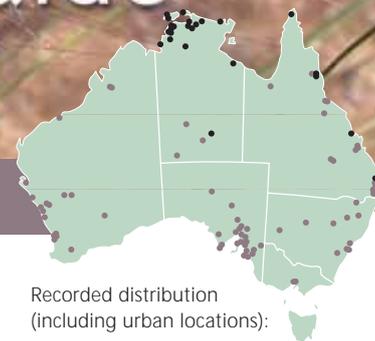


Weed Management Guide

Managing weeds for biodiversity



Recorded distribution (including urban locations):

- Fountain grass (*Pennisetum setaceum*)
- Mission grass (*Pennisetum polystachion*)

Feathergrasses and mission grasses (*Pennisetum* species)

The problem

A number of species in the grass genus *Pennisetum* have been introduced to Australia and become naturalised. They were generally introduced for ornamental purposes, soil stabilisation or fodder. The feathergrass group, which contains fountain grass (*P. setaceum*), feathertop (*P. villosum*) and African feathergrass (*P. macrourum*) is widespread, especially in southern and eastern Australia. The two mission grass species, mission grass (*P. polystachion*) and deenanth (or annual mission) grass (*P. pedicellatum*) are largely confined to northern Australia.

These grasses have spread to roadsides, rail corridors, along watercourses and

into pastures and native vegetation. Feathertop has been identified as a threat to biodiversity and is also a weed of pastures in NSW. Fountain grass is a declared weed in Qld and NSW, but it is still sold as a garden plant in other states. African feathergrass dominates riparian zones and can infest pastures. Swamp foxtail (*P. alopecuroides*), though considered to be native in parts of NSW and Qld, has been widely planted and is a weed in Vic., especially in East Gippsland. Most *Pennisetum* species have received relatively little attention in weed research in Australia and their ecology and impacts are not well documented.

Mission grass has invaded tropical savannas. It produces greater amounts

of flammable biomass than native grasses, grows into the dry season and can result in more intense fires which kill the native tree species that would otherwise survive less extreme fire events. Deenanth grass is a weed of grain sorghum crops in northern Australia and is also known to invade native vegetation.

Many perennial grass weeds are invading Australia's native vegetation, particularly grasslands, woodlands,

Key points

- A number of introduced, mostly perennial *Pennisetum* species are a threat to biodiversity in northern savannas and southern Australia.
- Fountain grass and related cultivars, as well as swamp foxtail that has become a weed outside its native range, are commonly planted in gardens and used in landscaping.
- Many species form large, dense tussocks and may alter fire regimes.
- Plants produce numerous, hairy burrs that are readily dispersed by wind, water, animals and human activities.
- Rhizomes are the major means of spread in some species.
- Most active growth is in summer provided there is adequate moisture.
- Small infestations can be dug out.
- Tussocks can be spot sprayed with herbicide when actively growing. Improved results may be obtained by treating regrowth after removing old foliage. Treatment must be followed up.



Fountain grass (*Pennisetum setaceum*) planted along a roadside has spread into adjacent bushland: Brisbane, Queensland.

Photo: S. Navie

rangelands and coastal areas. Invasive grasses displace native plants and can also contribute to changed fire regimes that affect native vegetation structure and biodiversity. Besides *Pennisetum* species, they include needlegrasses (*Nassella* spp.), veldt grasses (*Ehrharta* spp.), buffel grass (*Cenchrus ciliaris*), Coolatai grass (*Hyparrhenia hirta*), wheat-grasses (*Thinopyrum* spp.), Rhodes grass (*Chloris gayana*) and African lovegrass (*Eragrostis curvula*). Gamba grass (*Andropogon gayanus*) is a particular threat to tropical savannas. Several of these are also sown as pastures in Australia.



