

WEEDS OF NATIONAL SIGNIFICANCE

Olive hymenachne

**(*Hymenachne amplexicaulis* (Rudge)
Nees)**

strategic plan 2012–17

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

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An unpublished draft of the revised strategic plan has guided national coordination of this Weed of National Significance for the past two years.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

Supporting information about the Australian Weeds Strategy, Weeds of National Significance and progress to date may be found at www.weeds.org.au, where links and downloads provide contact details for all species and copies of the strategy. Comments and constructive criticism are welcome as an aid to improving the process and future revisions of this strategy.

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Summary

Hymenachne (*Hymenachne amplexicaulis*) or olive hymenachne is an invasive semi-aquatic grass, officially released in Australia in 1988 as dry season cattle fodder for use in ponded pastures. It quickly escaped from the production systems for which it was intended, invading wetlands, watercourses, water storages, and irrigation channels and drainage lines in agricultural crops such as sugar cane.

Hymenachne continues to encroach on iconic wilderness areas of Australia such as Kakadu National Park and parts of Arnhem Land in the Northern Territory, and Queensland's Wet Tropics and Cape York Peninsula. Tropical and subtropical areas are most at risk of incursion; however, hymenachne has shown it can tolerate cooler climates by establishing infestations in inland southern Queensland and northern New South Wales.

Through its ability to spread both vegetatively and via prolific seed production (producing up to 4000 long-lived seeds per seed head), hymenachne is rapidly fulfilling its potential distribution in Australia. It forms dense stands that are difficult and costly to control once established. Hymenachne therefore requires surveillance, early detection and immediate control once discovered.

Management of hymenachne, as with all the inaugural 20 Weeds of National Significance, will change from 2012. National coordination, funded by the Australian Government, will cease and actions to deliver this strategy will become the responsibility of state, territory and local governments, industry and the community.

Vision

Through national commitment, the spread of hymenachne is prevented and its adverse impacts reduced.

1 The challenge

To contain and reduce hymenachne's reach in an environment of ever-increasing competition for resources, and to find the balance between production benefits and adverse environmental, economic and social impacts.

Hymenachne is regarded as a 'conflict species' as it has both beneficial and detrimental impacts. Landholders planted hymenachne in good faith, on the advice of well-meaning governments, as a source of dry-season cattle fodder. Hymenachne has shown to be valuable to cattle production in purpose-built ponded pastures in Queensland and in alluvial floodplains of the Northern Territory. Unfortunately, hymenachne has escaped from such intentional plantings to wetlands, watercourses and other wet areas and now many landholders are reluctant to instigate control due to perceived production benefits. However, cattle will largely ignore hymenachne when other food sources are available, and wet areas need to dry sufficiently for cattle to access and browse hymenachne. Vast stands of hymenachne go untouched by cattle in tropical areas. Therefore, its value outside ponds and floodplains is questionable at best.

Hymenachne is a Weed of National Significance (WoNS) due to its potential to invade wet areas across a vast area of Australia (Figure 1). The negative impacts to biodiversity in wetlands and watercourses are well documented. Hymenachne has the ability to outcompete and displace native vegetation and form monocultures. It has negative impacts on water quality with flow-on effects to macroinvertebrate and fish communities, waterbirds and turtles. Studies have shown hymenachne encourages displacement of native fish with exotic fish. It can cause downstream sedimentation of streams, choke stream flows and potentially increase flood impacts. Hymenachne is encroaching into internationally significant wetlands in Kakadu National Park and Arnhem Land in the Northern Territory and the Wet Tropics and Cape York in Queensland.

The economic impacts posed by hymenachne are significant. It is difficult and costly to treat due to the wet environments it prefers and the need for repeated treatments to exhaust the seed bank. Low-lying sugarcane crops and associated drainage and irrigation channels are particularly susceptible to invasion. Once infestation occurs, farm management costs are greatly increased. Commercial barramundi fisheries are at threat via the degradation of wetlands that are nurseries for the species.

Hymenachne may also pose risks to human health by harbouring mosquitoes and increasing the prevalence of mosquito-borne diseases such as Ross River fever. Invasion of public water storages by hymenachne also presents risks of decreased water quality through reduced oxygen levels and the need to treat infestations with herbicides.

In 2000, it was estimated that hymenachne had infested at least 1000 hectares in Australia. At the beginning of 2011 it was conservatively estimated that at least 11 000 hectares were infested. If left unchecked, hymenachne could potentially invade an area hundreds of times as large again.

Collective action is needed to ensure available resources are focused on the most strategic goals.

To that end, this strategy seeks to introduce a zoned approach to management of hymenachne, whereby strategic management objectives are put in place according to the

level of infestation present in catchments; the economic importance to graziers; the feasibility of catchment-scale eradication; and the protection of economic, environmental and social assets (see Section 2.4). Implementation of this strategy will contain hymenachne to its current extent, allowing for reduction and eradication at the local level and preventing incursion into uninfested areas. The strategy will also improve public knowledge of the threats posed by hymenachne and garner broad support to reduce its impacts.



Figure 1 *Melaleuca wetland heavily infested by Hymenachne amplexicaulis*

2 Background

Hymenachne is of importance to all Australians.

It is of economic importance to the sugarcane industry through increased farm and irrigation management costs; to commercial fishers through negative impacts to native barramundi fisheries; and to graziers through control and containment costs. Hymenachne can provide economic benefits to cattle producers using the plant in purpose-built ponds in parts of Queensland and seasonal floodplains in the Northern Territory.

It is of environmental significance due to its ability to alter natural wetlands and associated wildlife.

It is of social importance to recreational fishers, boating enthusiasts, birdwatchers, other recreational users of waterways and the general public via infestation of drinking water storages and the harbouring of mosquitoes.

It is important to Aboriginal people as it is degrading culturally important sites and can interfere with species composition of traditional hunting and gathering places.

It is due to these far-reaching impacts that hymenachne was included as a WoNS and demonstrates why a collaborative, national approach is needed to mitigate its impacts.

Since being listed as a WoNS in 1999, several important steps have been undertaken aimed at reducing hymenachne's spread and impacts. Some of the key outcomes have been:

- formation of the National Hymenachne Management Group to oversee implementation of a national strategic plan
- identification and registration of effective herbicide controls
- local eradication projects implemented for outlier infestations
- local control programs initiated
- consistency of legislative controls across jurisdictions
- prohibition of new plantings—both for grazing and *Mimosa pigra* seedling suppression
- integration of hymenachne management into pest and natural resource management planning frameworks
- improved understanding of the ecology of hymenachne
- improved public awareness of the impacts and best practice control methods of hymenachne.

The Australian Weeds Committee (AWC) undertook a review of the progress and effectiveness of the implementation of the previous National Hymenachne Strategic Plan in 2010. The review culminated in a series of recommendations to improve national strategic management of hymenachne. The AWC recognised the work done by the National Hymenachne Management Group on drafting the National Hymenachne Zoning Strategy (see Section 2.4) and recommended its implementation via this new strategic plan. The AWC also recommended more effective engagement with the grazing industry to strike a balance between management of hymenachne for production and its control as a serious environmental weed. Significant advances have been made in addressing these

recommendations, with support gained from key stakeholders for the National Hymenachne Zoning Strategy and a commitment gained from the grazing industry in Queensland to collaboratively develop a code of practice for containment of hymenachne to genuine production systems. These recommendations are further addressed in the strategic actions in Section 3 of this document.

2.1 The biology of *Hymenachne amplexicaulis*

Hymenachne amplexicaulis is a robust, stoloniferous, perennial grass. It is commonly known as ‘olive hymenachne’ or ‘Olive’—the name of the commercially released cultivar. A relative, *Hymenachne acutigluma*, is native to Queensland and the Northern Territory.

Hymenachne commonly grows to 1–2.5 m tall; the leaves are 10–45 cm long and up to 3 cm wide. It can be distinguished from other species of hymenachne by its characteristic stem-clasping leaf sheaths (Figure 2). The plant’s stems float on water. Roots are produced at each node along the stolons where they contact moist soil.

