

Fountain grass (*Cenchrus setaceus*): NT Weed Risk Assessment Technical Report



Fountain grass
Cenchrus setaceus

This report summarises the results and information used for the weed risk assessment of Fountain grass (*Cenchrus setaceus*) in the Northern Territory. A feasibility of control assessment has also been completed for this species and is available on request.

Online resources are available at <https://denr.nt.gov.au/land-resource-management/rangelands/publications/weed-management-publications> which provide information about the NT Weed Risk Management System including an explanation of the scoring system, fact sheet, user guide, a map of the Northern Territory weed management regions and FAQs.

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Cover photo (top): Fountain grass infestation on lava flow, Hawai'i. (Source: Guinther 2005).

Cover photo (bottom): Cultivated fountain grass growing in a garden. (Source:

www.southeastweeds.org.au).

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Fountain grass
Cenchrus setaceus

Weed Risk = Very high

| | |
|-----------------------------------|------|
| Section A: Invasiveness | 75 % |
| Section B: Impact | 53 % |
| Section C: Potential distribution | 87 % |
| Total score = A x B x C x 1000 = | 342 |



| | |
|----------------------|---|
| <i>Taxon:</i> | <i>Cenchrus setaceus</i> |
| <i>Synonyms:</i> | <i>Pennisetum setaceum</i> |
| <i>Common name:</i> | Fountain grass |
| <i>Other names:</i> | African fountain grass, green fountain grass |
| <i>Family:</i> | Poaceae (grass family) |
| <i>Lifeform:</i> | Perennial grass |
| <i>Environment:</i> | Terrestrial |
| <i>Origin:</i> | Northern and eastern Africa and south-western Asia |
| <i>Description:</i> | Attractive perennial grass with a densely clumped growth form and erect stems that grow up to 1 metre high. Long wiry leaves are 1045cm long from the base and form dense, light green clumps. The small flowers are grouped in pink or purple, bristly, upright inflorescences 15-38cm long (inflorescences may also be cream coloured). Fruits are small, dry achenes adorned with long showy bristles. |
| <i>Habitat:</i> | Can colonise a very broad range of habitats, from grasslands to woodlands and rocky and riparian areas. It is most invasive in arid and semi-arid areas. |
| <i>Distribution:</i> | In Australia, naturalised in Western Australia, South Australia, Queensland, Victoria, New South Wales. In the Northern Territory, it is still highly restricted – most populations are believed to be confined to gardens in Alice Springs. |
| <i>Legislation:</i> | Declared in NSW and Queensland. Not declared in the Northern Territory. |
| <i>Other:</i> | Low grazing value due to its wiry leaves, tends to be avoided by grazing animals. Listed as a potential environmental weed and candidate for early preventative control in Csurhes & Edwards (1998). ¹ A separate species, purple fountain grass (<i>Cenchrus advena</i>) is easily mistaken for fountain grass. It is also known and sold under the names <i>Pennisetum setaceum</i> 'Rubrum' and <i>Pennisetum advena</i> Rubrum. A common ornamental, street plantings monitored in Darwin and Katherine have not set seed and are believed to be sterile. Purple fountain grass is not considered invasive and has not been recorded as naturalised anywhere in Australia. |

¹ Csurhes, SM & Edwards, R (1998) *Potential environmental weeds in Australia: candidate species for preventative control*, Queensland Department of Natural Resources, Brisbane.

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Summary of weed risk information by section

Invasiveness: In some parts of the world, it is an aggressive invader, in others less so. It is known to be highly adaptable and is able to change its behaviour according to its new environment (phenotypic plasticity). Establishment facilitated by disturbance. Relatively low seed production. Spread by wind and by humans who plant it in gardens.

Impact: Replaces native vegetation forming monocultures, reduces carrying capacity of pastures (low grazing value) and increases the severity and spread of fire.

Potential distribution: Highly adaptable species, drought tolerant, fire tolerant and able to increase its growth rate substantially in response to seasonal conditions. While nearly the whole of the Australian continent is predicted to be climatically suitable for its growth, it is likely to pose a higher risk in arid and semi-arid environments (less than 500 mm annual rainfall).