Swamp foxtail (*Pennisetum alopecuroides*) is widely planted and has become naturalised outside its native Australian range, especially in Vic. It is very similar to fountain grass (*P. setaceum*). Photo: S. Navie

The weeds

Pennisetum species in Australia are generally perennial tussock grasses. Exceptions include deenanth grass which generally grows as an annual and kikuyu (*P. clandestinum*) which is a perennial, low growing or prostrate turf species. Flowers of the tussock species are arranged in a conspicuous, spike-like head that in some species is purple to pink when fresh. Other species have straw coloured to white flower heads. The hairy burrs consist of individual flowers or flower clusters with their bristles. These contain the seed and are readily dispersed. Some species also spread by rhizomes. Most active growth is from spring to autumn and above ground foliage may die off in winter. This dry material accumulates, becoming a fuel hazard and can exclude other species and choke watercourses.

Generally tussock *Pennisetum* species are not very palatable to stock but on other continents in tropical regions young shoots of elephant grass (*P. purpureum*) are a major source of cut fodder. Deenanth grass is a pasture species in India.

Similar native species

Swamp foxtail has been included in the '*Pennisetum* species in Australia' table because it is a weed in Vic., although it is considered to be native in parts of NSW and Qld: note the features of the flowerhead and bristles that distinguish it from fountain grass and African feathergrass.

Spotter's grass (*Pennisetum basedowii*) is a native tussock grass, 0.1–1.4 m tall. The flowers of this species are cream or purple and occur from March to August. The bristles of the burrs lack long feathery hairs. It grows in clay on floodplains of northern Australia.

Common native tussock grasses with dense, hairy flower heads in southern Australia include bottle washers (*Enneapogon nigricans*) and some species of wallaby grass (*Danthonia* species).

Weed identification

Introduced *Pennisetum* species in southern Australia with a tussock habit may look similar and are often difficult to distinguish from each other. When

flowering, they can be distinguished by close examination of the bristles as described in the table. The colour of the flower head is somewhat variable in some species and colourful heads fade to a light straw colour as they mature.

Kikuyu grass is planted as lawn and pasture but is also an environmental weed. Its flowers are largely hidden in the leaves and in Australia it spreads by runners. It is not considered further in this guide.

How they spread

Feathergrasses and mission grasses produce seed in burrs, with the fluffy burrs being carried by water, wind, on animals, clothing or vehicles. In some species (African feathergrass, feathertop and elephant grass) the clumps expand by rhizomes. Spread of these rhizomes can be facilitated by cultivation or grubbing and the detached rhizome sections can form new plants. In southern Australia, establishment from seed may be episodic or relatively uncommon, especially in rhizomatous species.