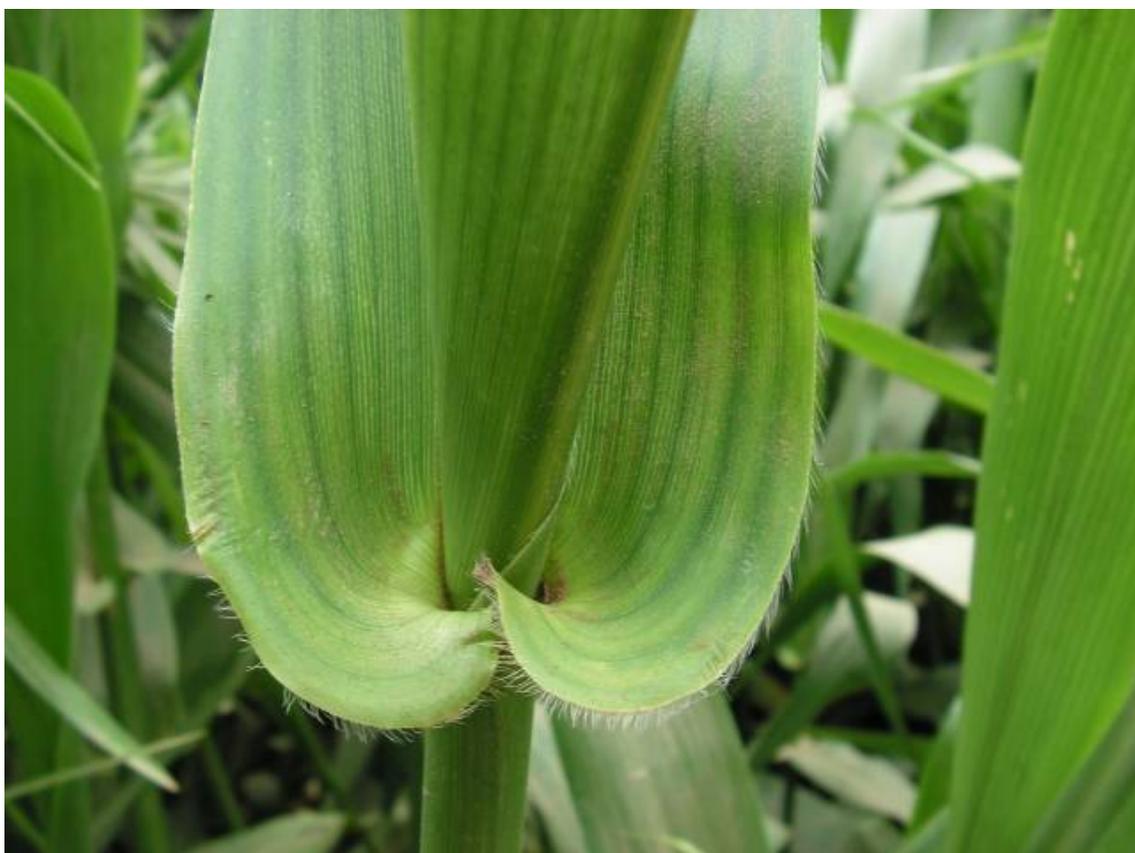


Figure 2 Stem clasping leaf sheath of *Hymenachne amplexicaulis*, showing fine hairs

Flowers are arranged in cylindrical panicles, 20–40 cm long (Figure 3). Spikelets are lanceolate, upright and 3–5 mm long. Flowering can occur anytime between September and May, with most flowering between mid-April and May. Hymenachne produces large numbers of viable seeds (up to 4000 per seed head) that germinate readily on waterlogged soil. Trials suggest that seeds need to be sitting on waterlogged soil for at least 48 hours before germination occurs. Seeds can remain viable for up to eight years.



Figure 3 Flower spike of *Hymenachne amplexicaulis*

When growing in suitable habitat, hymenachne forms pure stands that exclude other plant species. Growth can be particularly vigorous in eutrophic wetlands that act as depositional areas for agricultural run-off high in nutrients and sediment. Hymenachne prefers low-lying areas along the edges of permanent water bodies and within seasonally flooded areas where the soil is inundated in summer and moist but not inundated in winter (i.e. a moist subsoil). It can tolerate areas that are flooded for most of the year and can withstand short periods of drought. More recent discoveries of infestations in northern New South Wales and south-west Queensland suggest hymenachne tolerates cooler winters than originally anticipated via climate modelling, so long as water is available.

Graziers have in the past planted hymenachne from seeds and from fragments of stolons. Once planted, secondary dispersal occurs when run-off water transports seeds or broken stolon fragments. Spread can be rapid and occurs every wet season. It is difficult to prevent floodwaters from carrying hymenachne downstream (although some pondage areas have been constructed in flood-free locations). Anecdotal evidence suggests that birds carry stem fragments and seeds into new areas both through ingestion and in mud on their feet, although water is considered the primary vector.



Figure 4 Juvenile plants of *Hymenachne amplexicaulis*

Hymenachne is a transforming species, forming large homogenous stands in tropical floodplain areas in both its native and introduced ranges. In its native range it is associated with waterlogged basins, tall grasslands, forest edges and marsh ponds. In Australia, it can now be found growing in water storage facilities, irrigation channels, roadside ditches, natural lagoons and cane paddocks. The species has been able to establish and spread in floodplains and wetlands outside tropical areas (e.g. northern New South Wales and southern Queensland). Growth of hymenachne has been found to be less prolific in situations where tall, natural vegetation provides shade over the banks of lowland streams. The species is associated with other pasture species, such as para grass (*Brachiaria mutica*), where vegetation is often disturbed through seasonal flooding and/or cattle grazing. In these circumstances, it tends to form the largest stands on open floodplain areas, where there is little competition from other species. It will also establish along streams and rivers, although populations will often be more dispersed, forming smaller isolated populations. Where both hymenachne and para grass grow together, hymenachne will dominate in wetter, deeper areas of a floodplain or stream system and para grass will dominate in drier areas. Hymenachne can also be found growing alongside native hymenachne (*Hymenachne acutigluma*) stands.

Depth and duration of inundation are important determinants for hymenachne establishment and spread. In Australia, it has persisted in seasonally flooded areas (1–1.2 m deep) for more than 20 years with no reported decline, and has also been observed growing in deeper water (> 4 m); however, this occurs through floating rafts (common after floods) or growth on dense floating mats of water hyacinth. Hymenachne does appear limited by well-drained sites that dry out completely during the dry season. The life cycle of hymenachne is shown at Figure 5.

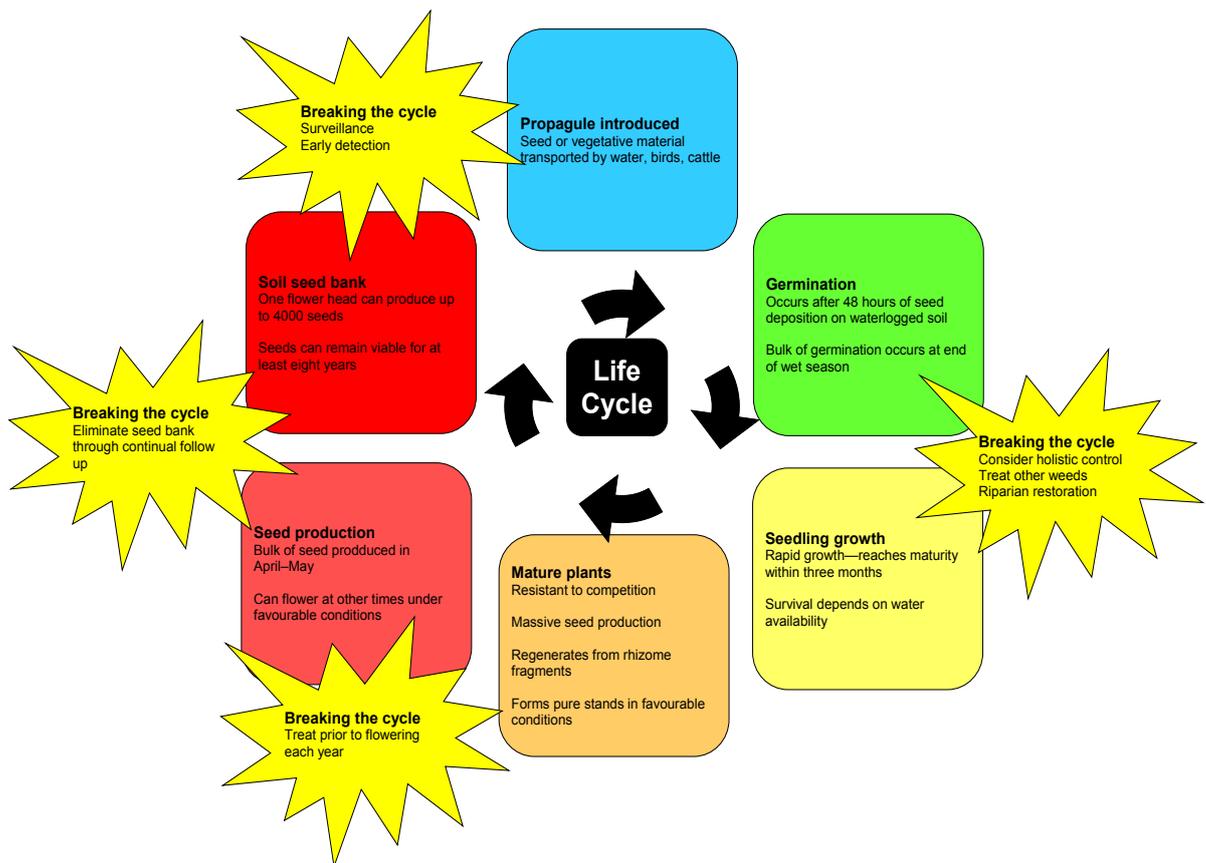


Figure 5 Life cycle of *Hymenachne amplexicaulis*

2.1.1 Hybridisation

Clarkson et al. (2011) described naturally occurring hybridisation between *Hymenachne amplexicaulis* and the Australian native species *H. acutigluma* as *Hymenachne × calamitosa* (Figure 6).

