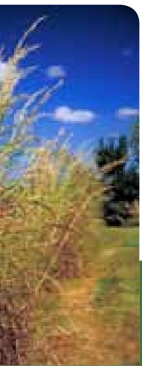
Australian Government

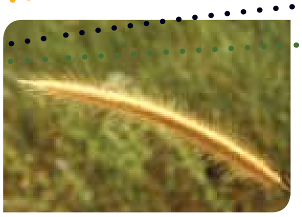
Department of Sustainability, Environment, Water, Population and Communities



Background:

Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses

Photo credits
FRONT COVER IMAGES (left to right)
Andropogon gayanus (Colin Wilson), *Urochloa mutica* (Queensland Department of Agriculture, Fisheries and Forestry), *Hymenachne amplexicaulis* (Robert Miller), *Hymenachne amplexicaulis* in melaleuca swamp (Queensland Department of Agriculture, Fisheries and Forestry)
BACK COVER IMAGES (left to right)
Cenchrus polystachios syn. *Pennisetum polystachion* & *Cenchrus pedicellatus* syn. *Pennisetum pedicellatum* (Colin Wilson), *Cenchrus polystachios* syn. *Pennisetum polystachion* (Colin Wilson), *Cenchrus polystachios* syn. *Pennisetum polystachion* (Colin Wilson), *Andropogon gayanus* (Colin Wilson), *Andropogon gayanus* (Colin Wilson)



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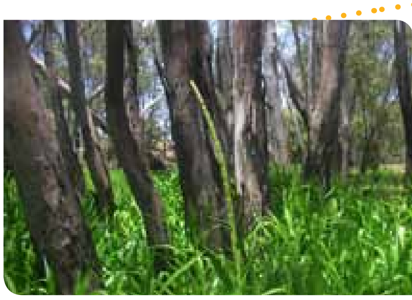

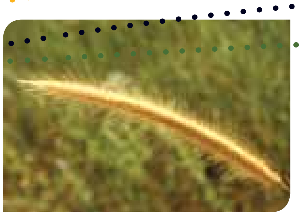

INTRODUCTION

In 2009 the Australian Government listed **'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*)'** as a key threatening process (KTP) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This initiated the development of the *Threat abatement plan to reduce the impacts on northern Australia's biodiversity by the five listed grasses* (TAP). This document aims to provide the detailed information that underpins the TAP. Relevant extracts from the EPBC Act are included at Appendix A to this document.

The TAP and this background document refer to these species as 'the five listed grasses' and follow the current Australian naming convention for the mission grasses according to recent changes to the names of *P. polystachion* and *P. pedicellatum* to *Cenchrus polystachios* and *C. pedicellatus*, respectively.[1] The KTP retains its original title as listed under the EPBC Act, despite the changes to the names of the grasses. For clarity, the common name 'perennial mission grass' has been adopted for *C. polystachios*, to avoid confusion with annual mission grass.

There are around 10 000 species of grasses worldwide, growing in a range of habitats on all continents. Because many grasses are productive, palatable and competitive, they are desirable as pasture species. However, these qualities also make them one of the weediest plant families in Australia and globally (Booth et al., 2009).

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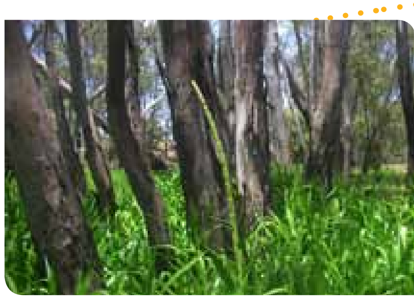
1 The scientific names of the two mission grasses previously known as *Pennisetum polystachion* and *P. pedicellatum* have recently changed in Australia. Over the past 10 years, several morphological and molecular phylogenetic studies have shown that the genera *Pennisetum* and *Cenchrus* are very closely related. A recent paper by Chemisquy et al. (2010), based on plastid DNA and morphological analysis, concluded that *Pennisetum* and *Cenchrus* should be treated as a single genus. Since *Cenchrus* has priority under the rules of botanical nomenclature, the authors transferred all *Pennisetum* species into *Cenchrus*. Australian botanists, led by Simon (2010), have accepted this change. Consequently, the Australian Plant Census now shows the names of the mission grasses to be *Cenchrus polystachios* (syn. *Pennisetum polystachion*) and *Cenchrus pedicellatus* (syn. *Pennisetum pedicellatum*) (APC, 2011). Some authoritative international databases, such as the International Plant Name Index, Tropicos and the United States of America's Department of Agriculture taxonomy site, have not yet made these changes and continue to place the mission grasses in the genus *Pennisetum*.



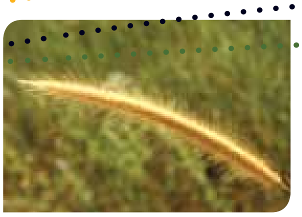
While the environmental impacts of most exotic grass species have not been quantified in Australia, it is accepted that many can alter fire regimes, hydrology, soil chemistry, and displace native plant species, resulting in ecosystem degradation, habitat loss and biodiversity decline (D'Antonio and Vitousek, 1992; Low, 1997; Douglas and O'Connor, 2004b; NRMW, 2006; TSSC, 2009).

Many grasses were introduced into Australia primarily for assessment and use in pastoral production. Species were selected for their persistence, high growth rates and nutritional value. From the 1950s, there was a perception that improved pastures were necessary for the viability of the pastoral industry in northern Australia (Christian, 1959 in Grace et al., 2004; Cook and Dias, 2006). More recently there has been growing awareness of the high economic costs and significant environmental damage associated with introducing invasive plants such as some of these grasses.

Before 1996, plants proposed for import into Australia were checked against a 'prohibited list' contained in a proclamation of the *Quarantine Act 1908*. This list included plants that had been identified as a potential risk to Australia due to their weed status elsewhere in the world (DAFF, 2010). A review of quarantine procedures in Australia (Nairn et al., 1996) led to the development of a science-based quarantine risk assessment tool for determining the weed potential of new plants proposed for import into Australia. To further strengthen the quarantine assessment process, the Nairn Review Committee also recommended a 'permitted list' for import, in addition to the 'prohibited list'. A review of the plant seeds permitted entry into Australia (listed at Schedule 5 of the *Quarantine Proclamation 1998*, also referred to as the Permitted Seeds List) replaced nearly 3000 genus-level listings with species already present in the country within those genera. In conducting the review, international obligations meant that any species that were already present in Australia and not under 'official control'[2] were included on the Permitted Seeds List.

In April 1997 the newly developed weed risk assessment (WRA) process was endorsed. Under revised legislation (the *Quarantine Proclamation 1998*), all plant species are prohibited from import into Australia unless they have been formally assessed under the national WRA system as having a low potential to become weeds and/or are on the Permitted Seeds List.

[2] 'Official control' is defined by the International Plant Protection Convention as 'the active enforcement of mandatory phytosanitary regulations and the application of mandatory phytosanitary procedures with the objective of eradication or containment of quarantine pests or for the management of regulated non-quarantine pests'.

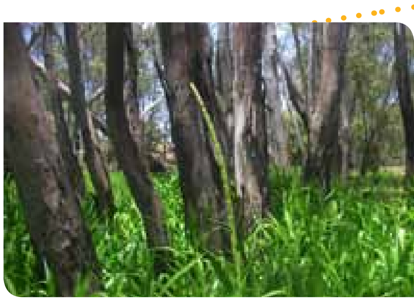


In 2011, of the five grass species listed in the identified KTP, only *Hymenachne amplexicaulis* was on the prohibited list. *Andropogon gayanus* and *Urochloa mutica* are on neither the permitted list nor the prohibited list, and would therefore require assessment to determine whether import into Australia would be permitted. The importation of *Pennisetum*[3] spp. other than *P. japonicum* is permitted under specified conditions and with appropriate permits (ICON, 2011).

