurrences and education of property staff and contractors will assist in limiting seed spread. The movement of contaminated products such as fodder and soil should also be avoided. Transport avenues (eg. roads, tracks, paths), areas of soil disturbance, water points and other high risk areas should be regularly monitored to achieve early detection of new outbreaks.

6.5.2 Chemical control

Gamba grass is susceptible to glyphosate based chemicals. For best results, gamba grass should be sprayed while it is actively growing and immature. Spraying plants prior to reaching full height, or following regrowth from slashing and/or burning will reduce time and chemical requirements.

Chemicals should be sprayed over the entire tussock using a fine spray with low application pressure. Effective control will require at least two treatments within a growing season with the initial treatment of existing mature plants and any seedlings ideally occurring following the onset of wet season rains, when there is active growth (usually November to December). A follow up treatment should be undertaken in approximately two to four weeks time to treat plants which may have been missed, or recently germinated seedlings. Breaking the plant's life cycle through control and prevention of seed production is the key to managing gamba grass. All herbicides should be used strictly in accordance with label directions and any APVMA permit condition. Seek further advice if in doubt.

6.5.3 Physical control

Although most infestations are best controlled using chemicals, some physical control options are available. Slashing can be useful as part of an integrated control program. While it won't kill gamba grass, it can be used to reduce biomass (fuel load), decrease seed production, increase competition by other plants, assist access and reduce costs of future herbicide application. Slashing young plants in May will prevent seed maturation.

Ploughing, grading or scraping can also be used, although multiple applications may be necessary together with follow up application of herbicides. Soil disturbance, erosion risks and permits associated with vegetation clearing may need to be considered. It is also critical that all machinery and vehicles involved in control operations be washed down before moving to areas free of gamba grass.

Individual plants, if not too large, may be removed by hand or using a mattock. It is important that the entire root mat be removed and excess soil shaken off to ensure the plant dies.

6.5.4 Fire

Fire is often used as a pasture management tool across Northern Australia and can be integrated into gamba grass management. While gamba grass fires can be destructive and difficult to manage, fire can be used pre-emptively to reduce high fuel loads. Fire may also be used to kill seedlings, reduce seed production, encourage new foliage prior to herbicide application, reduce herbicide control costs and improve site access.

Burning is best undertaken during the late wet - early dry season when fires tend to be lower intensity and easier to manage. To assist burning at this time, herbicide treatment may be used to create dry matter to sustain a fire. Seed dispersal (through thermal air currents) and invasion risk to adjoining native pastures may need to be considered. In addition to other fire management considerations, fire breaks may need to be wider for gamba grass fires due to high fuel loads and fire intensity.

Care must be taken with the use of fire since if used at the wrong time or during less susceptible growth stage, a fire will potentially kill competing native pastures and further benefit gamba grass invasion.

6.5.5 Biological control

No biological control agents have been introduced to control gamba grass within Australia. Given the size of infestations and inability to minimise impacts at a broadscale, there is a need to assess gamba grass as a potential biological control target. This will require consultation with industry, community and government stakeholders before a research program can commence.

Natural dieback has been reported at two sites in the Northern Territory and is thought to be caused by endemic pathogens. There is scope to investigate dieback presence and the potential use of pathogens to reduce gamba grass impacts.

6.5.6 Grazing management systems

Established gamba grass infestations should be managed in a way that minimises seed production and spread into clean areas and adjoining properties. This can be achieved by maintaining stocking rates at a level that will keep the grass below a height of 60 to 90cm. Above these heights, plant tussocks tend to become unpalatable and produce large quantities of seeds. Intensive and consistent management of stocking pressure and pasture monitoring is required to minimise spread.

6.5.7 Integrated control

No single treatment will be effective for all gamba grass infestation situations. Effective management may require a combination of methods to according to the infestation size and density, growth stage, landscape factors including other vegetation, time of year, cost and resources, and any legal obligations including permit requirements.

6.6 Quarantine and legislation

Gamba grass is a declared weed in all of the jurisdictions (Queensland, Western Australia and the Northern Territory) in which it is present.

State / Territory	Legislation	Declaration	Goals/Actions
Queensland	*Land Protection (Pest and Stock Route Management) Act 2002*	Class 2	Landowners must take reasonable steps to keep land free of **Class 2 pests**. Must not introduce, keep or supply a **Class 2 pest** without a permit issued by Biosecurity Queensland.
New South Wales	*Noxious Weeds Act 1993*	Not declared	N/A
Northern Territory	*Weeds Management Act 2001*	Class B/C and Class A/C	**Class A**: **To be eradicated**, in all areas of the NT except where it is classified as Class B; **Class B**: **Growth and spread to be controlled**. This is an area roughly bounded by the NT coastline in the north, the western boundary of Kakadu National Park in the east, the town of Katherine in the south, and the Daly River mouth in the west; and **Class C Not to be introduced into the NT** (all Class A and B areas are also classified as Class C).
Western Australia	*Biosecurity and Agriculture Management Act 2007 (BAMA)* will be the principal legislation for the management of declared organisms in Western Australia	Prohibited, Declared	**Eradication (C2)**
South Australia	*Natural Resources Management Act 2004*	Not declared	N/A
Victoria	*Catchment and Land Protection Act 1994*	Not declared	N/A
Tasmania	*Weed Management Act 1999*	Not declared	N/A
ACT	*Pest Plants and Animals Act 2005*	Not declared	N/A

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 Agriculture, Forestry and Fisheries	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/biosecuritysa/nrm_biosecurity/weeds
TAS	Dept of Primary Industries, Parks, Water and Environment	1300 368 550	www.dpipwe.tas.gov.au/weeds	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 Other information sources

Information on all the WoNS species 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. The Strategic Plan support documents (see Section 3) will be published here.