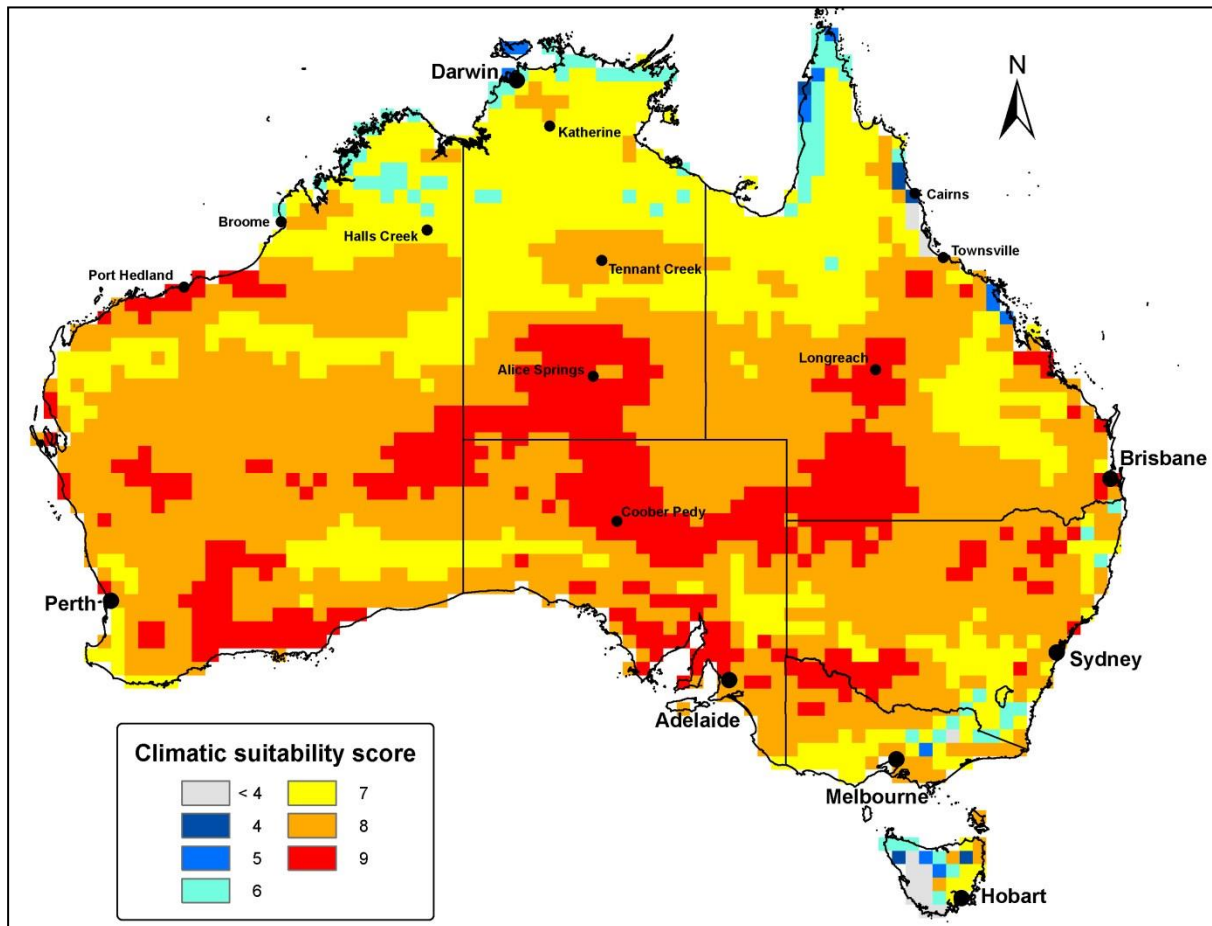


Figure 1. Potential distribution of fountain grass (*Cenchrus setaceus*) in Australia using CLIMATCH. Areas of suitable climate are indicated by a climatic suitability score of 7 or above out of 10 (source: NT Weed Management Branch 2010).