Where grass species with weed potential are already present in Australia, policy and regulation for control and management are largely the responsibility of the states and territories. Using the national WRA process as a basis, weed/pest risk assessment processes have been developed by each of the jurisdictions relevant to the TAP (the Northern Territory, Queensland and Western Australia). These processes are used to assess species that may, or have already, become significant weeds. Outcomes of assessments are then used to inform the regulation and management of these species.

Maps on the known and potential distribution of each of the listed grasses have been prepared by the Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) based on data available at the time of writing. Climatch modelling (Bureau of Rural Sciences, 2009) was used to determine a climatic suitability score. The top three categories of suitability were chosen as being appropriate to indicate potential distribution. These maps are for general information only and are not intended to be used for management purposes. Detailed mapping of the grasses to inform management activities is an action listed in the TAP.

[3] At the time of writing, the Australian Quarantine and Inspection Service's import conditions database (ICON) had not yet adopted the genus name *Cenchrus* for mission grass species.



SPECIES

1 Gamba grass

1.1. Origin and current distribution

Gamba grass (*Andropogon gayanus*) is native to the tropical savannas of Africa, occurring from Senegal in the west to Sudan in the east. Gamba grass in northern Australia is a cultivar known as cv. 'Kent' that was developed for use as cattle fodder by crossing material considered to be var. *squamulatus* and a second unknown variety (Oram, 1990). It was introduced into Australia by the Council for Scientific and Industrial Research[4] (CSIR) Division of Land Research in 1931, but was not widely used as a pasture grass until 1983 when commercial quantities of seed became available (Csurhes, 2005).

The species is well suited to northern Australian conditions as it is able to establish across a wide range of habitats, from open woodland to closed forests on floodplain margins (Flores et al., 2005).

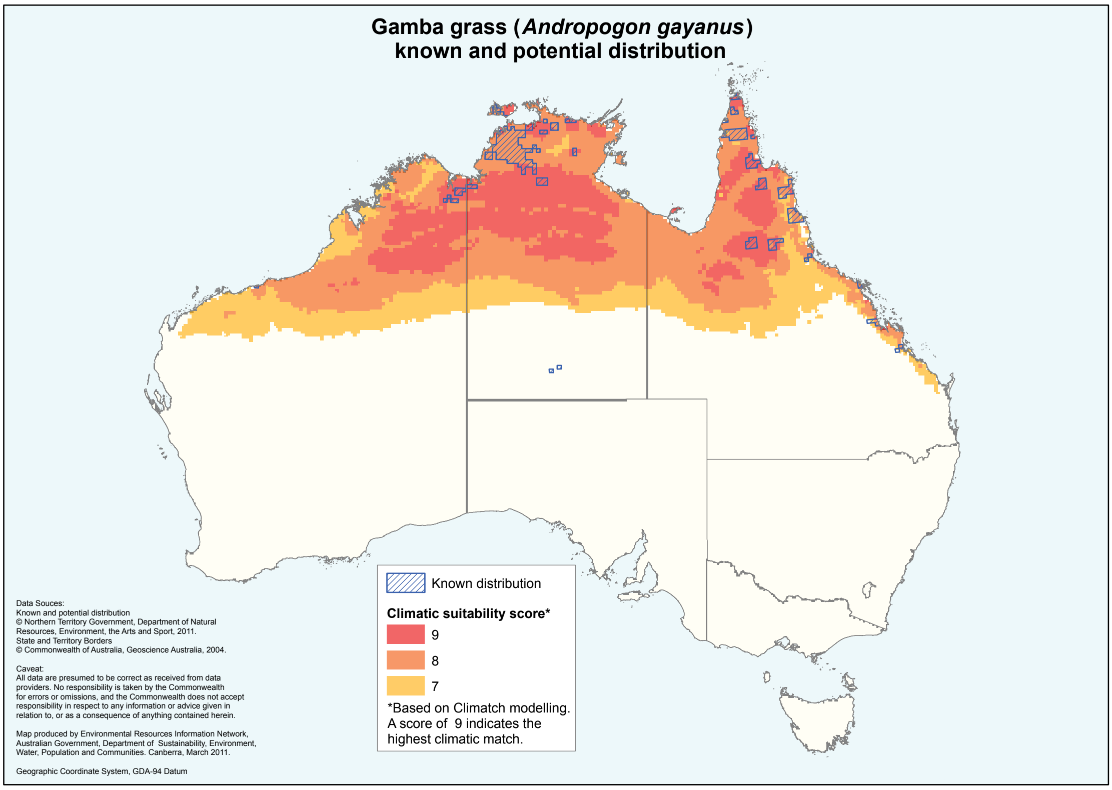
In the Northern Territory, preliminary trials on gamba grass were conducted at the Katherine Research Station from 1946. The trials were successful and resulted in widespread plantings in pastoral and agricultural areas of the Top End (NRETAS, 2010). The species is widely distributed in Darwin and Palmerston, in the Litchfield and Coomalie Shires, in the Adelaide, Mary, Douglas and Lower Daly River regions and in western Arnhem Land. The potential range of gamba grass in the Northern Territory is estimated to be 380 000 km^2. It has already established in an estimated 4 per cent of its potential range, covering an area of 10 000–15 000 km^2 (NRETAS, 2008).

The earliest record of gamba grass in Queensland is a specimen collected from a CSIR property near Rockhampton in 1942. The first record of a naturalised specimen was from Bamaga in 1992, although it was probably naturalised elsewhere in Cape York by that time (Csurhes and Hannan-Jones, 2008). The exact area of gamba grass cover in Queensland is unknown. However, it is estimated that there may be up to 18 000 hectares planted (ibid.). It is assumed that gamba grass exists as scattered populations across north Queensland, with most sites being in Cape York (ibid.).

[4] The Council for Scientific and Industrial Research was renamed in 1949 as the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

In Western Australia, the largest infestation of gamba grass is established at a station property, El Questro, in the east Kimberley region. It is rumoured to have been trialled at Derby and Kalumburu but appears not to have persisted (Sinclair, 2010).

Figure 1: Map indicating known and potential distribution of gamba grass in Australia

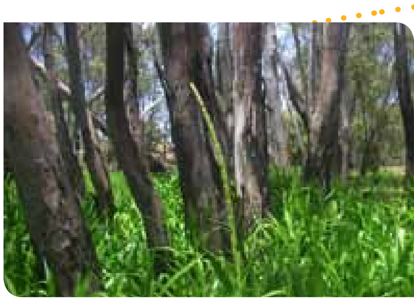


Source: DSEWPaC, 2011.

1.2. Biology and environmental impacts

Gamba grass is a perennial tussock-forming species that grows in very dense stands up to 4 metres high with tussocks up to 70 centimetres in diameter. These stands cure in June/July; this is much later than native grass species which cure in April (Rossiter et al., 2004).

Gamba grass flowers around April, with seed reaching maturity in late May/June. It can also seed in October/November after early wet-season storms. Seed can be produced in the first year of growth, with production being very prolific. A mature plant has the potential to produce up to 244 000 seeds in one season, with a viability of up to 65 per cent (Flores et al., 2005).



However, seed banks appear to be short-lived as a seed longevity trial showed survival rates to be less than 1 per cent after 12 months' burial (ibid.). Native seed banks, although depleted, are not eliminated under gamba grass, thereby providing a natural source of regeneration material (Setterfield et al., 2004).

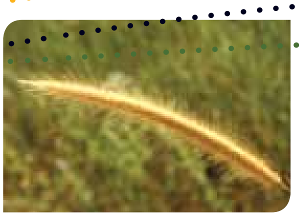
Gamba grass can invade undisturbed savanna ecosystems and does not need soil or canopy disturbance to become established, although both these factors will increase its ability to colonise sites (Setterfield et al., 2005). The spread of gamba grass is most obvious along roads and disturbance corridors (Kean and Price, 2003), but riparian corridors are an important and major pathway of spread into remote areas (Petty et al., 2012).