Pennisetum species in Australia: main species and features

Species	Status and habitat	Habit and flowering season	Flowers, seedhead, bristles	Legislation and alert listing	Distribution
 Fountain grass or African fountain grass (<i>Pennisetum setaceum</i>) Photo: S. Navie	Weed Woodlands, grasslands, coastal vegetation, rail embankments, roadsides, mines	Perennial; dense tussocks to 0.9 m tall; leaves rough to touch Flowers in spring and summer	Flower head 10–12 cm long, purple, maturing to light straw-coloured Bristles feathery near base Bristles mostly to 26 mm long, one per spikelet is much longer (to 40 mm)	Declared in NSW, Qld Weed Alert in NSW Still sold as an ornamental	ACT, NSW, NT, Qld, SA, Vic., WA Origin: northern and tropical Africa, Middle East
 Swamp foxtail (<i>Pennisetum alopecuroides</i>) Photo: S. Navie	Native in NSW, Qld.; weed in Vic. Wetlands, riparian areas, swamps, ditches	Perennial; tussocks to 1 m tall Flowers in summer	Flower head 7–20 cm long, may be purple Bristles not feathery Inner bristles 15–30 mm long, outer whorl shorter	Not declared	NSW, Qld (native) ACT, Vic. (naturalised) Origin: Asia, Australia*
 Feathertop or longstyle feathergrass (<i>Pennisetum villosum</i>) Photo: S. Navie	Weed Grasslands, open woodlands, roadsides, pastures	Perennial; untidy tussocks usually 10–50 cm tall (taller in moist sites); short rhizomes Flowers in summer	Flower head 2–12 cm long, generally pale green to almost white Bristles feathery near base Bristles unequal in length, longer ones 30–70 mm long	Declared in Tas., and in certain local government areas in NSW	ACT, NSW, Qld, SA, Tas., Vic., WA Origin: north-east Africa and Yemen
 African feathergrass (<i>Pennisetum macrourum</i>) Photo: J. Virtue, SA DWLBC	Weed Riparian areas, pastures	Perennial; dense, erect tussocks to 1.8 m tall; rhizomes up to 2 m long Flowers in summer	Flower head 8–30 cm long; straw-coloured Bristles not feathery One bristle per spikelet is longer, (5–20 mm) and thicker	Declared in NSW, SA, Tas., Vic. Weed Alert in NSW	ACT, NSW, SA, Tas., Vic., WA Localised to certain catchments in these states Origin: Africa, Yemen
 Elephant grass (<i>Pennisetum purpureum</i>) Photo: S. Navie	Weed Tropical and subtropical regions, also near Perth Riparian areas, roadsides in wetter regions	Perennial; large, bamboo-like clumps to 4 (7.5) m tall, with rhizomes and stolons Flowers in summer	Flower head 8–30 cm long, usually yellow—brown Bristles not feathery, most 10–16 mm long; one longer bristle per spikelet, up to 40 mm long	Not declared	NSW, NT, Qld, WA Origin: tropical Africa
 Mission grass (<i>Pennisetum polystachion</i> or <i>polystachyon</i>) Photo: C. Wilson	Weed Native tropical savanna woodlands	Perennial; tussocks to 3 m tall Flowering begins early in the wet season	Flower head 3–25 cm long, yellow—brown Bristles numerous, 4–12 mm long, one longer bristle per spikelet, 6–25 mm long	Declared in NT	NT, Qld Origin: Tropical Africa and Macronesia
 Deenanth or annual mission grass (<i>Pennisetum pedicellatum</i>) Photo: C. Wilson	Weed Infests grain sorghum crops; invades roadsides and other disturbed sites	Annual or persistent, tussocks to 1.5 m tall with lateral branches Flowers early in the dry season	Flower head 5–15 cm long, cream-coloured with a purple tinge Bristles numerous, woolly near base, one longer bristle per spikelet, 16–24 mm long	Not declared	NT, Qld, WA Origin: Tropical Africa, India and Macronesia

*Some authorities question whether swamp foxtail is native to Australia—it may have been introduced before European settlement.



Feathertop (*Pennisetum villosum*) has short rhizomes and commonly spreads along roadsides. It is unpalatable and can infest pastures. It is often confused with fountain grass.
Photo: S. Navie

Fountain grass and swamp foxtail are commonly grown in gardens and used in landscape plantings, as are various *Pennisetum* cultivars. Plants and seeds in dumped garden waste can lead to infestations. Mission grasses can be spread through use of contaminated mulch hay in northern Australia.

Fountain grass seed may survive for up to 7 years in the soil and seed set does not require fertilisation. African feathergrass seed is not long-lived but a few seeds may remain viable in the soil for several years. Elephant grass is mainly propagated vegetatively.

Deenanth grass produces very high numbers of seed that generally germinate in the following wet season and are not long-lived in soil. Mission grass seed also mainly germinates in the following wet season but a small proportion may persist in the soil.

Where they grow

Introduced *Pennisetum* species originate from Africa, the Middle East and Asia but are widely naturalised on other continents. Fountain grass and feathertop are weeds in South Africa

and the USA. Fountain grass is of particular concern in Hawaii where it alters natural fire regimes and threatens native vegetation. African feathergrass is a weed in New Zealand. Elephant grass is a weed of watercourses and native vegetation in South Africa and is also listed as a weed on other continents.

Pennisetum species generally grow in open situations including roadsides, pastures and other disturbed sites. They invade grasslands, woodlands, riparian and coastal zones, and

wetlands. Feathergrasses are found in Mediterranean, temperate and subtropical climates in Australia, and mission grasses occur in tropical savannas in northern Australia. Elephant grass is mainly established in eastern Qld and NSW.

Fountain grass is tolerant of a relatively wide range of climatic conditions and has an extensive distribution in Australia. It is widely naturalised in coastal and agricultural regions, generally spreading along roadsides and rail corridors from plantings. It has also been recorded in more arid regions, generally around towns. African feathergrass is well established, mainly along watercourses in regions with reliable rainfall in all southern states. Feathertop mostly occurs in southern Australia where annual average rainfall is 400 mm or more. It has been recorded on roadsides, at urban waste places and in native vegetation, and it infests pastures in NSW.