Field observations suggest the hybrid will be at least as invasive under Australian conditions as *H. amplexicaulis* and should be dealt with accordingly. The National Hymenachne Management Group wrote to all states and territories in March 2011 seeking its declaration. All references to management of olive hymenachne or *H. amplexicaulis* in this strategy should be taken to include *H. × calamitosa*.



Figure 6 Leaf blade bases of *Hymenachne* spp. Left to right: *H. amplexicaulis*, *H. x calamitosa* and *H. acutigluma*

2.2 History of spread

Hymenachne amplexicaulis grows naturally in seasonally flooded lowlands and along riverbanks throughout tropical and subtropical areas of South and Central America. The species is a significant weed in Florida, United States.

Hymenachne has spread considerably in Australia over the past two decades and is now widely distributed within waterways and wetlands across coastal and subcoastal Queensland and the Northern Territory (Figure 7). Small populations extend to northern New South Wales and south-western Queensland.

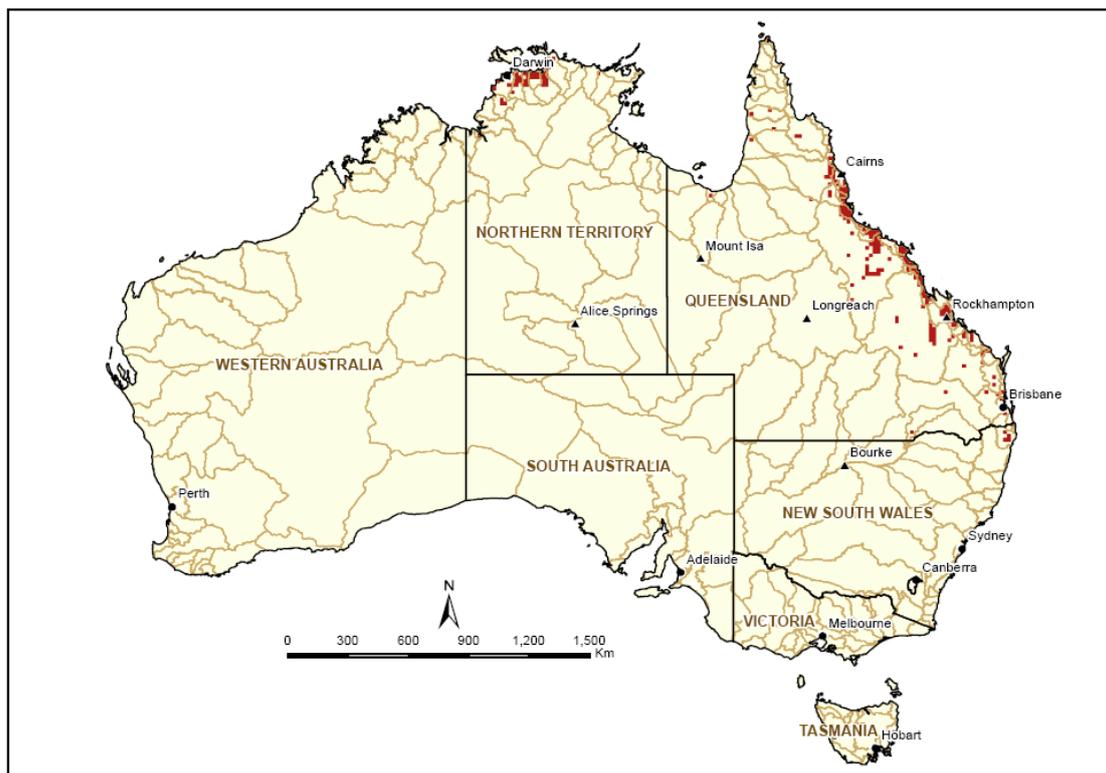


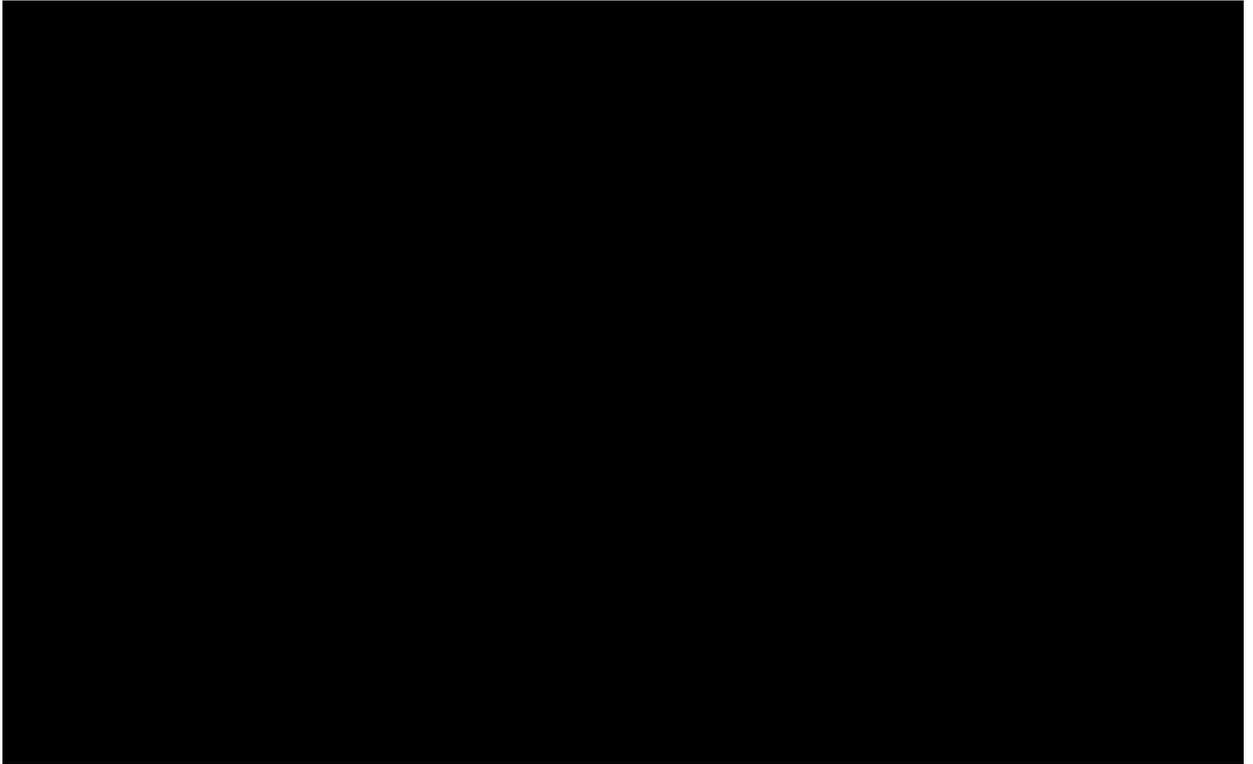
Figure 7 National distribution of *Hymenachne amplexicaulis*

Tropical and subtropical areas are at greatest risk of infestation and many catchments east of the Great Dividing Range in central and north Queensland are heavily infested in parts (see, for example, Figure 9), as are northern catchments in the Northern Territory. Within these ‘core infestation’ areas, however, distribution can be patchy and hymenachne has far from reached its potential range (Figure 8), thanks in part to the relatively short time it has been present in Australia and to local control efforts. Hymenachne is not known to exist in Western Australia, although it is present in the Northern Territory on its border with Western Australia. Natural wetlands and watercourses of the Kimberley region are thought to be at high risk of incursion, as is the Ord River irrigation scheme. Small, isolated infestations have been located in northern New South Wales and southern and south-western Queensland, some in areas that are heavily frosted in winter. Scientific analyses and climate modelling have indicated that aquatic and riparian weeds can extend beyond their potential range, due to milder climates, frost protection and water availability in waterways. This, coupled with climate change impacts and recorded isolated hymenachne outbreaks suggests areas such as the Murray–Darling Basin contain suitable habitat at risk of incursion.

Initial experimental planting occurred on grazing properties in central Queensland in the early 1980s. One of these properties was Granite Vale near St Lawrence, the property of J. and P. Olive (hence the cultivar name ‘Olive’). Hymenachne was trialled in numerous other areas, including properties around the lower Burdekin River catchment, coastal north Queensland. In August 1988, *Hymenachne amplexicaulis* cv. ‘Olive’ was approved for release by the Queensland Herbage Plants Liaison Committee, which recommended registration on the submission of the Queensland Department of Primary Industries.

The introduction and approval of olive hymenachne was for use within ponded pastures, which have arisen through the construction of artificial ponds, or the construction of banks for the purpose of capturing or holding water and developing pasture. The construction of

ponded pastures prevented seawater incursion (along the coast), collected run-off during storms, increased the catchment area and, if built on floodplains, could retain flood flows. While ponded pastures have existed since the 1930s, in the early 1970s a boom in beef prices led to crop areas being converted to pasture. To improve production, ponded pastures became more prevalent. The species used for ponded pastures include both native and introduced plants. Para grass was the most common species used. The introduction and approval for release of olive hymenachne allowed deeper water areas of the ponded pasture to be used. The release of olive hymenachne was actively promoted with the ponded pasture concept from the late 1980s. Graziers throughout northern Australia were made aware of the concept and the species suitable for planting.