Compared with native grasses, gamba grass has higher photosynthetic rates, using light more efficiently to produce more leaf area and biomass (Rossiter, 2001). This process results in the replacement of native grass fuel loads with tall, dense fuel beds producing fires of substantially greater intensity than typical native grass fires (up to 48 000 kilowatts per metre compared with 2000 kilowatts per metre) (Rossiter-Rachor et al., 2008; Setterfield et al., 2010). These intense fires can result in a dramatic increase in flame height, leading to passive canopy fires (Setterfield et al., 2010) and subsequent decrease in tree cover (Ferdinands et al., 2006; Brooks et al., 2010). Rossiter et al. (2004) also found that available soil nitrate levels were lower, grass water usage trebled and deep drainage of water more than halved in sites invaded by gamba grass compared with native grasses. Therefore, gamba grass has the ability to out-compete native species and alter catchment hydrology, ultimately transforming ecosystem functions and structure.

1.3. Community perception and value

Gamba grass is a highly productive and palatable fodder, capable of supporting significantly higher stocking densities of cattle than native grasses. Cattle feeding on gamba grass as opposed to just on native grasses can result in increased growth rates, pregnancy rates and weaner rates as well as reduced death rates (NRETAS, 2008). Gamba grass is generally used in a rotational grazing system in combination with native species. Despite the potential benefits to pastoralists, gamba grass is no longer recommended for new plantings as it is difficult to manage, particularly on smaller properties. High stocking densities are required to graze it appropriately, keeping the grass low and palatable. If gamba grass exceeds 90 centimetres in height, de-stocking followed by slashing or burning is required to regain use (NRETAS, 2008).

Because of its tendency to lead to high-intensity fires, gamba grass is increasingly being recognised as dangerous to human health and safety when growing around towns and infrastructure. Once gamba grass fires gain momentum they can be dangerous and difficult to extinguish, due to the intense heat and large volumes of smoke produced (NRETAS, 2008). This has led to the Australasian Fire Authorities Council releasing a national position paper on gamba grass (AFAC, 2008).



1.4. Regulation and management

Gamba grass has been subject to weed risk assessments in the Northern Territory, Queensland and Western Australia. The results have been largely consistent across these jurisdictions, as follows.

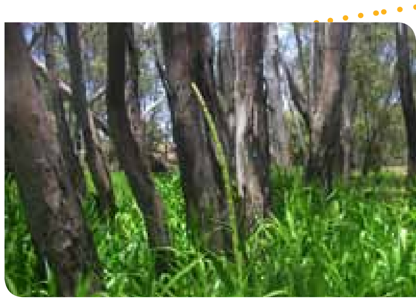
- Northern Territory: a very high-risk weed where potential exists for successful management (NRETAS, 2010).
- Queensland: has the potential to cause significant problems in areas where it is not subject to grazing by cattle. Areas at risk include most of the northern tropical savanna systems (DPIF, 2008).
- Western Australia: potentially a high impact for the Kimberley region (Sinclair, 2010).

Gamba grass was listed as a Weed of National Significance (WoNS) in 2012. It is a declared weed in all jurisdictions relevant to the TAP (see Table 1).

In the Northern Territory, gamba grass is a declared Class A/C and Class B/C weed. Under the Territory's gamba grass management plan there are defined 'eradication' and 'management' zones for gamba grass. Land managers within the eradication zones are required to actively identify and eradicate existing infestations and prevent the establishment of new infestations. Within the management zones, land managers must control the growth and spread of gamba grass on and between properties. Obligations with respect to management differ between small landholders (less than 20 hectares) and large landholders (more than 20 hectares). Specific obligations also apply to landholders who wish to use gamba grass as a pasture species, and to managers of service and transport corridors. All land users must ensure that there is no further introduction of gamba grass into the Northern Territory or into uninvaded areas (NRETAS, 2010).

Gamba grass is a declared Class 2 pest in Queensland. All landholders are obliged to try to keep their land free of Class 2 pests and it is an offence to possess, sell or release these pests without a permit (DEEDI, 2010).

In Western Australia, gamba grass is categorised as a P1 and P2 plant across the entire state. This means that the introduction or movement of the plant within the state is prohibited and that all known plants are to be eradicated by land managers.



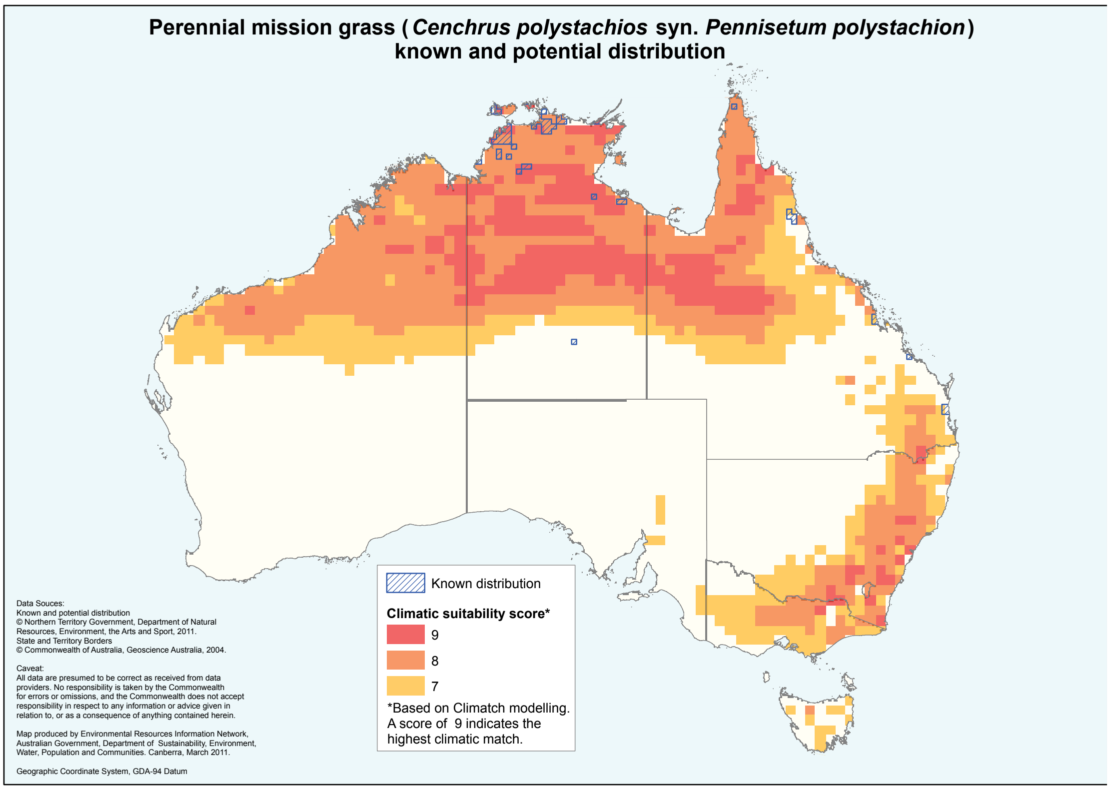
2 Perennial mission grass

2.1. Origin and current distribution

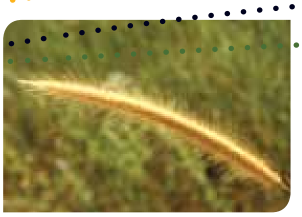
The introduction into Australia of African mission grasses began in the 1930s (Cook and Dias, 2006). It is not clear whether perennial mission grass (*Cenchrus polystachios* syn. *Pennisetum polystachion*) was introduced deliberately as a pasture species or by accident.