Weed Risk Assessment - Determinations

Invasiveness

1. What is the ability of the plant to establish amongst intact native environments?
 - a) Time to seeding
 - b) Annual production of viable seed per square metre or plant
 - c) Vegetative reproduction
3. Do propagules of the plant have properties that allow them to be dispersed long-distance by natural means?
 - a) Flying animals (birds, bats)
 - b) Other wild animals
 - c) Water
 - d) Wind
4. How likely is long-distance dispersal by human means?
 - a) Deliberate spread by people
 - b) Accidentally by people and vehicles
 - c) Contaminated produce
 - d) Domestic/farm animals

Determination

High

| |
|----------------|
| 1 year or less |
| Low |
| None |

| |
|------------|
| Don't know |
| Yes |
| Yes |
| Yes |

| |
|------------|
| Occasional |
| Occasional |
| Unlikely |
| Occasional |

Impacts

1. What is the plants competitive potential?
2. What is the plant's potential to modify the existing fire behaviour and alter the fire regime?
3. What is the plant's potential to restrict the physical movement of people, animals, vehicles, machinery and/or water?
4. What is the plant's potential to negatively affect the health of animals and/or people?
5. Does the plant potentially have negative effects on natural and cultural values?
 - a) reducing habitat quality for native animals
 - b) threatened species or communities
 - c) sites of natural significance
6. Is the plant presumed to have negative effects on environmental health?
 - a) soil chemistry/stability
 - b) water quality
 - c) hydrology

High

Significant potential

None

None

| |
|-------------|
| High |
| More than 1 |
| More than 1 |

| |
|----|
| No |
| No |
| No |

Potential distribution

1. What is the climate suitability score (which indicates out of 10 the proportion of the NT environment that is suitable for the plant)?
2. How many broad habitat types in the NT will the plant potentially naturalise in (up to 5) ?
3. What is the potential of the plant to occur throughout its favoured habitat in the NT (from those identified in question 2)?

9.5

>=Five

Some

Weed Risk Assessment - Evidence Used

A INVASIVENESS

A1 What is the ability of the plant to establish amongst intact native environments?

| | |
|---|--|
| It can invade riparian habitats, flood lines and rocky shores of reservoirs and rivers in low elevation. | Arizona-Sonora Desert Museum (2010) |
| Fountain grass is an aggressive invader in the arid and semi-arid habitats of the tropics and subtropics. | Gonzalez-Rodriguez et al. (2010) |
| <i>Pennisetum setaceum</i> was introduced as an ornamental into three states in the USA between 1917 and 1940. However it is not equally invasive in these three states. In Hawaii it is extremely noxious, colonising lava fields and dry forests on flows. In Arizona it is prevalent and spreading quickly, while in southern California it is confined to roadsides and ruderal areas and has not aggressively invaded habitats (J. Poulin, unpublished data). | Poulin et al. (2007) |
| This plant is considered mildly invasive if planted near undisturbed natural areas (Horticopia Inc. 1999 cited in Pacific Island Ecosystems at Risk 2005). | Horticopia Inc. (1999) Pacific Island Ecosystems at Risk (2005) |
| It has phenotypic plasticity. | Poulin et al. (2007) |
| Seedlings readily establish in wetter years and then become drought tolerant in drier years, allowing it to maintain dominance over other grasses. | FloraBase (2010) |
| It is a weed of woodlands, grasslands, coastal vegetation, rail embankments, roadsides and mines. | FloraBase (2010) |
| Fountain grass is extremely drought tolerant. Established plants thrive in climates with less than 20 inches (500 mm) of rain annually. | Floridata (2010) |
| It requires full sun for the survival and development but tolerates partial shade. | Floridata (2010) |
| This species is known to occur in deserts, grasslands and disturbed sites such as roadsides. | European and Mediterranean Plant Protection Organization (2010) |
| Fountain grass is apparently able to take advantage of rainfall with higher photosynthetic rates whenever there is enough precipitation. | Poulin et al. (2007) |
| In apomictic species, seeds are produced asexually and result in progeny that are genetically identical to the maternal plant, but some genetic variation may occur because few apomictic species are completely asexual (Richards, 1997). The success of several apomictic species as invasive species has been presumed to be associated with high levels of phenotypic plasticity and a general-purpose genotype (Baker, 1965), (Poulin et al. 2007 and references therein). | Baker (1965) Poulin et al. (2007) Richards (1997) |
| It can grow on all types of soils (clay to sandy), acid to slightly alkaline, but does not tolerate saline conditions. | European and Mediterranean Plant Protection Organization (2010) |