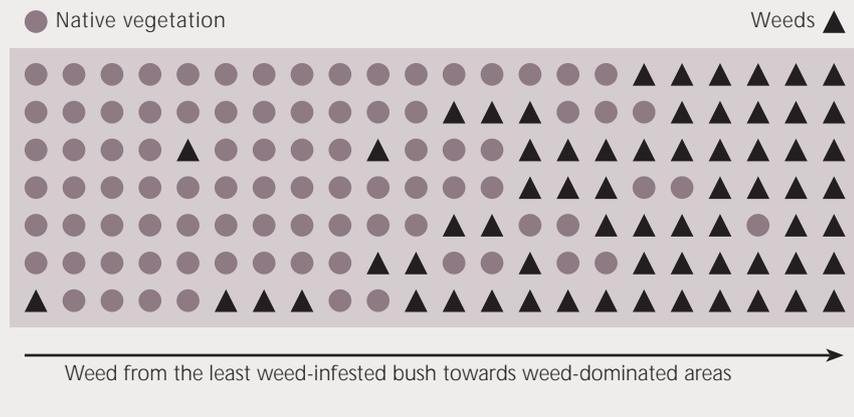
Potential distribution

Climate mapping indicates that there is considerable potential for spread of most *Pennisetum* species into regions where they do not currently occur. Mission grass is well established in the Top End of the NT and in parts of Qld,



Mission grass (*Pennisetum polystachion*) infestation: Top End NT.
Photo: C. Wilson

Strategic weeding in native vegetation



but has the potential to spread more widely in northern Australia. Fountain grass could become established more widely, including in semi arid regions.

Growth cycle

Pennisetum species are summer-active grasses. Feathergrasses mainly flower between spring and autumn, depending on species, seasonal conditions and location. Plants may be almost dormant in winter. New shoots of African feathergrass arise from rhizomes and crowns in spring, whilst seed germinates (rarely) in autumn. The seed of mission grasses are shed during the early to mid dry season (April to July) and the

majority germinate with the onset of the wet season.

What to do about it

It is more practical and cost-effective to prevent weed problems than to remove them, thus early detection is critical. Through coordinated and consistent action, the spread of *Pennisetum* species may be prevented. In regions where one or more *Pennisetum* species is well established, a long-term management program at the local or property scale can reduce the weeds' harmful effects, help to contain their spread and encourage native vegetation to recover. It is



African feathergrass (*Pennisetum macrourum*) is mainly a weed of riparian areas and pastures. Photo: Matthew Baker, Tasmanian Herbarium

essential to have the species identified correctly. For example it is important to determine whether populations mainly spread via rhizomes or seed and to recognise swamp foxtail within its native range where it is not a weed.

Prevent *Pennisetum* species spreading

- Raise awareness of alternative plants which can be substituted for weedy *Pennisetum* species, among gardeners, landscapers, nursery suppliers and road managers. Increase community capacity to recognise *Pennisetum* species that are declared, naturalised or present in ornamental plantings and to remove plantings that become weeds. Garden waste should be disposed of at appropriate facilities.
- Raise awareness about spread of mission grasses caused by using mulch hay contaminated with *Pennisetum* species.
- Identify locations where there are isolated plants or sparse populations. Target control measures to these areas first to keep uninfested areas free of the weed.
- Contain existing infestations. Remove seedlings and treat isolated plants or clumps first and ensure follow up with physical or chemical treatment.
- Practise weed hygiene during slashing, road grading and hay making. Slash from uninfested towards infested areas, preferably when not seeding. Cultivation can spread weeds, especially rhizomatous *Pennisetum* species. In paddocks, avoid infestations when cutting and making hay. Source mulch hay that is weed-free.

Reduce established infestations

Where large infestations of *Pennisetum* species occur in native vegetation a planned, strategic approach is essential to ensure that the weed is replaced by





Elephant grass (*Pennisetum purpureum*) has rhizomes and can form very tall, large clumps.
Photo: S. Navie

desirable plant cover rather than weed seedlings and regrowth of the target species or other weeds. As well as the information presented in this guide on the biology and control of *Pennisetum* species, the plan needs to be based on specific knowledge about the site—including the distribution of other major weeds.