Perennial mission grass occurs predominantly in the Top End of the Northern Territory and in northern Queensland. It also grows in central and south-east Queensland and in southern areas of the Northern Territory (Navie and Adkins, 2007). The first record of perennial mission grass as a weed in the Northern Territory was in the 1970s. It quickly spread in Darwin and extended its range south to Katherine, east into Arnhem Land, south-west to the Daly River and north to the Tiwi Islands (Miller, 2006). The species was introduced into Queensland in the 1970s (ibid.). It is not known to occur in Western Australia.

Figure 2: Map indicating known and potential distribution of perennial mission grass in Australia



Source: DSEWPaC, 2011.



2.2. Biology and environmental impacts

Perennial mission grass is a tall, perennial, tussock-forming grass growing to three metres. It now commonly occurs in disturbed areas such as roadsides, pastures and waste sites, and also invades natural bushland (Brooks et al., 2010). Seed heads are dispersed by wind and animals and by attaching to vehicles and equipment.

In areas invaded by perennial mission grass, fuel loads can be up to five times higher than in uninvaded sites, resulting in large fires which can carry into the canopy of trees (Douglas et al., 2004; Brooks et al., 2010). Perennial mission grass displaces native plant species (Brooks et al., 2010) and may alter nitrogen cycling in savanna systems, with up to a 10 per cent reduction in nitrate availability compared with native grasses (Douglas et al., 2004). Perennial mission grass often occurs with gamba grass.

2.3. Community perception and value

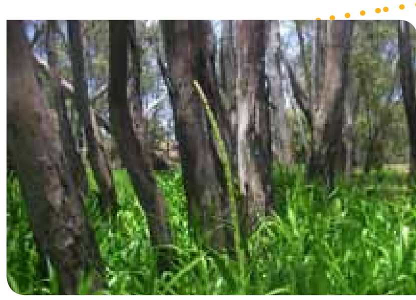
Perennial mission grass is not considered to be particularly valuable, and its use as a pasture species is not promoted. Because of its potential to contribute to intense fires, perennial mission grass is considered by some members of the community to be a problem. Generally speaking, awareness of the species and associated issues is not as widespread as it is for gamba grass.

2.4. Regulation and management

Perennial mission grass is declared in the Northern Territory as a Class B/C weed (see Table 1). This means that landholders have a duty to manage the plant on their land, to prevent other land from being infested and to prevent further introductions.

Perennial mission grass is not declared under state legislation in either Queensland or Western Australia.

In Western Australia, a weed risk assessment has concluded that perennial mission grass could potentially have a high biological impact on the Kimberley region.

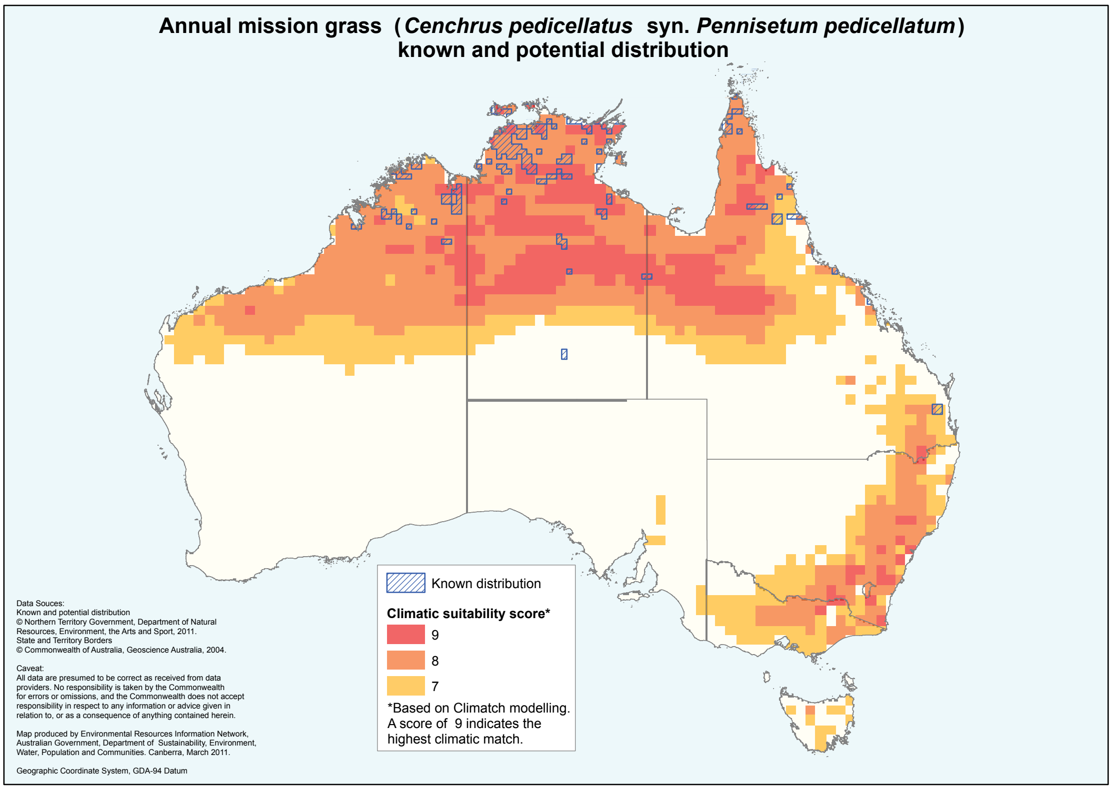


3 Annual mission grass

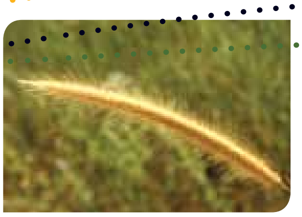
3.1. Origin and current distribution

Annual mission grass (*Cenchrus pedicellatus* syn. *Pennisetum pedicellatum*) was imported into northern Australia from Africa in the 1940s as a pasture grass (Cook and Dias, 2006). By the 1970s it had become widespread across the north (Setterfield et al., 2006). It is found on Cape York in Queensland, in the Top End of the Northern Territory and in the north-east of Western Australia (GBIF, 2010).

Figure 3: Map indicating known and potential distribution of annual mission grass in Australia



Source: DSEWPaC, 2011.



3.2. Biology and environmental impacts

Annual mission grass incorporates two sub-species: *Cenchrus pedicellatus* subsp. *pedicellatus* syn. *Pennisetum pedicellatum* subsp. *pedicellatum*, and *Cenchrus pedicellatus* subsp. *unispiculus* syn. *Pennisetum pedicellatum* subsp. *unispiculum* (TSSC, 2009). Occurring in high densities, it grows to 1.5 metres tall and has a high seed output (Setterfield et al., 2006). Mechanisms of spread are thought to be similar to those of other grass species (i.e., by attachment to vehicles and equipment etc.). Given its high biomass, it probably has similar impacts to those of gamba grass and perennial mission grass, out-competing native species and contributing to increased fuel loads, resulting in intense late-season fires (TSSC, 2009). It is also reported to grow in shady areas where native grasses do not, thereby facilitating the spread of fires beneath sensitive trees and shrubs that would not normally be subjected to burning (Sinclair, 2010).

3.3. Community perception and value

Annual mission grass is not important to the pastoral industry. Community awareness regarding annual mission grass is low.

3.4. Regulation and management

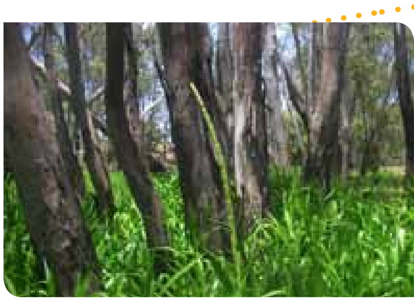
Annual mission grass is not declared in any jurisdiction, and no formal management strategies are in place to control its spread.