Source: Queensland Department of Agriculture, Fisheries and Forestry

Figure 8 Climex model potential distribution of *Hymenachne amplexicaulis*; the black area is considered to be highly suitable and the grey area marginally suitable

Concerns regarding the plant's propensity to invade natural wetlands were raised during the late 1980s when it showed evidence of establishing outside planted areas. The problem was further highlighted in 1989 in the lower Burdekin area. Graziers had been planting hymenachne in natural and artificial ponds in the Giru, Clare and lower Burdekin areas, and there was evidence of the plant naturalising outside these areas.

In the Northern Territory, olive hymenachne was also promoted for more productive pastures in floodplain areas. It was planted as a pasture grass along the Adelaide, Daly, Finnis and Mary river floodplains, and at Arafura Swamp in northern central Arnhem Land. The species was also used to suppress seedling growth of *Mimosa pigra*. It has now spread through parts of these catchments, including important conservation areas such as Kakadu National Park.

In 1997, its invasiveness was realised when dozens of infestations were reported in and around sugarcane areas. An aerial survey at that time revealed extensive infestations in coastal wetlands.

2.3 Summary of impacts

2.3.1 Environmental impacts

In Australia, olive hymenachne tends to invade and dominate (with 93% cover and 100% biomass) waters where emergent and floating–attached/submergent native vegetation occurs (Figure 9). By comparison, in uninvaded native plant communities, cover and biomass is shared by multiple species. As a result of the dominance of hymenachne, floating–attached/submergent native aquatic plants are displaced. The resulting emergent hymenachne grass beds harbour fewer plant species and have a 30-fold increase in plant biomass. In deeper river channels it is capable of forming a floating mat over the water surface, resulting in shading of the submerged vegetation.



Figure 9 Lake Mitchell, north Queensland

Changes in vegetation structure as a result of hymenachne invasion have been implicated as an important factor influencing macroinvertebrate and fish species composition. Compared with areas dominated by native vegetation, areas dominated by hymenachne support a higher relative abundance of introduced fish. The composition of macroinvertebrate assemblages has also been shown to differ in hymenachne stands compared to native stands.

There has been little research on the impact of hymenachne on vertebrates. Turtle and waterbird richness were found to increase following removal of hymenachne in the Fitzroy catchment, however. Research on the impacts of para grass on avifauna can provide useful

information on the likely impacts of hymenachne. In one study most birds did not use para grass habitat; in fact, most birds were associated with native vegetation or habitats with little or no para grass. Ferdinands et al. (2005) noted that ‘it seems reasonable to propose that a monoculture of dense, matted grass that produces little edible seed offers limited food resources for birds and impedes access to other resources in the water or soil’. It is clear from documented studies that habitat modification as a result of high-biomass invasive macrophytes, such as para grass and hymenachne, will have negative effects on wetland biodiversity.

There have been limited studies on the impact of hymenachne on water quality. However, in comparable wetland systems where invasive weeds have been removed from waterways, there have been rapid and substantial increases in dissolved oxygen and improved suitability of the habitat for fish. In a recent study in the Mungalla Wetlands near Ingham, north Queensland, where dissolved oxygen was monitored over time and across water depths, the water within hymenachne stands had much lower dissolved oxygen than the uninvaded open water. For example, the near-surface water adjacent to hymenachne invaded areas was 87% saturated with oxygen while the water within the hymenachne stands was only 17% saturated, which is well below the 30% minimum concentration required to prevent acute stress from developing in sensitive species of local fish.

Additional impacts of hymenachne include impediment of fish movement due to physical barriers and/or low dissolved oxygen. Such impacts have ecological, economic and social consequences.

There are significant conservation areas in Australia at risk from hymenachne. Concerns have been raised in the Northern Territory, where hymenachne is considered a key threat to wetlands in the World Heritage-listed Kakadu National Park. In Queensland, it has established within tributaries connected to Lakefield National Park, raising concerns for the extensive wetland systems that harbour rare flora and fauna species. Waterbirds such as magpie geese depend upon a range of wetland plant species, including native sedges and *H. acutigluma* for food and secure roost sites. Thus, although it is not known what impact the development of extensive, pure stands of hymenachne will have on bird populations, it is likely to be negative.

2.3.2 Human health

Recent health concerns have been expressed by the Rockhampton Regional Council in regard to the association between hymenachne and the increased abundance of two species of mosquito—one of which is of particular concern due to its potential to transfer Ross River virus to people. The thick mats of hymenachne prevent fish from feeding on mosquito larvae, thus allowing mosquito populations to increase. Research is currently examining best management practices to solve this issue.

The establishment of hymenachne within water storage facilities is of considerable public concern, given that herbicides are used to control the species.

2.3.3 Economic losses

The economic cost of hymenachne is difficult to estimate. The main economic cost to the sugarcane industry appears to arise from the cost of weed control. Hymenachne has been shown to block drainage and irrigation channels and water storages that supply water to sugarcane farms. The species needs repeated spraying, hence control costs are relatively

high. Additionally, if the source (from neighbouring properties or upstream) is not managed, control costs would be continual, hence having a significant impact on returns.

For local governments and landholders the continued cost of hymenachne control is a significant issue. Although this cost has not been quantified, continued management represents an ongoing problem for local councils. Costs include herbicide, labour and resources to access waterways. As most infestations occur on private land, there is an additional cost of trying to enforce compliance with legislation. Since the longevity of hymenachne seed is at least eight years, these costs are ongoing.

Other potential problems and costs relate to infrastructure damage. This is a particular problem during floods when large rafts of hymenachne are deposited against bridges and barrages. The species has also caused havoc with boats in Rockhampton, when in 2007 fast-moving floodwaters resulted in large masses of hymenachne catching on moored boats, snapping their anchoring and sweeping the vessels downstream.

2.4 National Hymenachne Zoning Strategy

Working with key stakeholders over a number of years, the National Hymenachne Management Group has collaboratively drafted the National Hymenachne Zoning Strategy. The result is a strategy for managing hymenachne on a national scale, with strategic objectives assigned on a catchment basis. A zoned approach has been pursued as hymenachne is not widespread nationally and its importance to cattle producers as a pasture varies from region to region (Figure 10; see also Appendix 1).

The strategic objectives have been designed with practical and achievable control measures in mind. There are four strategic objectives:

- prevention (low and high risk)—keeping clean areas clean; if an incursion is detected, it must be eradicated as soon as is practicable
- eradication—all live plants and all seeds are removed from the target area
- containment—there is neither expansion of existing infestations nor development of new ones within containment areas
- asset protection—reducing impacts to environmental, economic or social assets or clean areas within otherwise infested areas.

The National Hymenachne Zoning Strategy forms the basis of the paper, *Geographic differentiation of management objectives for invasive species: a case study of Hymenachne amplexicaulis in Australia* (Grice et al. 2011).

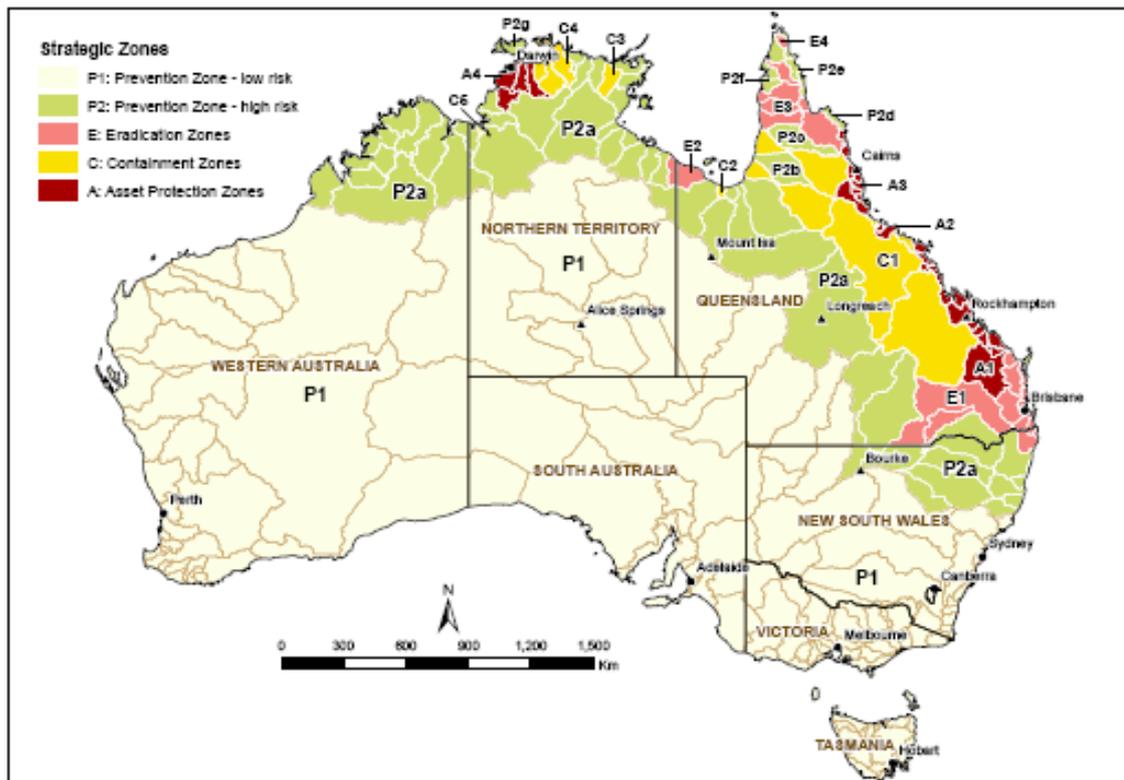


Figure 10 National Hymenachne Zoning Strategy

2.5 History of research and management including regulation

Several trials have been conducted on hymenachne aimed at improving knowledge of its ecology. These have focused on seed production and viability. Trials have shown hymenachne is capable of producing up to 4000 seeds per seed head and that those seeds may persist for eight years (8–24% viable after eight years).