Develop and implement a **long-term** weed management plan.

1. Investigate the site

- **Identify all plant species:** especially weeds that could occupy the site after control has been implemented and native plants that need to be protected during treatments. Determine which *Pennisetum* species are present and whether they mainly spread by seed or rhizomes.
- **Map weed infestations:** indicate weed density throughout the site, identify major sources of seed.
- **Map native vegetation condition:** assess its capacity for recovery after the target weeds are removed and identify sites of high biodiversity value, such as rare flora.

- **Values and risks:** identify native fauna habitat values and high-risk sites for erosion potential and other factors.

2. Develop the site action plan

- Identify goals and priorities based on the site information.
- Define priority areas for control by overlaying maps of weed density, native vegetation, site values and risks.
- Plan to weed strategically:
 - protect the better quality native vegetation first and consider the needs of native fauna and flora
 - work from isolated pennisetum plants towards core infestations
 - control plants from upstream to downstream.
- The size of the area targeted at each stage should be manageable enough to follow up thoroughly. Weed control that is not followed up is wasteful and can cause a bigger problem.
- Include control of other weeds so that they do not establish where the target weed has been removed. Prepare a monitoring plan.

- Select the most suitable control method for each growth stage to avoid damage to native vegetation. Plan appropriate disposal of weed material in accordance with legislation.
- Prepare a weed management calendar to maximise the effectiveness of control activities. Plan herbicide treatment before seeding.

3. Implement the action plan

- Remove pennisetum plants from the least infested areas into the more infested areas. Ensure that activities do not spread the seed or disturb native ground cover. Avoid physical removal while the weed is seeding. Adapt to local seasonal conditions.
- Follow up weed regrowth each year in areas previously treated before moving to new areas of infestation.
- Coordinate control programs with neighbouring landholders to maximise effectiveness and reduce ongoing spread.

4. Monitor and evaluate outcomes and adapt the plan accordingly

Include monitoring of native plant regeneration to determine its response to weed control. In weed management programs there is often a tendency to focus on the removal of weeds as a goal, but at the site level the ultimate goal is restoration of native vegetation or productive pastures for grazing properties.

Control methods

Mature perennial grass tussocks are difficult to destroy because they can be very large and can regrow from the roots (and rhizomes, if present) if the tops are cut or burnt. In selecting the most suitable control techniques it is essential to minimise adverse impacts on native vegetation and to encourage its subsequent recovery. Different methods may be appropriate for sparse plants amongst native vegetation,



Fountain grass (*Pennisetum setaceum*) flowerheads are purple becoming straw coloured.
Photo: S. Navie

compared with areas where weeds are dominant. Where weedy *Pennisetum* species infest a pasture, consult local weed control authorities for more detailed advice. No biological control agents have been identified for *Pennisetum* species.

Physical weed removal

Seedlings, small plants and small infestations can be dug out (grubbed),

making sure that all the roots are removed. This is more feasible for species that do not form rhizomes. Follow up control is essential as regrowth may occur. In the case of deenanth grass, it is essential to remove plants before seeds mature. For perennial species this should be undertaken whenever possible. Most mission grass seed germinates at the start of the wet season and it is much



Fountain grass (*Pennisetum setaceum*) bristles are feathery towards the base.
Photo: S. Navie

more effective to undertake control before seeding.

Chemical control

Herbicide can be effective in controlling *Pennisetum* species, providing it is carefully chosen and selectively applied to minimise regrowth and off-target damage. The range of herbicide treatments available is limited and the plants must be actively growing at the time of application.

Foliar spray

Feathergrasses and mission grasses can be sprayed with herbicide. To be effective, spraying should be undertaken when the growth rate is high, and the herbicide applied to as much green foliage as possible. In native vegetation, spot spray using hand-held equipment (handgun and hose or knapsack) minimises off-target damage. Species such as mission grass grow to several metres tall, which makes them difficult to spot spray. Spray mission grasses before seeding or at early head stage. It is essential to follow up by targeting regrowth and seedlings when actively growing.