In Western Australia, the results of a weed risk assessment concluded that the species has the potential to have a high impact in the Kimberley.

4 Olive hymenachne

4.1. Origin and current distribution

Olive hymenachne (*Hymenachne amplexicaulis*) is native to tropical and sub-tropical South and Central America. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) imported olive hymenachne in the early 1970s for assessment as a ponded pasture species for cattle. It was approved for release in 1988. There were reports of this grass invading cane-growing areas soon after it was released.



Prior to its declaration as a weed, the use of olive hymenachne in Queensland was widely promoted within the grazing industry as well as to the grazing industry by government agencies (Magnussen, 2011). In the Northern Territory, small areas were sown during the 1990s. According to anecdotal reports, propagation material was sent to graziers in the Kimberley region of Western Australia in 1993; however, surveillance and extension work suggests that it has failed to establish there (ibid.; ARMCANZ, 2000).

In 2010, distribution in the Northern Territory was around Darwin, the Adelaide, Mary and Daly River floodplains and east Arnhem Land (Magnussen, 2011). Infestations are now starting to develop in areas where it has been used in mimosa control programs (as a competitive cover crop). It also occurs in conservation areas such as Kakadu National Park. In 2007, the Department of Natural Resources, Environment, The Arts and Sport (NRETAS) reported 5000–6000 hectares of olive hymenachne growing within the Northern Territory (Cobon, 2009).

In Queensland this species occurs in isolated patches on Cape York, with extensive infestations occurring in areas down the east coast (and into inland areas) and into the Northern Rivers area of New South Wales. Isolated infestations continue to be discovered in inland southern Queensland.

Olive hymenachne is not known to occur in Western Australia, although the Kimberley region is considered to be at high risk of incursion. Migratory birds are a likely spread vector from the isolated infestation on the Keep River in the Northern Territory into the Kimberley region (Magnussen, 2011). There is also the potential for the species to spread into the Ord region by attachment to machinery and equipment (Cobon, 2009).

In 2007 the total area of occupancy nationally was estimated at 14 000 hectares (Cobon, 2009).

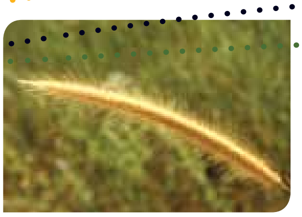
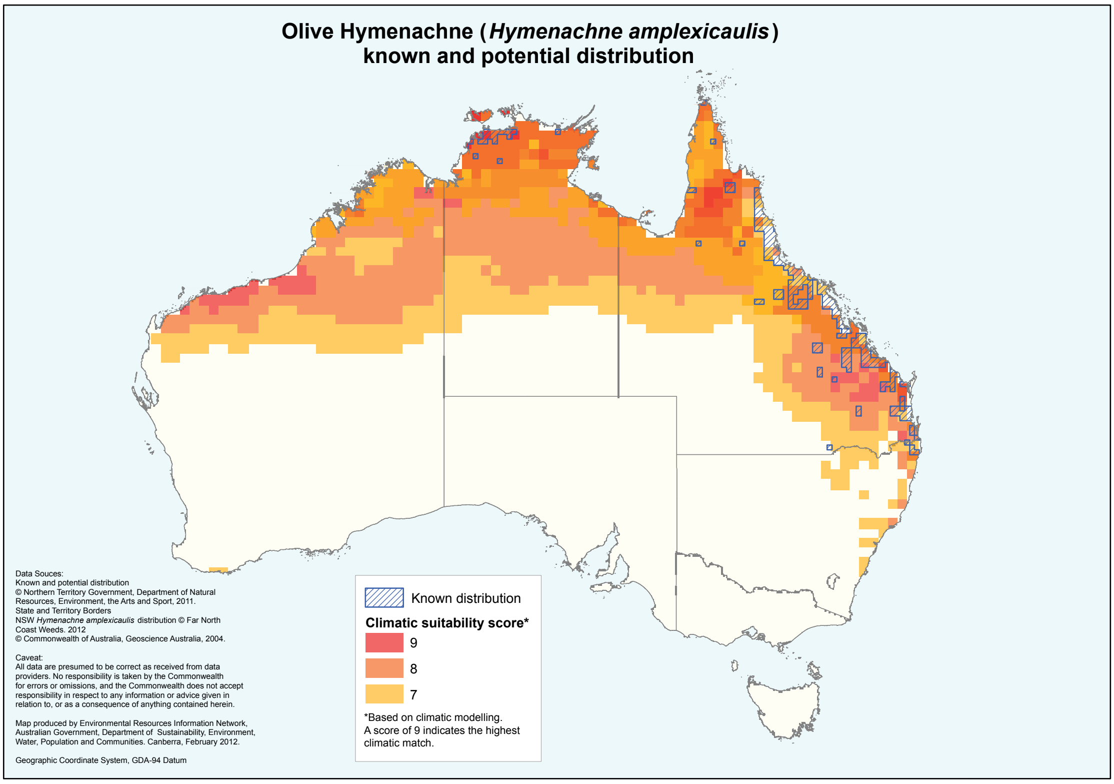


Figure 4: Map indicating known and potential distribution of olive hymenachne in Australia

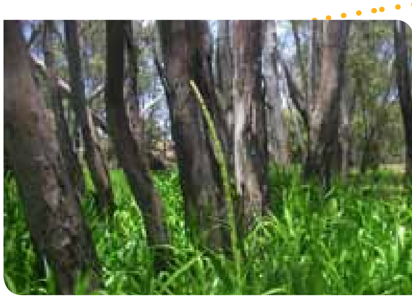


Source: DSEWPaC, 2011.

4.2. Biology and environmental impacts

The name 'olive hymenachne' distinguishes this species from native hymenachne (*H. acutigluma*). Olive hymenachne is a perennial semi-aquatic grass with upright or semi-upright stems growing from a creeping base, that reaches up to 2.5 metres tall. Its habitat is primarily seasonal, shallow freshwater wetlands and riverbanks in coastal and sub-coastal areas. It reproduces by seed as well as vegetatively from stem fragments. It produces large numbers of viable seeds, and graziers have reported good germination by throwing seeds into ponds (CRC, 2003).

Seed is dispersed by floodwaters, in mud (Navie, 2007) and on vehicles (NRMW, 2006). It is also thought to be spread by migratory birds such as magpie geese (Magnussen, 2011). Olive hymenachne can form dense monocultures in open water, reducing plant diversity and posing a severe threat to wetlands. It may also affect the recruitment of native trees and exclude native grasses and sedges that provide foraging resources and nesting habitat for native wildlife (NRMW, 2006). Impacts are well documented (ibid.; Csurhes et al., 1999; NWSEC, 2000).



4.3. Community perception and value

Olive hymenachne is recognised as one of Australia's worst weeds because of its invasiveness, potential for spread, and economic and environmental impacts. In areas of heavy infestation it can affect primary production, water infrastructure, fisheries, public amenity and tourism (NRMW, 2006). Olive hymenachne invades sugarcane fields, resulting in crop contamination and increased production costs. It can damage water storage facilities, and large floating mats can block drainage channels and pumps.

It has been suggested that olive hymenachne may affect recreational and commercial fishing by invading nursery areas for barramundi (*Lates calcarifer*) (NRMW, 2006). Additionally, as prawns breed in response to natural flood events, disruptions to natural run-off patterns caused by olive hymenachne infestations may affect recruitment (ibid.).

Olive hymenachne has the potential to affect Indigenous traditional activities (see Section 4: Social and economic impacts). There is awareness of issues relating to olive hymenachne among some Indigenous communities. For example, the Nywaigi Aboriginal people from the north of Townsville have been working with the CSIRO to manage this invasive grass and restore the health of the Mungalla wetlands.