7.3 The WoNS Program and its phases[3]

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 (Figure 4). This 'phased approach' aims to provide the most cost-effective use of limited 'national coordination' resources.

[3] Adapted from Thorp 2012 "Additional List of Weeds of National Significance – April 2012" www.weeds.org.au/WoNS.

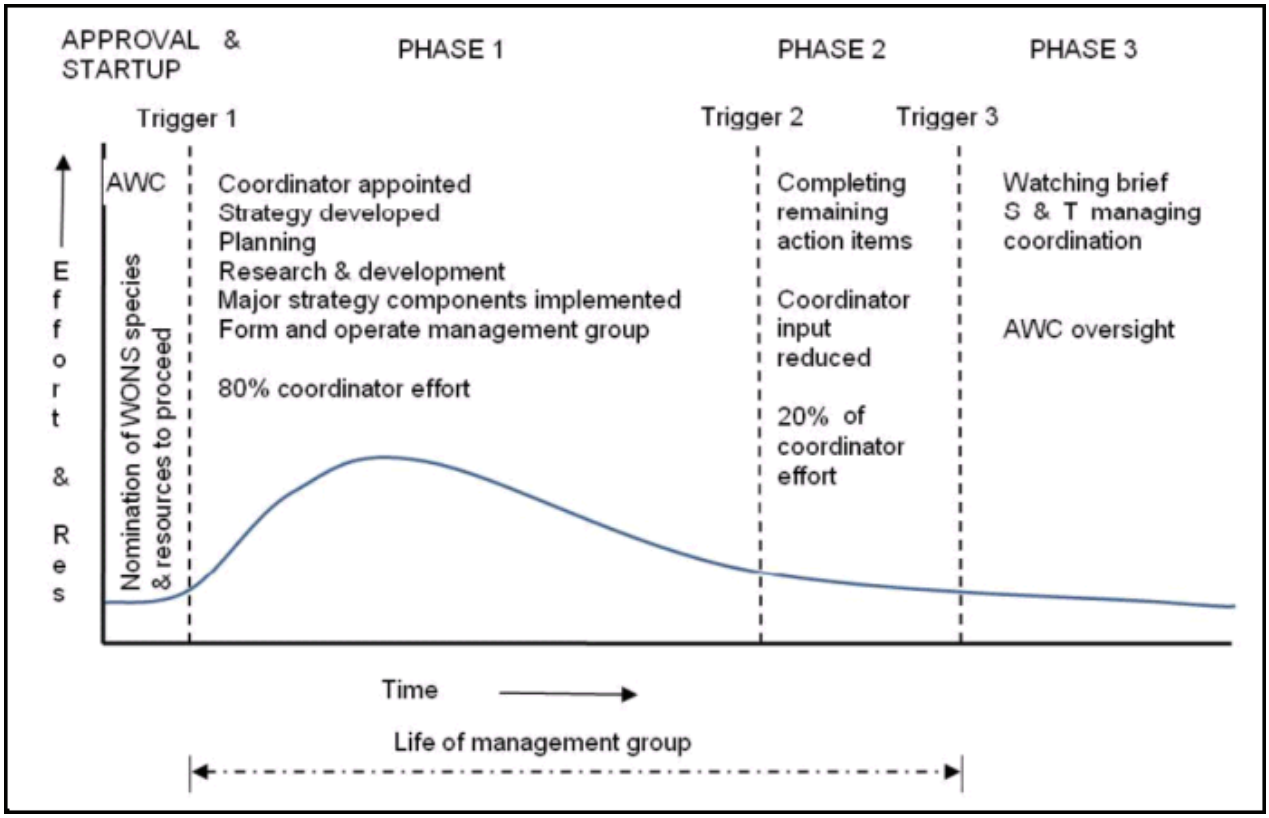


Figure 4. *Australian Weed Committee diagrammatic representation of coordinator effort and resource use when implementing a Weed of National Significance strategy*

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 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. Theses species were independently assessed and the AWC endorsed twelve additional 'species' to be listed as WoNS (including gamba grass). The AWC Chairman, Dr Jim Thompson, announced these additional plant species as WoNS on 20 April 2012. Further information on the selection of these species and the phased approach is available on www.weeds.org.au/WONS.

7.4 Glossary and Acronyms

ACT	Australian Capital Territory
APVMA	Australian Pesticides and Veterinarian Medicines Authority
AWC	Australian Weeds Committee
BPM	Best Practice Management
Coordinator/s	WoNS National Coordinator or similar
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFWA	Department of Agriculture and Food, Western Australia
IGAB	Intergovernmental Agreement on Biosecurity
Land Councils	Organisations representing traditional Aboriginal landowners and Aboriginal people
Local government	Local governments that have legislated weed management

	responsibilities
MERI	Monitoring, Evaluation, Reporting and Improvement
NRM/CMA	Natural Resource Management / Catchment Management Authority
DLRM	Northern Territory Department of Land Resource Management
NRM	Natural Resource Management
NSW	New South Wales
NT	Northern Territory
SEWPAC	Department of Sustainability, Environment, Water, Population and Communities
QDAFF	Queensland Department of Agriculture, Fisheries and Forestry
Qld	Queensland
SA	South Australia
Tas	Tasmania
Vic	Victoria
WA	Western Australia
WoNS	Weeds of National Significance

Definition of key terms:

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

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

Outliers – An infestation separate from core and may be eradicable.

Priority outliers – One that is feasible to eradicate or contain or reduce / prevent spread.

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

Partner – Person, group or organisation actively supporting in WoNS strategy implementation.

Stakeholder – A person, group or organisation interested in or concerned about gamba grass and or their management

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).

Eradication - The elimination of every single individual of a species from an area to which recolonisation is unlikely to occur, including propagules.

7.5 References

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