Combined treatment of extensive infestations

Dry foliage may shield green leaves from herbicide spray and seasonal variations may reduce the effectiveness of treatment. For feathergrasses, initial slashing of old foliage followed by spraying fresh growth after sufficient rainfall can improve results. Slashing may be impractical for an extensive infestation unless it can be treated in stages. Spraying and burning may be combined to control extensive stands of mission grass in northern Australia, however *Pennisetum* species would be promoted by repeated burning. Follow up all treatment with further spraying or grubbing of surviving plants and seedlings when actively growing.





Deenanath grass (*Pennisetum pedicellatum*) infestation: Top End, NT.
Photo: C. Wilson

Registered herbicides for *Pennisetum* species

Most *Pennisetum* species are not listed on registered herbicide labels, but grass-specific herbicides containing flupropanate are registered for spot spraying African feathergrass in Tas. and WA. The active constituent has some residual herbicide action in the soil that could have an impact on surrounding vegetation and subsequent regeneration. Glyphosate is a registered herbicide for grasses generally, but the timing and details of application must be adapted to the species and the situation.

When using herbicides always read the label and follow instructions carefully. At least one member of a group should have formal training in the safe storage, handling, preparation and use of the herbicide. Particular care should be taken near waterways because rainfall runoff can carry herbicides into waterways and wetlands. Check with local authorities on the width of buffer

zone required around water bodies. Use special formulations for such environments where appropriate.

Permits

A 'Permit to allow minor use of an AGVET chemical product' may be issued to allow registered products to be used for a purpose or in a manner that is not included on the approved label. Permits that include spot treatment of environmental weeds (perennial grasses) with glyphosate in some situations exist in Tas., WA, Qld, SA, NSW and the ACT. A permit also exists for glyphosate application to perennial tussock grasses on roadsides via rope wick applicator after prior slashing. Refer to the Australian Pesticides and Veterinary Medicines Authority website to find the relevant permit for your state or territory and obtain advice on local conditions from the permit holder. Also consult community groups working on weed grasses in your region. Refer to the fact sheet 'Off label chemical use in Victoria'

for sources of advice in that state. Under the Northern Territory *Agricultural and Veterinary Chemicals (Control of Use) Act 2004*, a person does not contravene the legislation if the person uses a registered agricultural chemical product to control a pest not specified in the instructions unless the instructions on the approved label prohibit use in that way.

Glyphosate is a non-residual, systemic chemical and is non-selective, affecting both broad-leaved plants and grasses. Care is needed to prevent contact with off-target species. Where legally permitted, it can be applied to individual weed plants in native vegetation by community groups, landholders and public land managers. Penetrant is sometimes added to increase the effectiveness of the herbicide, but involves greater risk of off-target damage and its suitability is limited in sensitive situations such as riparian zones and native vegetation. Refer to product labels.

Mission grass invasion and restoration of tropical savanna woodlands

The current extent of mission grass (*Pennisetum polystachion*) in northern Australia is relatively limited compared to its potential distribution across the savanna region, but it is considered a major threat due to its impact on ecosystem structure and function. There is an urgent need to understand the degradation process and develop restoration strategies. PhD student Kris Brooks has been funded* to research the impact of mission and gamba grass (*Andropogon gayanus*) invasion and its management, on the restoration potential of savanna woodlands in the Darwin region.

Savanna woodland with understorey dominated by mission grass was compared with uninvaded understorey sites (Brooks et al in press). Invasion by mission grass was associated with a decrease in understorey species richness and a change in species composition and community structure. In particular, perennial and annual grass and forb abundance was substantially reduced. Although such above-ground changes were detected at the invaded sites, the native soil seedbank was relatively intact, indicating that there

is potential for self-driven, or autogenic recovery following mission grass control.

The effect of exotic grass management on the native plant community is another area of research (Brooks et al in prep.). Fire and the non-selective herbicide glyphosate are widely used to manage mission grass, with burning predominantly taking place in the early dry season, and herbicide application occurring throughout the wet season.