4.4. Regulation and management

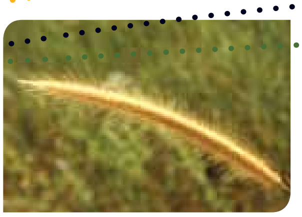
Olive hymenachne was listed as a WoNS in 1999 under the National Weeds Strategy. It is a declared weed in all jurisdictions relevant to the TAP (see Table 1). Olive hymenachne is also a declared weed in every other Australian state and territory.[5]

A weed risk assessment undertaken by the Queensland Government in 1999 determined that olive hymenachne has the potential to dominate shallow, seasonally flooded freshwater wetlands across most of the wet tropics and coastal central Queensland, with serious consequences for native ecosystems and certain fishery habitats. It is a declared Class 2 pest in Queensland.

In the Northern Territory, olive hymenachne is a declared Class B/C weed. The main infestations occur around the East Alligator River catchment and the Arafura Swamp (Cobon, 2009).

In Western Australia the species has been determined to be a high ecological risk for the Kimberley area (Sinclair, 2010). It is categorised as a P1 and P2 plant across the entire state.

[5] Australian Capital Territory (*Pest Plants and Animals Act 2005*); New South Wales (*Noxious Weeds Act 1993*); South Australia (*Natural Resources Management Act 2004*); Tasmania (*Weeds Management Act 1999*); and Victoria (*Catchment and Land Protection Act 1994*).



As a WoNS, there is a significant body of work relating to the control of olive hymenachne. A national strategic plan was released in 2001 which outlined a range of management actions aimed at preventing the spread of this species and reducing its adverse impacts.

The National Hymenachne Strategic Plan progress review (2008–2009) recommended that, given the value of olive hymenachne to the Northern Territory and Queensland cattle industries, an industry code of practice for existing ponded hymenachne pasture management be developed and incorporated in local planning. The revised draft National Hymenachne Strategic Plan centres on a catchment-based, zoned management approach to engage all relevant stakeholders in hymenachne management. However, this approach remains to be ratified by relevant jurisdictions (Carter and Dodd, 2009).

In 2011, a hybrid resulting from the crossing of *H. amplexicaulis* with the native *H. acutigluma* was described as *Hymenachne* × *calamitosa* and declaration of the hybrid as a weed in all jurisdictions was recommended (Clarkson et al., 2011).

5 Para grass

5.1. Origin and current distribution

Para grass (*Urochloa mutica*, also known as *Brachiara mutica*) is a native grass of Africa and South America that was introduced into Australia around 1880 (Cameron, 2008). It was initially used to control erosion along river banks, but has since been promoted as a pasture grass throughout northern Australia (Clarkson, 1995). In the Northern Territory, para grass was introduced as a pasture species to the area now known as Kakadu National Park (Douglas and O'Connor, 2004a) and to Arnhem Land (Grace et al., 2004). It is still promoted as a pasture grass for wet and flooded soils by the Northern Territory Government (DoR, 2012). Para grass affects approximately 40 000 hectares in the Northern Territory (Low, 1997) and 100 000 hectares in Queensland (NRMW, 2006). In Western Australia, para grass occurs in the north-eastern and south-western regions of the state.

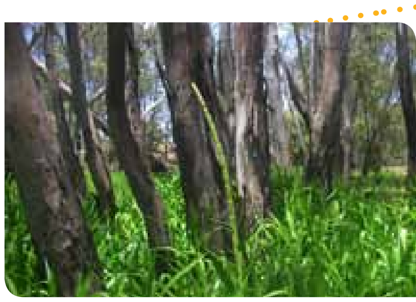
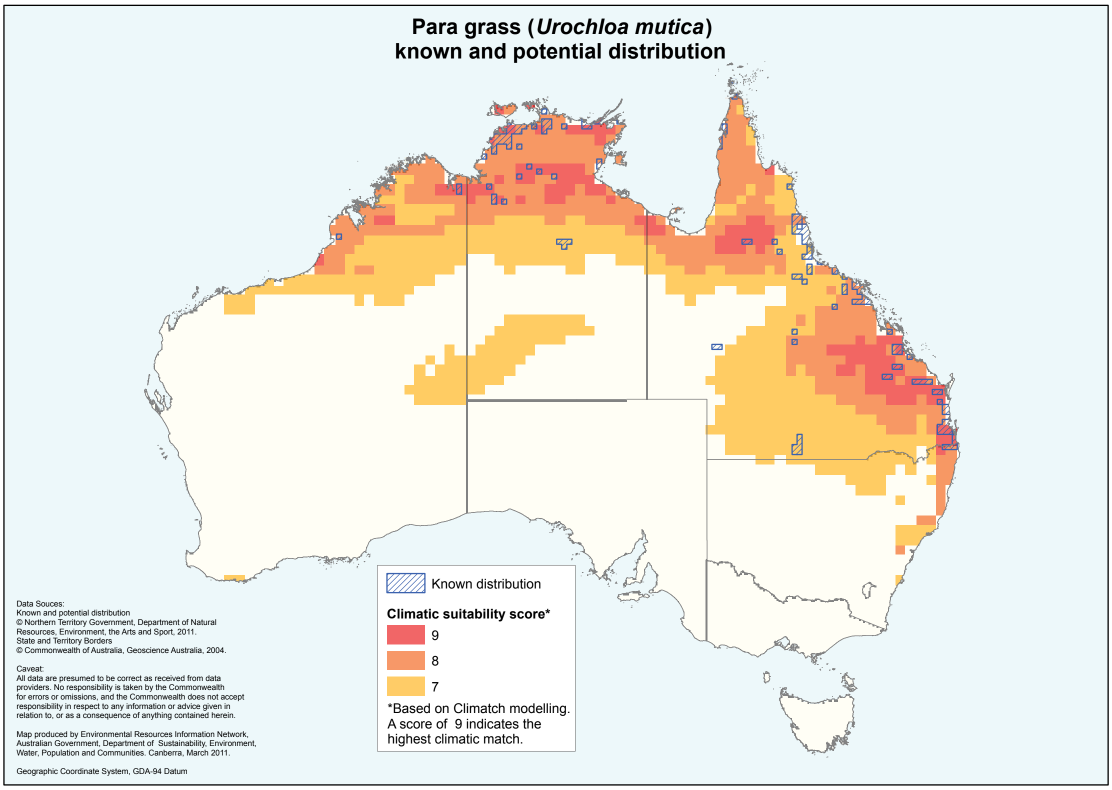


Figure 5: Map indicating known and potential distribution of para grass in Australia

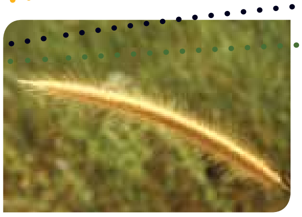


Source: DSEWPaC, 2011.

5.2. Biology and environmental impacts

Para grass is a perennial grass growing up to 1 metre tall. Stems are hollow and robust with a prostrate growth habit, forming dense floating mats. It grows on a range of soil types and is adapted to wet conditions, waterlogging and prolonged flooding (Cameron, 2008). It reproduces by seed and by stolon fragments, both of which are readily transported by floodwaters, waterbirds and vehicles (Gould, 2001).

In a survey of wetland systems of the Top End of the Northern Territory, para grass was found in dense monocultures which displaced native plants, including ecologically important species such as wild rice (*Oryza meridionalis*) (Ferdinands et al., 2005). Fish and bird communities are negatively affected by para grass (ibid.). Beggs et al. (2003) reported a lower abundance of frogs in areas dominated by para grass compared to those without para grass. A study by Douglas and O'Connor (2004a) revealed reduced richness and abundance of terrestrial invertebrates in wetlands dominated by para grass.