A significant effort by members of the National Hymenachne Management Group has resulted in the drafting of the National Hymenachne Zoning Strategy. This document (Section 2.4) underpins the strategy and has been used as a model for national management of other WoNS.

At the time of writing, a number of hymenachne trials were in the submission phase. These all aim to improve knowledge and reduce impacts of hymenachne. One proposal seeks to research genetic diversity of hymenachne, which may in turn strengthen any future case for a biological control program.

2.6 Control methods

2.6.1 Biological control

Studies on natural enemies of hymenachne in Australia have identified 16 insects that are also found on native hymenachne (*H. acutigluma*). A blissid bug (*Ischnodemus variegatus*) identified in Florida causes severe damage to *Hymenachne amplexicaulis* and current studies have suggested a high level of specificity—*H. acutigluma* was found to be an inferior host.

Temperature studies indicate the tropical climate of northern Australia would be ideal for the development and population growth of the blissid bug.

A biological control program in Australia would require *H. amplexicaulis* to be nominated and approved as a target for biological control. Given the species' rapid spread into northern Australian waterways and the problems with control, such a program deserves consideration. However, it would require approval from the production sectors, which may be difficult given the value still placed on this species by parts of the grazing industry. Its success would also be contingent on the availability of damaging natural enemies that would not significantly affect native hymenachne. The availability of sufficiently host-specific natural enemies is yet to be confirmed, although results on the blissid bug are encouraging.

2.6.2 Routine management

Chemical control methods are limited to glyphosate or haloxyfop (Verdict®) in non-aquatic situations and in waterways in some jurisdictions (Figure 11) (at the time of writing a minor-use permit was in place in Queensland with applications awaiting consideration for New South Wales and the Northern Territory). The effectiveness of glyphosate is limited when plants are treated when standing in water. Haloxyfop is particularly effective in such situations and has the added benefit of selectivity. Repeated treatments are needed to exhaust the seed bank. Treatments should be timed so that plants are not allowed to set seed.



Figure 11 Post-herbicide treatment of *Hymenachne amplexicaulis*

Burning dry stands of hymenachne at the end of the dry season is an effective option in some areas.

Mechanical removal of floating mats of plant material is feasible but expensive. It is not practical in many situations.

Grazing by cattle can reduce the amount of standing dry matter, but grazing is not an effective control method in isolation as cattle will not readily eat hymenachne in areas that remain wet and where they have access to preferred pastures (Figure 12). Flowering and seeding also coincides with wet seasons when grazing access is limited.



Figure 12 Cattle show preference for other pasture species over hymenachne

2.7 Socioeconomic factors affecting management decisions

Hymenachne represents particular social and policy challenges in regard to management, as it is considered beneficial as a ponded pasture for livestock production and drought management, and in contrast is considered extremely destructive, causing widespread ecological and economic damage. The fact that this species was promoted by governments for pasture improvement makes management of the species complex, as the departments in charge of enforcement of the legislation (see Section 2.8) are at times the same ones that promoted it.

Landholder surveys undertaken in the Fitzroy Basin of Queensland in 2008 showed management efforts varied among landholders, some persisting in control, some giving up control, and others viewing control as a waste of effort. Many landholders considered other terrestrial weeds a higher priority for management. There was also a considerable lack of knowledge about the species by landholders and a lack of interest by landholders in non-infested areas. Furthermore, there was a general antipathy towards potential regulatory controls and the legislation itself. This leads to some landholders giving up on control, because neighbouring landholders are not controlling their infestations. Landholders also substantially underestimated costs of hymenachne management, which may explain why many give up and become disillusioned with the prospect of long-term management.

2.8 Quarantine and legislative controls

H. amplexicaulis is not known to be present in the Australian Capital Territory, Victoria, Tasmania, South Australia or Western Australia. Eight small infestations of hymenachne have been detected in northern New South Wales and all are subject to eradication works. Any outbreaks of hymenachne must be reported to the local council within three days. The legal status of hymenachne is summarised in Table 1.

Table 1 Legislation related to *Hymenachne amplexicaulis*

Jurisdiction	Legislation	Declaration	Action
Australian Capital Territory		Class 4 prohibited pest plant	The propagation and commercial supply of hymenachne is prohibited. The reckless supply, use or disposal of contaminated material, machinery and vehicles is prohibited
Commonwealth	Commonwealth plant quarantine legislation		Plant or seed material is prohibited for import to Australia
New South Wales	<i>Noxious Weeds Act 1993</i>	Class 1 weed	Poses a serious threat to primary production or the environment and it is not present in the state or is present only to a limited extent Must be eradicated from the land and the land must be kept free of the plant
Northern Territory	<i>Weeds Management Act 2001</i>	Class B weed and Class C weed	Class B—growth and spread must be controlled Class C—introduction is prohibited
Queensland	<i>Land Protection (Pest and Stock Route Management) Act 2002</i>	Class 2 pest	Landholders must take reasonable steps to keep their land free of hymenachne by controlling and, if possible, eradicating any outbreaks on their property, and preventing spread into areas free of hymenachne
South Australia	<i>Natural Resources Management Act 2004</i>	Declared	A person must not sell it, or sell anything that is carrying the plant (i.e. that is contaminated by it)
Tasmania		Not declared	
Victoria	<i>Catchment and Land Protection Act 1994</i>	Declared as a restricted weed	Plant cannot be sold or traded in Victoria as it poses an unacceptable risk of spread
Western Australia	<i>Agricultural and Related Resources Protection Act 1976</i>	P1 and P2 weed The legislative arrangements are currently in a transition from the <i>Agriculture and Related Resources Protection Act 1976</i> to the <i>Biosecurity and Agriculture Management Act 2007</i> (BAM Act)	P1—All movement of plants, seed, contaminated machinery and produce is prohibited P2— any hymenachne found must be treated to prevent propagation, and infested areas must be managed to prevent any further spread

Note: The National Hymenachne Management Group wrote to all states and territories in March 2011 seeking inclusion of the hybrid *H. × calamitosa* in their respective declarations of hymenachne.

2.9 Principles underpinning the plan

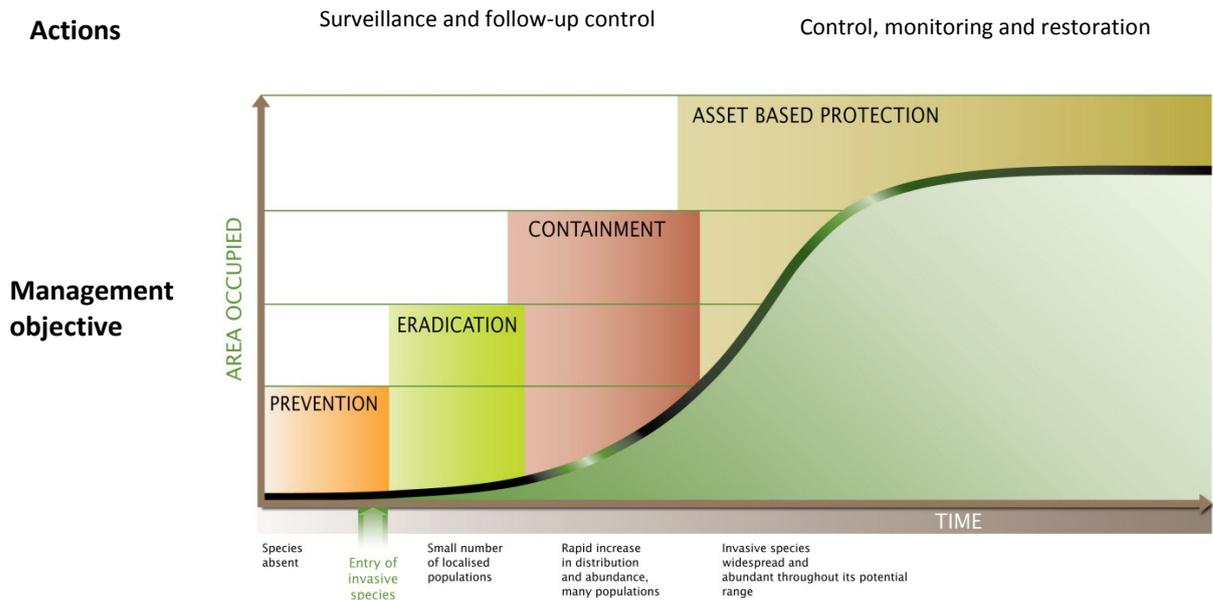
This strategic plan is based on the seven key principles of the Australian Weeds Strategy (NRMMC 2007):

- Weed management is an essential and integral part of the sustainable management of natural resources for the benefit of the economy, environment, human health and amenity.
- Combating weed problems is a shared responsibility that requires all parties to have a clear understanding of their roles.
- Good science underpins the effective development, monitoring and review of weed management strategies.
- Prioritisation of, and investment in, weed management must be informed by a risk management approach.
- Prevention and early detection are the most cost-effective techniques for managing weeds.
- Weed management requires coordination among all levels of government in partnerships with industry, land and water managements, and the community, regardless of tenure.