A2a Reproductive ability: Time to seeding?

| | |
|--|--|
| Plant reaches maturity in the first year, and produces seeds every year. | European and Mediterranean Plant Protection Organization |
|--|--|

Weed Risk Assessment - Evidence Used

| | | (2010) |
|------------|---|---|
| A2b | Reproductive ability: Annual production of viable seed per square meter or per plant? | |
| | Seed set is usually quite low, typically less than 20% = less than 50 seeds per seed head; Total (viable?) seed production recorded as <1000/m ² . | Pacific Island Ecosystems at Risk (2005) |
| | An average of 100 seeds per plant was measured in a greenhouse trial. | Poulin et al. (2007) |
| | Produces large amounts of seed. | Herbiguide (2010) |
| A2c | Reproductive ability: Vegetative reproduction? | |
| | No evidence of vegetative reproduction. | No reference |
| A3a | Propagule dispersal: Flying animals (birds, bats) | |
| | No specific information available. | No reference |
| A3b | Propagule dispersal: Other wild animals | |
| | Seeds may be spread by animals. | Poulin et al. (2007) |
| A3c | Propagule dispersal: Water | |
| | Seeds may be dispersed by water. | Benton (2005) |
| A3d | Propagule dispersal: Wind | |
| | Fountain grass seeds are primarily wind-dispersed. | Benton (2005) Poulin et al. (2007) |
| A4a | Human dispersal: Deliberate spread by people | |
| | Fountain grass is a declared weed in Qld and NSW, but it is still sold as a garden plant in other states. | CRC for Australian Weed Management (2008) |
| | Fountain grass has been widely planted as an ornamental in Australia and overseas. However, like many other "garden escapees", it is highly invasive, fire-adapted colonizer that readily out-competes native plants. | DPI Queensland (2008) |
| A4b | Human dispersal: Accidentally by people and vehicles | |
| | Seeds caught in the base of the plant, can spread after the plant is uprooted. | Global Invasive Species Database (2010) |
| | Scattered populations occur in windward areas, mostly in roadside habitats. Fountain grass is readily dispersed by vehicles, humans, wind, water, and possibly birds. | Tunison (1992) |
| A4c | Human dispersal: Contaminated produce | |
| | No specific information available. | No reference |
| A4d | Human dispersal: Domestic/farm animals | |
| | Seeds may be dispersed by livestock. | Benton (2005) |

Weed Risk Assessment - Evidence Used

B IMPACTS

B1 What is the plant's competitive potential?

| | |
|---|---|
| In dry and open environments fountain grass is a highly aggressive, fireadapted colonizer that readily out-competes native plants. It can produce seeds apomictically (asexually). | Poulin et al. (2007) Global Invasive Species Database (2010) Poulin et al. (2007) |
| Seeds can remain viable in the soil for 6 years or longer. | European and Mediterranean Plant Protection Organization (2010) |
| It is a highly invasive plant forming monoculture and out-competing native plants by reducing available resources such as space, water and nutrients. | European and Mediterranean Plant Protection Organization (2010) |
| This study conducted in the Canary Islands reported that fountain grass has high phenotype plasticity, and has been able to readily adapt to the low levels of resources available in the study area. | Gonzalez-Rodriguez et al. (2010) |
| This study reported that the activity of photosystem II was higher and lasted longer in <i>P. setaceum</i> than in the native grasses. | Gonzalez-Rodriguez et al. (2010) |
| (In the Canary Islands) <i>Cenchrus setaceus</i> first coexists with, and eventually replaces, the native grasses <i>Hyparrhenia hirta</i> , <i>Cenchrus ciliaris</i> , and <i>Aristida adscensionis</i> ssp. <i>coerulescens</i> as urban areas enlarge (Martín Esquivel et al. 1995 cited in Gonzalez-Rodriguez et al. 2010). | Gonzalez-Rodriguez et al. (2010) Martín Esquivel et al. (1995) |
| Fountain grass out-competes and suppresses native vegetation, invades pasture, spread rapidly along roadsides, railways and fence lines, and greatly increases fire risk. | Eyre Peninsula Natural Resources Management Board (2010) |
| Fountain grass is of low grazing values because of its coarse rough leaves. | DPI NSW (2010) |