Para grass infestations can provide a significant fuel load, resulting in destructive, late-season floodplain fires from which para grass can re-establish but many native species cannot (Hunter et al., 2010).

5.3. Community perception and value

Despite para grass generally being acknowledged as an aggressive invader of wetland habitats (see, for example, Douglas et al., 2004; Ferdinands et al., 2005), it is one of a range of species currently being used as an alternative pasture grass to olive hymenachne. However, there is increasing community concern about the impacts of para grass and other introduced pasture species that are establishing outside pasture systems (Douglas et al., 2004). As with olive hymenachne, para grass has the potential to have a significant impact on wetlands, affecting a range of activities including recreational, commercial and traditional.

5.4. Regulation and management

Para grass is not declared as a weed in any jurisdiction.

Queensland has a ponded pastures policy that covers the management of para grass and other semi-aquatic species used by the grazing industry (NRM, 2003). No other jurisdictions have formal management programs in place.

Para grass has been assessed in Western Australia as being a high ecological risk for the Kimberley region.

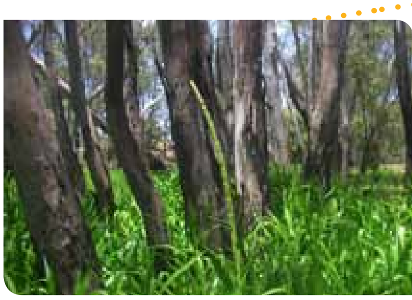
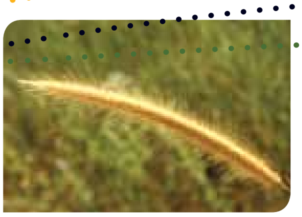


Table 1: Classification of the five listed grasses under state and territory legislation

Species	State	Classification (see Table 2 for definitions)	Legislation
Gamba grass (*Andropogon gayanus*)	NT	Class A/C and Class B/C weed	*Weeds Management Act 2001*
	Qld	Class 2 pest	*Land Protection (Pest and Stock Route Management) Act 2002*
	WA	P1 and P2 for whole state	*Agriculture and Related Resources Protection Act 1976*
Perennial mission grass (*Cenchrus polystachios* syn.*Pennisetum polystachion*)	NT	Class B/C	*Weeds Management Act 2001*
	Qld	Not declared	
	WA	Not declared	
Olive hymenachne (*Hymenachne amplexicaulis*)	NT	Class B/C weed	*Weeds Management Act 2001*
	Qld	Class 2 pest	*Land Protection (Pest and Stock Route Management) Act 2002*
	WA	P1 and P2 for whole state	*Agriculture and Related Resources Protection Act 1976*
Annual mission grass (*Cenchrus pedicellatus* syn. *Pennisetum pedicellatum*)		Not declared in any jurisdiction	
Para grass (*Urochloa mutica*)		Not declared in any jurisdiction	

Table 2: Definitions of classifications under state and territory legislation

State/territory and legislation	Definition of classification
Northern Territory *Weeds Management Act 2001*	Class A weed – to be eradicated in all areas except where it is classified as Class B Class B weed – growth and spread to be controlled Class C weed – not to be introduced into the Northern Territory
Queensland *Land Protection (Pest and Stock Route Management) Act 2002*	Class 2 pest – a pest that has already spread over substantial areas of the state but whose impacts are considered significant enough to control it and avoid further spread
Western Australia *Agriculture and Related Resources Protection Act 1976*	P1 – introduction of the plant into, or movement of the plant within, an area is prohibited P2 – plant is to be eradicated in the area

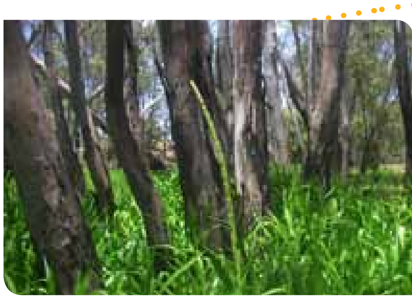


THREATENED SPECIES AND ECOLOGICAL COMMUNITIES

Each of the five species of grasses identified in this KTP can have detrimental impacts on native species and ecosystems. These include changing native species composition through competition, and promoting intense, late-season fires by increasing fuel loads (Douglas and O'Connor, 2004b; Ferdinands et al., 2005; Brooks et al., 2010; Setterfield et al., 2010). Impacts on native species can occur in a number of ways. For example, in the case of the yellow-snouted gecko, changes to fire regimes are likely to increase mortality of geckos and their eggs through increased predation due to reduction of the leaf litter cover in which they live (DEWHA, 2006). Introduced grasses can also reduce food resources for granivorous species such as the Gouldian finch. Monocultures of a single species of grass – such as gamba, which seeds at only one time of the year, in contrast to a mix of native species which provides seeds over extended periods – have the potential to seriously affect these birds. Increased intensity of fires may also reduce the number of nesting hollows available for breeding (O'Malley, 2006). In wetland environments, para grass can replace wild rice (*Oryza meriodionalis*) and *Eleocharis dulcis*, both energy-rich resources important to magpie geese for the build-up of fat reserves essential for survival through the dry season (Ferdinands et al., 2005).

Gamba grass and perennial mission grass have recently established on the Gove Peninsula and are found within the distribution of the Gove crow butterfly. Altered fire regimes could result in the loss of rainforest patches on which the butterfly is dependent for survival (Braby, 2007).

EPBC Act–listed species and ecological communities potentially affected by the spread of introduced grasses are listed at Table A in the TAP.



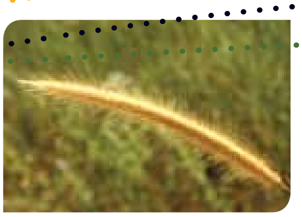
SOCIAL AND ECONOMIC IMPACTS OF THE FIVE LISTED GRASSES

Native pastures are the primary component of northern Australian grazing systems, but environmental and climatic conditions mean there are limits to production in some areas. Native grasses tend to have short growing seasons and produce fodder for only a few months of the year. For pastoralists in northern Australia there is significant benefit in using introduced pasture grasses; however, there are also costs associated with responsible management of these grasses to ensure that they do not escape property boundaries.

Outside the pastoral industry, introduced grasses are documented as having significant negative economic impacts on other primary producers. For example, they can invade sugarcane crops, potentially resulting in increased production costs and reduced yields. Large infestations also lead to loss of amenity and can significantly affect recreational activities and tourism. They can also fuel intense fires which are difficult to control, thereby posing a serious threat to human life, property and community safety.

The social wellbeing of Indigenous people may also be affected by the five listed grasses, as they can interrupt both physical and spiritual connections to country. Introduced grass infestations can restrict or prevent Indigenous hunting activities, limit the availability of traditional foods such as yams, and render habitats unsuitable for culturally significant species including magpie geese (Hunter et al., 2010). Physical access to sacred sites may also be hindered.

While there may be significant costs associated with the control of these introduced grasses, these will be offset by the substantial savings resulting from early action. As these grasses are considered to be in early stages of invasion (TSSC, 2009), prompt intervention is more cost-effective than managing a widely established species.



APPENDIX A

Environment Protection and Biodiversity Conservation Act 1999

3 Objects of Act

(1) The objects of this Act are:

(a) to provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance; and

(b) to promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources; and

(c) to promote the conservation of biodiversity; and

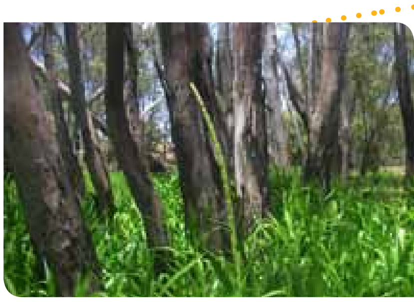
(ca) to provide for the protection and conservation of heritage; and

(d) to promote a cooperative approach to the protection and management of the environment involving governments, the community, landholders and indigenous peoples; and

(e) to assist in the cooperative implementation of Australia's international environmental responsibilities; and

(f) to recognise the role of indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity; and

(g) to promote the use of indigenous peoples' knowledge of biodiversity with the involvement of, and in cooperation with, the owners of the knowledge.