Building capacity across government, industry, land and water managers, and the community is fundamental to effective weed management.

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

Effective broadscale management of WoNS and other weeds requires an integrated approach that includes prevention and eradication programs, establishment and implementation of management zones, and the protection of key environmental, social and economic assets in areas where the weeds are already widespread (Figure 13).



Goal Prevent spread → Reduce impact

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

Figure 13 Stages of weed invasion with corresponding goals, management objectives and actions at each stage

2.9.1 The national program—progress to date

In 2009, the Natural Resource Management Ministerial Council (Resolution 15.7, 21 May 2009) endorsed a three-phased approach to national management of WoNS species (Appendix 2). In August 2009, a panel from the Australian Weeds Committee reviewed the implementation of the hymenachne strategic plan to:

- assess progress towards implementation of the goals and actions of the strategic plan
- assess the need for future national coordinated effort
- propose changes to the strategic plan
- make recommendations as to the appropriate level of future support and coordination.

Revision of the previous strategy was undertaken by the National Hymenachne Management Group, whose membership comprises representatives from the grazing industry, conservation and research bodies, and state and local governments. The organisations represented on the National Hymenachne Management Group are supportive of the actions identified in this strategic plan. The draft plan was available for public comment during February and March 2011. Seven submissions were received and amendments were incorporated into this document as a result.

2.10 Relevance to other strategies

The Hymenachne Strategic Plan 2012–17 has been developed to provide a framework for coordinated management of hymenachne across the country. Complementary links can be

found in a range of existing resource management initiatives at all jurisdictional levels, as shown in Table 2.

Table 2 Strategies and plans for the management of hymenachne

Scale	Natural resource management	Pest management	Weed species management
National	<i>Environment Protection and Biodiversity Conservation Act 1999</i> National Strategy for the Conservation of Australia's Biological Diversity 2010	Australian Weeds Strategy Threat Abatement Plan—High Biomass Grasses (draft) Caring for our Country Business Plan	Weeds of National Significance Strategy
State	Queensland Government policy on ponded pastures State biodiversity and natural resource management strategies	State agency pest management plans	Guideline for the management of hymenachne (Queensland)
Regional	Regional natural resource management plans	Regional pest management strategies	Regional hymenachne management plans
Catchment	Catchment management strategies	Catchment pest management strategies / plans	NSW North Coast Alligator Weed / Hymenachne Action Plan (Draft)
Local	Landcare plans	Local government pest management plans	Local hymenachne management plans
Property	Property management plans	Property pest management plans National Parks pest management plans	Property weed management plans

3 Strategic goals

Revised actions to prevent the spread of hymenachne and reduce its adverse impacts are described in Sections 3.1–3.3.

3.1 Goal 1: The spread of hymenachne is prevented and adverse impacts reduced (prevention, eradication, containment and asset protection)

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

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

Objective	Strategic actions	Action level ^a	Responsibility ^b
1.1 Implement the NHZS (see Section 2.4)	Promote adoption of the objectives of the NHZS in jurisdictional weed management plans (i.e. seek consistency with prevention, eradication, containment and asset protection zones)	1	National Hymenachne Management Group, state and territory agencies, regional natural resource management bodies, local governments and community groups
	Support implementation of the NHZS by promoting hymenachne management in government agency and other organisation funding priorities and encouraging and assisting project funding applications	1	National Hymenachne Management Group, state and territory agencies, regional natural resource management bodies, local governments
	Prevent spread into areas that do not have hymenachne by promoting early detection and eradication by assisting landholders and others to identify the plant	1	National Hymenachne Management Group, state and territory agencies , regional natural resource management bodies, local governments
	Identify champions for key infestations in management zones to monitor progress and maintain momentum of projects	1	National Hymenachne Management Group, local governments
	Maintain accurate hymenachne mapping	1	State and territory agencies , regional natural resource management bodies, local governments
1.2 Encourage compliance with legislation to implement the	Review declaration of hymenachne in relevant jurisdictional legislation regarding the implementation of the NHZS	1	National Hymenachne Management Group, state and territory agencies

Objective	Strategic actions	Action level ^a	Responsibility ^b
	Identify, build partnerships with and support agencies statutorily responsible for ensuring compliance	1	National Hymenachne Management Group, state and territory agencies , regional natural resource management bodies, local governments
1.3	Develop and implement a code of practice for containment of hymenachne to production systems	1	National Hymenachne Management Group, grazing industry
	Collaborate with key stakeholders to develop a code of practice that is consistent with relevant legislation and the management objectives of the NHZS	1	State and territory agencies , National Hymenachne Management Group, grazing industry
	Implement and promote an endorsed code of practice in partnership with the grazing industry	1	State and territory agencies , National Hymenachne Management Group, grazing industry
1.4	Improve knowledge of the ecology and impacts of hymenachne	2	State and territory agencies , research bodies, grazing industry, National Hymenachne Management Group , research bodies
	Identify critical information gaps and investigate research opportunities to fill identified information gaps	2	State and territory agencies , research bodies, grazing industry, National Hymenachne Management Group , research bodies
	Revise best management practice resource as required	2	National Hymenachne Management Group , research bodies
	Liaise with research bodies regarding the application of alternative available and new herbicides	2	State and territory agencies , research bodies
	Seek approval for use of newly identified herbicides as required	2	State and territory agencies , research bodies

NHZS = National Hymenachne Zoning Strategy

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

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

OR

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

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

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

b Lead agencies are in bold.

3.2 Goal 2: National commitment to effective hymenachne management is improved

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

Table 4 Objectives and strategic actions to achieve goal 1 of the Hymenachne Strategic Plan 2012–17

Objective	Strategic actions	Action level ^a	Responsibility ^b
2.1 Oversee implementation of this strategic plan	Maintain a National Hymenachne Management Group for information sharing and to guide implementation of this strategic plan	1	State and territory agencies , regional natural resource management bodies, local governments, landowners
	Develop and implement a monitoring evaluation reporting and improvement plan for this strategic plan	1	National Hymenachne Management Group
2.2 Build community awareness of hymenachne impacts	Update and maintain a national hymenachne communication plan	1	National Hymenachne Management Group
	Undertake targeted distribution of hymenachne extension material	1	National Hymenachne Management Group, state and territory agencies , regional natural resource management bodies, local governments
	Improve hymenachne identification and encourage reporting of new infestations	1	National Hymenachne Management Group, state and territory agencies , regional natural resource management bodies, local governments
2.3 Encourage community involvement in and ownership of hymenachne management	Build new and strengthen existing partnerships with key stakeholders	2	National Hymenachne Management Group , state and territory agencies, regional natural resource management bodies, local governments, community groups
	Promote hymenachne control success stories to reward and encourage effort	2	National Hymenachne Management Group, state and territory agencies , regional natural resource management bodies, local governments, community groups
	Promote adoption of the objectives of the NHZS in jurisdictional weed management plans (i.e. seek consistency with prevention, eradication, containment and asset protection zones)	2	National Hymenachne Management Group, state and territory agencies, regional natural resource management bodies, local governments
	Promote the NHZS at all levels of management (e.g. Commonwealth, state and local governments, regional natural resource management bodies, community groups) and at other appropriate forums	2	National Hymenachne Management Group , state and territory agencies, regional natural resource management bodies, local governments

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

4 Monitoring, evaluation, reporting and improvement framework

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

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

Individual jurisdictions and/or organisations responsible for weed management and conservation will need to develop their own monitoring strategies. They should, where possible, coordinate actions to implement this plan, and monitor and evaluate progress towards its goals in conjunction with existing state, regional or local plans. While individual actions should be monitored at the jurisdictional level, data or evidence collected as a part of state, regional and local activities or plans should be provided to the AWC and collated so that it can be assessed each year within the national context. This will help to build a comprehensive overview of the plan's delivery. Table 5 lists key evaluation questions that should be assessed by the AWC each year at the national level to ensure progress against strategy goals, and which should be used to provide the basis for an annual report to the AWC.