B2 What is the plant's potential to modify the existing fire behaviour and alter the fire regime?

| | |
|--|----------------------|
| In the Hawaiian Islands, <i>C. setaceus</i> is an extremely noxious weed because it is an early aggressive colonizer of lava fields and dry forests on the Islands of Hawaii, and this has led to the destruction of native communities by increasing fire frequency and by limiting germination, survival, and growth of native dry forest species. | Poulin et al. (2007) |
| Fountain grass produces lots of fuel loads, which increases the intensity and spread of a fire in dry forests. | Benton (2005) |

B3 What is the plant's potential to restrict the physical movement of people, animals, vehicles, machinery and/or water?

| | |
|------------------------------------|--------------|
| No specific information available. | No reference |
|------------------------------------|--------------|

B4 What is the plant's potential to negatively affect the health of animals and/or people?

| | |
|------------------------|--------------|
| Not recorded as toxic. | No reference |
|------------------------|--------------|

Weed Risk Assessment - Evidence Used

B5a Natural & cultural values: Reducing habitat quality for native animals

In the Hawaiian Islands, *C. setaceus* is an extremely noxious weed because it is an early aggressive colonizer of lava fields and dry forests on the Islands of Hawaii, and this has led to the destruction of native communities by increasing fire frequency and by limiting germination, survival, and growth of native dry forest species. Poulin et al. (2007)

It is a highly invasive plant forming monoculture and out-competing native plants by reducing available resources such as space, water and nutrients. European and Mediterranean Plant Protection Organization (2010)

B5b Natural & cultural values: Threatened species of communities

There are two species of threatened land snail with highly restricted distributions close to Alice Springs, *Semotrachia filixiana* and *Semotrachia euzyga*. These species and others would be impacted by fountain grass if it were to escape and spread. D. Liddle, NT Biodiversity Conservation, pers. comm. (2010)
Ward et al. (2006)
Wilson et al. (2007)

B5c Natural & cultural values: Sites of natural and cultural significance

The Greater MacDonnell Ranges is a site of conservation significance that may be impacted by *Cenchrus setaceus*. D. Liddle, NT Biodiversity Conservation, pers. comm. (2010)
Harrison et al. (2009)

The Waterhouse Range is a site of conservation significance that may be impacted by *Cenchrus setaceus*. D. Liddle, NT Biodiversity Conservation, pers. comm. (2010)
Harrison et al. (2009)

B6a Environmental health: Soil chemistry/stability

Used for binding sand to prevent erosion. Herbiguide (2010)

B6b Environmental health: Water quality

Terrestrial species. No reference

B6c Environmental health: Hydrology

No specific information available. No reference

C POTENTIAL DISTRIBUTION

C1 What is the CLIMATE suitability score (which indicates the proportion of the NT environment that is suitable for the plant)?

The CLIMATCH model used by the NT Weed Management Branch predicts that 95% of the Northern Territory is climatically suitable for *Cenchrus setaceus* (see Figure 1). NT Weed Management Branch (2010)

Weed Risk Assessment - Evidence Used

This species is known to occur in deserts, grasslands and disturbed sites such as roadsides.

European and
Mediterranean Plant
Protection Organization
(2010)

C2 **How many broad vegetation types in the NT will the plant potentially naturalise in (up to 5) ?**

The broad vegetation types in the Northern Territory that *Pennisetum setaceum* will potentially naturalise in are:

- Tropical riparian areas
- Tropical open forests/savanna woodlands
- Sandstone heathlands
- Mitchell grasslands
- Spinifex grasslands
- Arid and semi-arid woodlands
- Arid and semi-arid shrublands
- Arid riparian

Of these, the favoured vegetation type is arid riparian.

C3 **What is the potential of the plant to occur throughout its favoured habitat in the NT (identified in question 2)?**

NT Weed Risk
Management Committee
(2010)
Rossiter-Rachor et al.
(2012)

Cenchrus setaceus has the potential to occur through some of its favoured habitat.

NT Weed Risk
Management Committee
(2010)

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