Two management methods were compared in this research:

1. glyphosate application in the late wet season (late March) just prior to flowering, followed by an early dry season burn
2. an early dry season burn (in line with common practice) to reduce biomass, and glyphosate application early in the following wet season (early January).

The results indicated that both treatments reduced the abundance of native perennial species. However the first method resulted in less bare soil being exposed to the damaging impact of wet season rains and it allowed for replenishment of the soil seedbank, which is dominated by native annual

species. It also enhanced germination in the season following control and aided in the retention of nitrate in the system. Thus, autogenic recovery is initiated and a transition from exotic grass-invaded savanna woodland to native grass savanna woodland can occur. In contrast, the second treatment interrupted flowering and therefore reduced seeding of annual species and exposed soil to rain impact for the remainder of the wet season. In the two seasons following control there was substantially reduced establishment of the herbaceous layer, increased area of bare ground and increased potential for nitrate to leach from the system. Though the long-term outcome is not known, the study indicated that inappropriate management of mission grass-invaded savanna woodland may push the system in an unintended direction and highlights the importance of incorporating restoration outcomes into weed management programs.

References for this study can be found under Brooks in the 'References and further information' section.

* funding by Land and Water Australia's Defeating the Weeds Menace Programme, Charles Darwin University and the Tropical Savannas CRC.



Experimental plots in April 2007, two wet seasons after treatment illustrating from left to right: a) a non-invaded species-rich native plant understorey; b) the dense establishment of the native annual grass (*Pseudopogonatherum irritans*) in plots sprayed in the late wet season (note unsprayed perennial mission grass (*Pennisetum polystachion*) flowering in the background); and c) the sparse establishment of annual cover in plots sprayed in the early wet season. Photos: Kris Brooks

Contacts

State / Territory	Department	Phone	Email	Website
ACT	Dept of Territory and Municipal Services	132281	N/A	www.tams.act.gov.au/live/environment/
NSW	Dept of Primary Industries	1800 680 244 131555	weeds@dpi.nsw.gov.au	www.dpi.nsw.gov.au/weeds
NT	Dept of Natural Resources, Environment and the Arts	(08) 8999 4567	weedinfo.nreta@nt.gov.au	www.nt.gov.au/nreta/natres/weeds/index.html
Qld	Dept of Primary Industries and Fisheries	132523	callweb@dpi.qld.gov.au	www.dpi.qld.gov.au/
SA	Dept of Water, Land and Biodiversity Conservation	(08) 8303 9620	N/A	www.dwlbc.sa.gov.au
Tas.	Dept of Primary Industries and Water	1300 368 550	weedsenquiries@dpiw.tas.gov.au	www.dpiw.tas.gov.au/
Vic.	Dept of Primary Industries Dept of Sustainability and Environment	136186	customer.service@dpi.vic.gov.au customer.service@dse.vic.gov.au	www.dpi.vic.gov.au www.dse.vic.gov.au
WA	Dept of Agriculture and Food	(08) 9368 3333	enquiries@agric.wa.gov.au	www.agric.wa.gov.au
Australia-wide	Australian Pesticides and Veterinary Medicines Authority (APVMA)	(02) 6210 4700	N/A	www.apvma.gov.au

Contact details for state and territory agencies with responsibility for weeds are listed above, along with the APVMA. The APVMA website hosts the PUBCRIS database which contains information on all herbicides that are registered for use on weeds in each Australian state and territory, including minor use permits.

Consult the natural resource management organisation for your region or local council to find contacts on managing weeds for biodiversity, including community groups working on *Pennisetum* species.

Refer to the CRC for Australian Weed Management website (www.weedsrc.org.au) for weed management guides in this series, as well as guides for Weeds of National Significance and Alert List species. The Introductory Weed Management Manual (also available from this website) may assist in developing a plan tailored to your situation.

Legislation

Declared plants are prohibited from sale and accidental or deliberate movement. Control by landholders may be required to reduce weed impacts and minimise spread into uninfested areas. Requirements for *Pennisetum* species vary from state to state and by species and some declarations are at the regional level:

- fountain grass (*P. setaceum*) is a declared plant in NSW and Qld at the state level
- African feathergrass (*P. macrourum*) is a declared plant in NSW, SA, Tas., and some regions in Vic.
- feathertop (*P. villosum*) is a declared plant in 15 local government areas of NSW and in Tas.
- mission grass (*P. polystachion*) is declared in the NT and prohibited entry to WA.