Threat abatement plans and the *Environment Protection and Biodiversity Conservation Act 1999*

Section 271 Content of threat abatement plans

(1) A threat abatement plan must provide for the research, management and other actions necessary to reduce the key threatening process concerned to an acceptable level in order to maximise the chances of the longterm survival in nature of native species and ecological communities affected by the process.

(2) In particular, a threat abatement plan must:

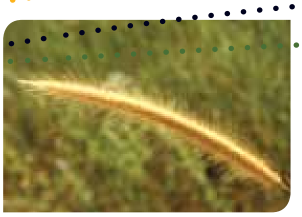
- (a) state the objectives to be achieved; and
- (b) state criteria against which achievement of the objectives is to be measured; and
- (c) specify the actions needed to achieve the objectives; and
- (g) meet prescribed criteria (if any) and contain provisions of a prescribed kind (if any).

(3) In making a threat abatement plan, regard must be had to:

- (a) the objects of this Act; and
- (b) the most efficient and effective use of the resources that are allocated for the conservation of species and ecological communities; and
- (c) minimising any significant adverse social and economic impacts consistently with the principles of ecologically sustainable development; and
- (d) meeting Australia's obligations under international agreements between Australia and one or more countries relevant to the species or ecological community threatened by the key threatening process that is the subject of the plan; and
- (e) the role and interests of indigenous people in the conservation of Australia's biodiversity.

(4) A threat abatement plan may:

- (a) state the estimated duration and cost of the threat abatement process; and
- (b) identify organisations or persons who will be involved in evaluating the performance of the threat abatement plan; and



(c) specify any major ecological matters (other than the species or communities threatened by the key threatening process that is the subject of the plan) that will be affected by the plan's implementation.

(5) Subsection (4) does not limit the matters that a threat abatement plan may include.

Section 274 Scientific Committee to advise on plans

(1) The Minister must obtain and consider the advice of the Scientific Committee on:

(a) the content of recovery and threat abatement plans; and

(b) the times within which, and the order in which, such plans should be made.

(2) In giving advice about a recovery plan, the Scientific Committee must take into account the following matters:

(a) the degree of threat to the survival in nature of the species or ecological community in question;

(b) the potential for the species or community to recover;

(c) the genetic distinctiveness of the species or community;

(d) the importance of the species or community to the ecosystem;

(e) the value to humanity of the species or community;

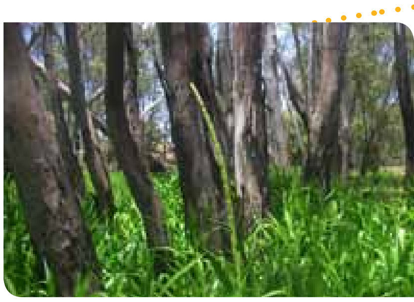
(f) the efficient and effective use of the resources allocated to the conservation of species and ecological communities.

(3) In giving advice about a threat abatement plan, the Scientific Committee must take into account the following matters:

(a) the degree of threat that the key threatening process in question poses to the survival in nature of species and ecological communities;

(b) the potential of species and ecological communities so threatened to recover;

(c) the efficient and effective use of the resources allocated to the conservation of species and ecological communities.



Section 279 Variation of plans by the Minister

(1) The Minister may, at any time, review a recovery plan or threat abatement plan that has been made or adopted under this Subdivision and consider whether a variation of it is necessary.

(2) Each plan must be reviewed by the Minister at intervals of not longer than 5 years.

(3) If the Minister considers that a variation of a plan is necessary, the Minister may, subject to subsections (4), (5), (6) and (7), vary the plan.

(4) The Minister must not vary a plan, unless the plan, as so varied, continues to meet the requirements of section 270 or 271, as the case requires.

(5) Before varying a plan, the Minister must obtain and consider advice from the Scientific Committee on the content of the variation.

(6) If the Minister has made a plan jointly with, or adopted a plan that has been made by, a State or selfgoverning Territory, or an agency of a State or selfgoverning Territory, the Minister must seek the cooperation of that State or Territory, or that agency, with a view to varying the plan.

(7) Sections 275, 276 and 278 apply to the variation of a plan in the same way that those sections apply to the making of a recovery plan or threat abatement plan.

Threat abatement plans and the *Environment Protection and Biodiversity Conservation Regulations 2000*

Part 7 Species and communities

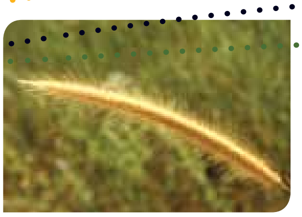
Regulation 7.12 Content of threat abatement plans

For paragraph 271 (2) (g) of the Act, a threat abatement plan must state:

(a) any of the following that may be adversely affected by the key threatening process concerned:

- (i) listed threatened species or listed threatened ecological communities;
- (ii) areas of habitat listed in the register of critical habitat kept under section 207A of the Act;
- (iii) any other native species or ecological community that is likely to become threatened if the process continues; and

(b) in what areas the actions specified in the plan most need to be taken for threat abatement.



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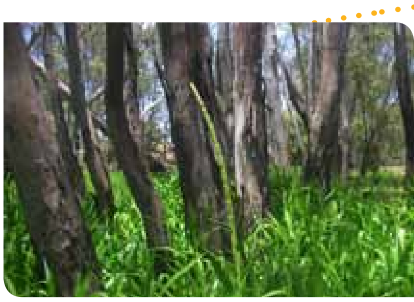

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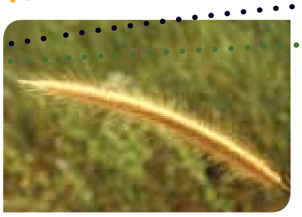

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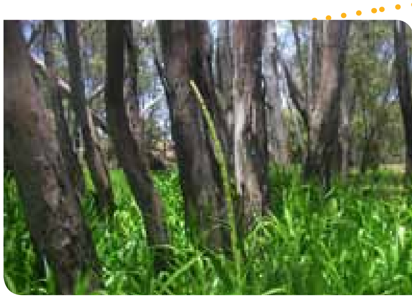

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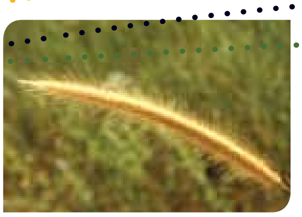

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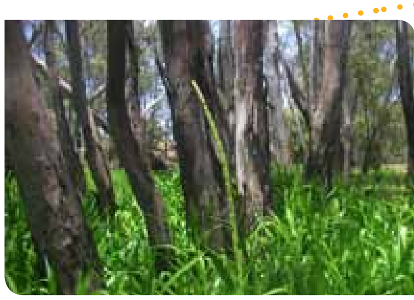

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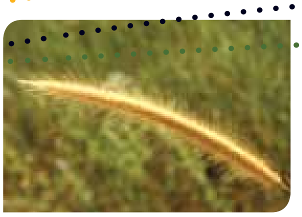

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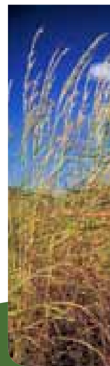
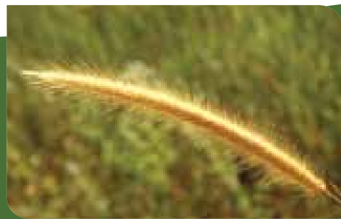

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