This monitoring, evaluation, reporting and improvement (MERI) framework lists the basic reporting information that should be collected for the life of the strategic plan—including during phase 3 delivery (see Appendix 2). This will ensure that sufficient data are collected to identify successes and failures, and provide the opportunity for improvement where outcomes are not being achieved. Annual MERI plans may be developed to follow activities in more detail.

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

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

Table 5 Suggested monitoring and evaluation questions to measure progress under the phase 3 WoNS Hymenachne Strategic Plan 2012–17

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

Table 5 *continued*

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

Table 5 *continued*

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

WoNS = Weeds of National Significance

Scoring:

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

5 Stakeholder responsibilities

Although landowners and managers have primary responsibility for the control of hymenachne on their land, relevant agencies share responsibility for the actions listed in Sections 3 and 4. The effective implementation of this strategy requires the involvement of a range of stakeholders. Stakeholders' responsibilities may vary between jurisdictions: some actions may be optional while others are prescribed by legislation. The successful achievement of strategic actions relies on the development and maintenance of partnerships between community, industry and government, and recognition of the roles of each stakeholder. In particular, while the National Hymenachne Management Group provided oversight for the original strategy, future coordination arrangements will evolve to maintain and build on past achievements. The Australian Weeds Committee, at a national level, and various agencies at the state and territory level will continue to provide a leadership role. Suggested responsibilities for each group are listed below.

Australian Government

- Provide resourcing to agreed levels to ensure the effective coordination and monitoring of the Hymenachne WoNS Strategy.
- Promote the status of hymenachne as a WoNS, its impacts and the importance of management.
- Ensure strategic hymenachne control is undertaken on all federally managed lands.
- Prevent imports—Australian Quarantine and Inspection Service (Biosecurity Australia).
- Provide research support through CSIRO and the Commonwealth Weeds Research Group.

Australian Weeds Committee

- Monitor, evaluate and report on the success of the implementation of this strategy.
- Promote the status of hymenachne as a WoNS, its impacts and the importance of management.
- Promote the importance and benefits of the WoNS initiative to all levels of government.

National Hymenachne Management Group

- Promote, seek consistency with and oversee implementation of this strategy.
- Maintain and build partnerships with key stakeholders to improve national hymenachne management.
- Work collaboratively with the grazing industry to develop a code of practice for the containment of hymenachne to existing production systems.
- Identify and fill critical information gaps, including best management practice.

State and territory agencies

- Contribute to the delivery of the WoNS initiative.
- Ensure pest management plans for state lands are consistent with this strategy.
- Promote consistency with this strategy in jurisdictional pest management plans.

- Work with the grazing industry to implement a code of practice for the containment of hymenachne to existing production systems.
- Source funding for strategic management programs.
- Refine and enforce legislation (or support enforcement by local government) to support implementation of this strategy.
- Contribute to priority research initiatives.
- Develop and implement communications strategies that include hymenachne impacts and management.
- Maintain spatial data on hymenachne distribution.
- Provide representation to the National Hymenachne Management Group.

Local governments

- Ensure consistency of jurisdictional pest management plans with this strategy.
- Implement jurisdictional pest management plans to ensure the prevention, eradication and containment of hymenachne.
- Improve community awareness of impacts and identification and promote early detection.
- Collaborate with stakeholders to maintain project momentum.
- Collect spatial data on hymenachne distribution.
- Enforce legislation and develop consistent local policies relevant to hymenachne management.
- Seek funding for strategic control projects that are consistent with this strategy.
- Provide representation to the National Hymenachne Management Group.

Industry

- Grazing industry—work collaboratively to develop and implement a code of practice for the containment of hymenachne to existing production systems.
- Grazing, sugar, others—improve awareness of impacts and identification among members.

Natural resource management bodies and community groups

- Ensure consistency of regional pest and natural resource management plans with this strategy.
- Promote consistency of jurisdictional pest management plans with this strategy.
- Seek funding for strategic management projects that are consistent with this strategy.
- Include hymenachne impacts, prevention and control in regional communications activities.
- Collect spatial data on strategic hymenachne infestations.

Private landholders

- Control hymenachne on private lands in accordance with state, territory and local government legislation and policy.
- Improve skills to identify hymenachne and knowledge of its impacts.
- Undertake surveillance of private lands for hymenachne outbreaks.
- Report new infestations to weeds officers.

Appendix 1 National hymenachne distribution and management zone map, February 2011

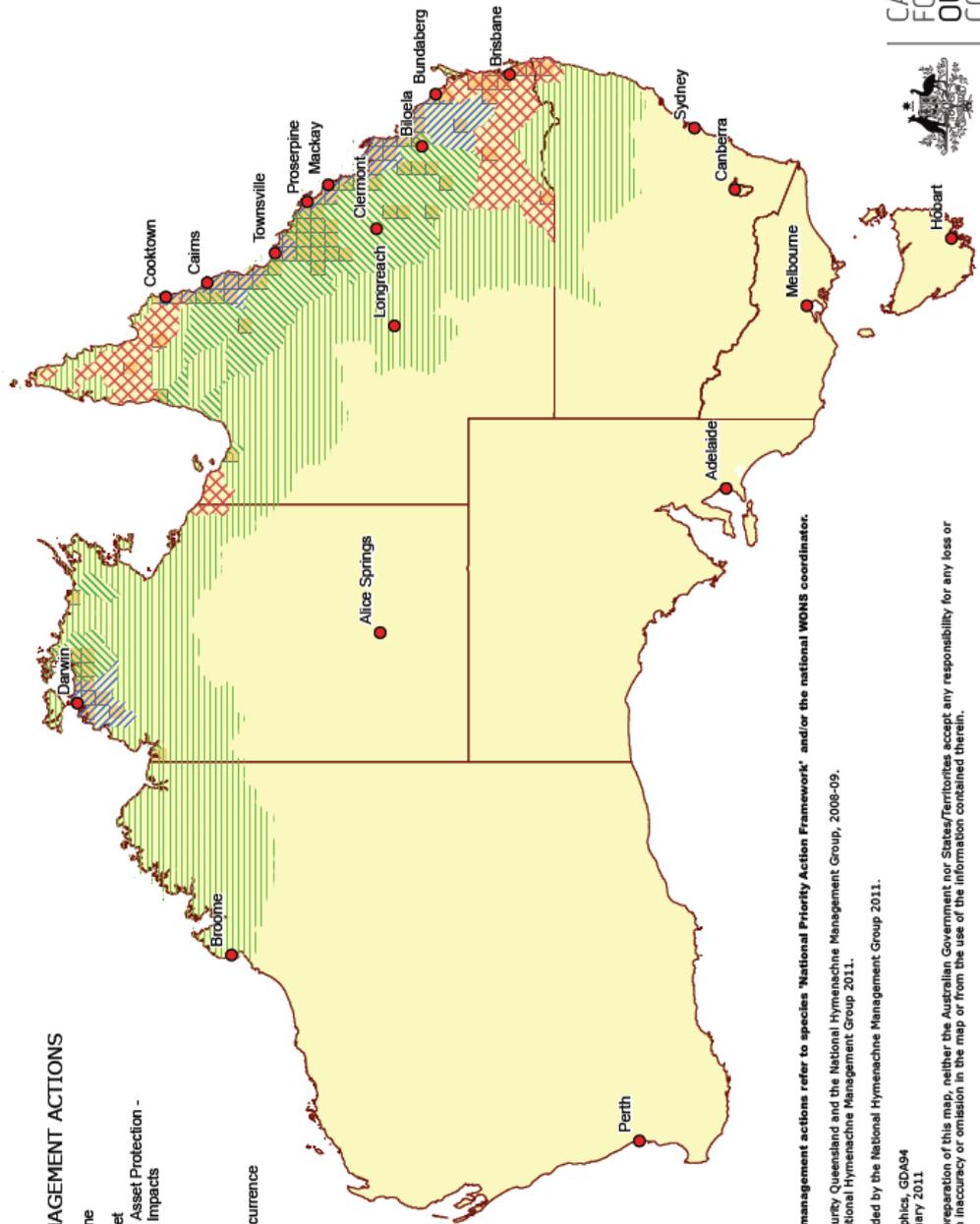
The map below reflects priority management actions for hymenachne and should be viewed in conjunction with the more recent hymenachne zoning strategy at Figure 10.

Map 2.4.27

HYMENACHNE (*Hymenachne amplexicaulis*) WEED SPREAD & MANAGEMENT ACTIONS 2011

HYMENACHNE MANAGEMENT ACTIONS

-  Containment Zone
-  Eradication Target
-  Core infestation: Asset Protection - Contain/Reduce Impacts
-  Surveillance
-  Weed Present
-  No Reported Occurrence



For detailed information on management actions refer to species 'National Priority Action Framework' and/or the national WONS coordinator.

Digital data supplied by Biosecurity Queensland and the National Hymenachne Management Group, 2008-09. Subsequent updates by the National Hymenachne Management Group 2011.