See the contacts table for sources of current information relevant to your location. Weed control that could significantly damage native vegetation may be regulated by legislation.

Acknowledgments

Information and guide revision: Dr S.A. Setterfield, Charles Darwin University; Dr J.G. Virtue, SA DWLBC; M. Baker, Tasmanian Herbarium; D. Butler, Qld EPA; I. Miller and A. Cameron, NT DRDPFR.

Map: Australia's Virtual Herbarium, (*P. setaceum* and *P. polystachion*), via Royal Botanic Gardens Melbourne, Council of Heads of Australian Herbaria.
www.rbg.vic.gov.au/cgi-bin/avhpublic/avh.cgi.

Case study: Kristine Brooks, Charles Darwin University.

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Feathertop (*Pennisetum villosum*) burrs have long bristles that are feathery towards the base.
Photo: S. Navie

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African feathergrass (*Pennisetum macrourum*) infestation.
Photo: J. Virtue, SA DWLBC

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Knowledge gaps

Most *Pennisetum* species have received relatively little attention in weed research in Australia and their ecology and impacts are not well documented. A lack of such information limits the accuracy of weed risk assessment for particular species and regions. Effective techniques for broad-scale management of introduced grasses to conserve native ecosystems are needed, especially in northern Australia.

Strategic management of pennisetums

Quick reference guide

Regional / local status of pennisetums	Not yet established	Small, isolated outbreaks	Widely established
Management goals	Prevent establishment	Eradicate	Contain infestations and mitigate threats
Strategies required	<p>Practise weed hygiene</p> <p>Raise community awareness and capacity to recognise the weeds and the problem</p> <p>Monitor, detect and identify possible new infestations</p>	<p>Do not allow young stands to seed</p> <p>Treat manually or use herbicide with minimal disturbance</p> <p>Follow up</p> <p>Prevent re-establishment or invasion by other weeds and encourage natural regeneration of native vegetation</p>	<p>Native vegetation: Identify high priority biodiversity assets under threat from <i>Pennisetum</i> species</p> <p>Protect these assets through implementing long-term site management plans</p> <p>Public and private gardens: Replace any known weedy species</p> <p>Monitor specimens of other species and remove if seedlings found</p> <p>Roadsides and other corridors: Map infestations and practise weed hygiene to prevent spread along and from roadsides into native vegetation</p> <p>Pastures: Control declared species and encourage non-weedy competitive grasses</p>

Vegetation management or weed control?

Adopt a strategic, integrated, long-term approach to maximise restoration of native vegetation or pasture and minimise reinvasion by weeds.

Natural regeneration of native plants is the best form of revegetation, but in sites dominated by pennisetums over many years, there may be no native plants or seed remaining. Where this is the case, establish a range of locally collected indigenous plants, including native grasses.

Adapt the control method to the species and the situation

Pennisetum species occur in a wide range of environmental conditions and land uses. Rhizomatous species are

particularly difficult to remove by physical methods. Where appropriate, old growth may be removed by slashing or burning and regrowth treated with herbicide. Care is needed to avoid off-target damage in native vegetation and contamination near watercourses.

Apply herbicides during periods of active growth

Herbicide should only be applied when plants are leafy and actively growing, preferably before the flower heads mature. Avoid hot or wet conditions, or periods when plants are under stress, as specified on the herbicide labels.

Consider disposal options

If seed heads or rhizomes are left on the site they may regrow. Destroy them on site.

Follow up

It is essential to monitor for regrowth from root crowns and rhizomes after physical or chemical treatment and follow up thoroughly.

Prevent weed re-establishment

Once mature plants have been killed, the focus is on preventing re-establishment from seeds.

- Avoid large-scale disturbance that would create extensive areas of bare soil, such as too-frequent fire in native vegetation or overgrazing in pasture.
- Identify likely weed seed or rhizome sources, dispersal agents and patterns of invasion.
- Monitor weed-free areas every year to detect and remove seedlings and resprouts before they seed.

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