Management action data provided by the National Hymenachne Management Group 2011.

Projection and datum: Geographics, GDA94
Map production date: 10 February 2011

Whilst all care is taken in the preparation of this map, neither the Australian Government nor States/Territories accept any responsibility for any loss or damage which may result from inaccuracy or omission in the map or from the use of the information contained therein. All rights reserved.



Appendix 2 The Weeds of National Significance initiative and its phases¹

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

Following the reviews, the Natural Resource Management Ministerial Council (Resolution 15.7, 21 May 2009) endorsed a three-phased approach to national management of WoNS species (Figure 14). This ‘phased approach’ aims to provide the most cost-effective use of limited ‘national coordination’ resources.

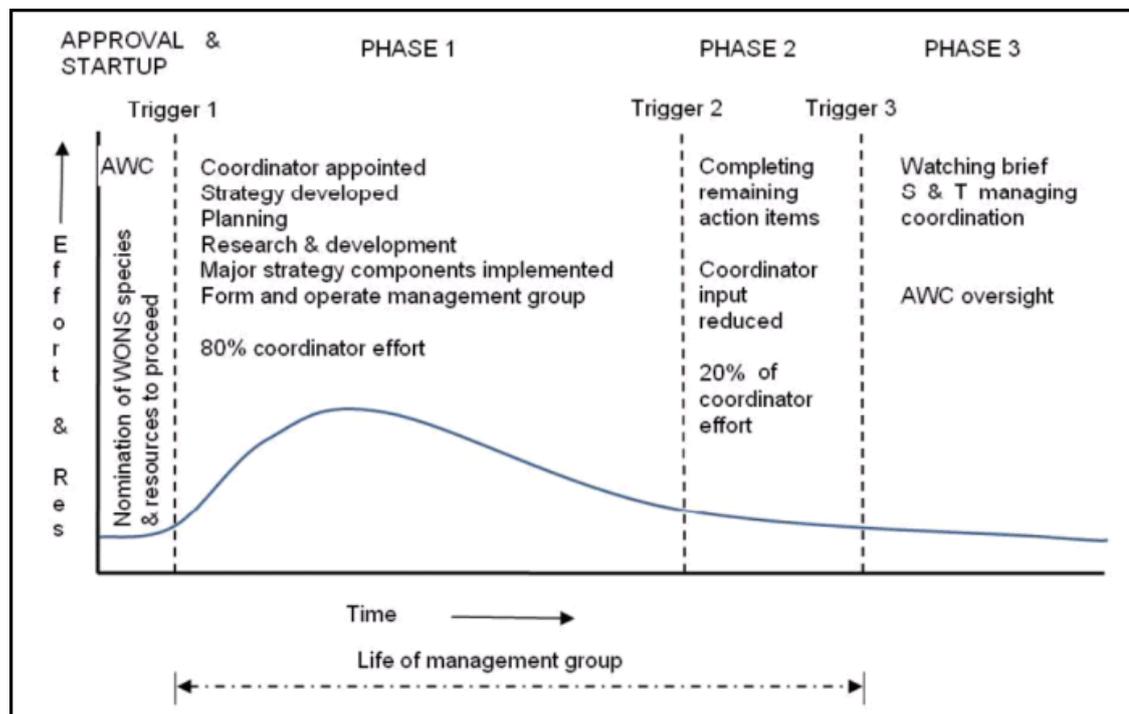


Figure 14 Australian Weed Committee diagrammatic representation of coordinator effort and resource use when implementing a Weeds of National Significance strategy

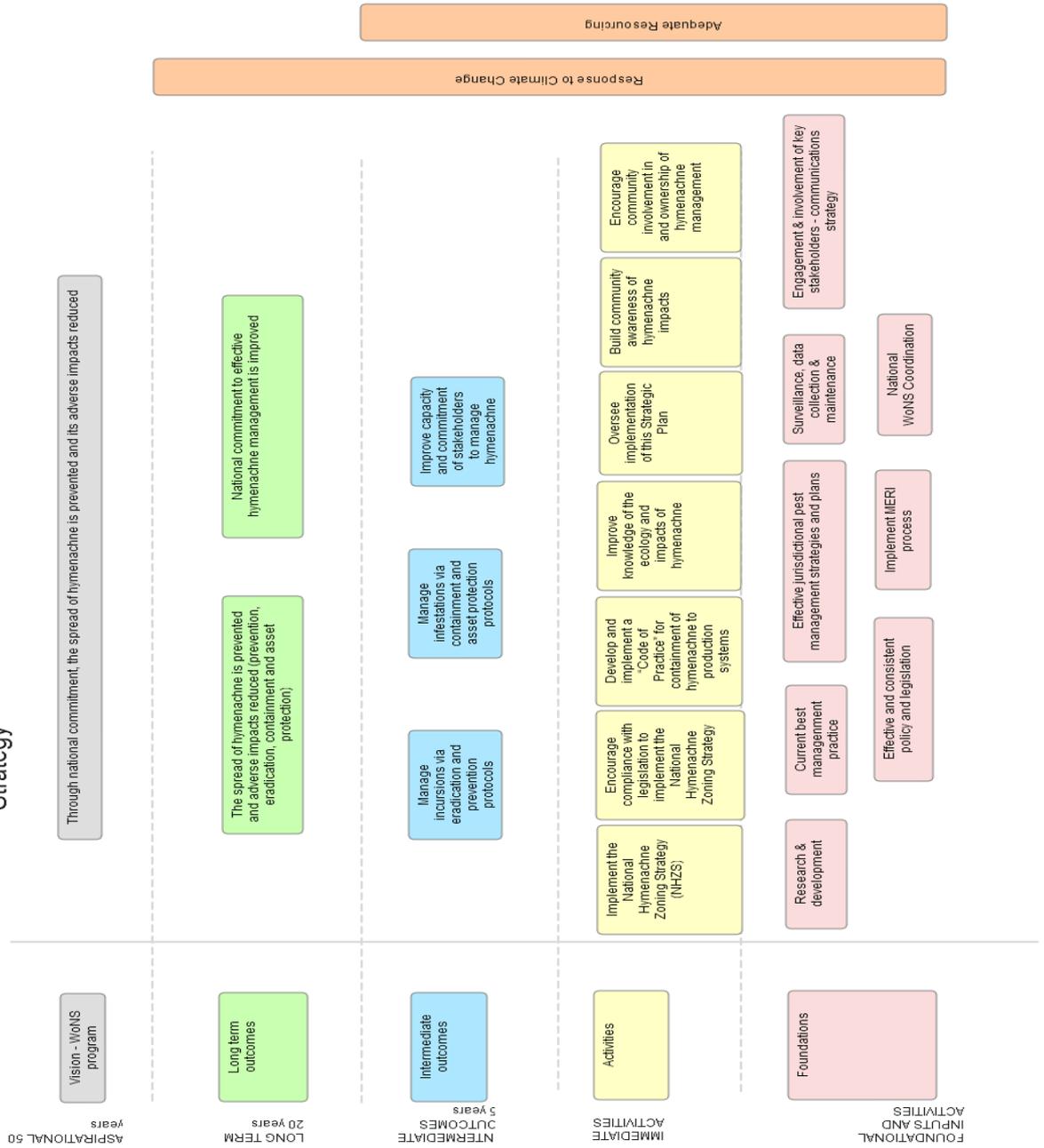
The phased approach recognises the need for reduced national coordination (‘phasing down’) of WoNS species that are under effective national management, and allows for further weed species to be nominated for consideration as additional WoNS. The AWC is implementing these reforms, and national coordination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

¹ Adapted from Thorp 2012, Additional list of Weeds of National Significance, <www.org.au/WoNS>.

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

Appendix 3 Program logic model for the hymenachne strategic plan

WoNS Program Logic for Hymenachne National Strategy



Further reading

Papers written by agency and research staff greatly contributed to the preparation of this strategy:

Clarkson, JR, Karan, M & Evans, DS 2011, 'A report of hybridisation in *Hymenachne* (Poaceae, Panicoideae) with description of *Hymenachne* × *calamitosa*, a new species of hybrid origin from tropical Australia', *Telopea*, vol. 13, issue 1–2, pp. 105–14.

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Ferdinands, K, Beggs, K & Whitehead, P 2005, 'Biodiversity and invasive grass species: multiple use or monoculture?', *Wildlife Research*, vol. 32, pp. 447–457.

Grice, AC, Clarkson, JR & Calvert, M 2011, 'Geographic differentiation of management objectives for invasive species: a case study of *Hymenachne amplexicaulis* in Australia', *Environmental Science & Policy*, vol. 14, issue 8, pp. 986–97.

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NRMMC (National Resource Management Ministerial Council) 2007, *Australian Weeds Strategy—a national strategy for weed management in Australia*, Australian Government Department of the Environment and Water Resources, Canberra.

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Wearne, LJ, Ko, D, Hannan-Jones, M & Calvert, M in press, 'Potential distribution of an invasive plant species and risk assessment: a case study of *Hymenachne amplexicaulis* in Australia', Human and Ecological Risk Assessment.