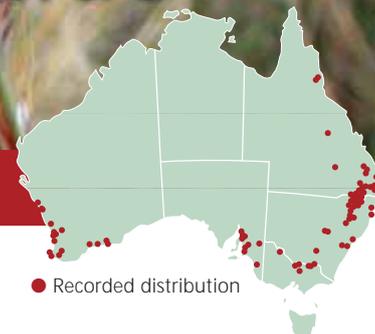


Weed Management Guide

Managing weeds for biodiversity



Coolatai grass (*Hyparrhenia hirta*)

The problem

Coolatai grass is a tall, bulky, introduced grass invading grassy woodlands and grasslands that represent some of southern Australia's rarest native plant communities, including the white box—yellow box—Blakely's red gum grassy woodlands and derived native grasslands. This community is listed nationally as a Critically Endangered Ecological Community under the *Environment Protection and Biodiversity Conservation Act 1999*. Coolatai grass forms densely tufted tussocks that can become the dominant ground cover, reducing native plant diversity and affecting native fauna populations. It also dominates extensive areas of pasture. It is becoming conspicuous

along roadsides in agricultural regions and is of concern to fire authorities due to the abundance and flammability of its dry leaves and stalks.

Coolatai grass was introduced for pasture and is very persistent under grazing, but not generally preferred as feed for livestock. Once established, it is very difficult to control and requires a sustained control program, integrating various methods. It is rapidly becoming more widespread.

Coolatai grass is just one of many perennial grass weeds invading Australia's native vegetation, particularly grassy plant communities, rangelands and coastal areas. Invasive grasses displace native plants and can also contribute to changed fire regimes

that affect native vegetation structure and biodiversity. They include needle-grasses (*Nassella* spp.), feather-grasses (*Pennisetum* spp.), veldt grasses (*Ehrharta* spp.), buffel grass (*Cenchrus ciliaris*), wheat-grasses (*Thinopyrum* spp.), Rhodes grass (*Chloris gayana*) and African lovegrass (*Eragrostis curvula*). Several of these are also sown as pastures. Non-native grass weeds, such as gamba grass (*Andropogon gayanus*), are a particular threat to tropical savannas in northern Australia.

Key points

- Remnant grassy box woodlands in southern Australia are threatened by Coolatai grass.
- Coolatai grass spreads by seed and is commonly dispersed by mowing and water movement.
- It rapidly regrows after it is burnt, grazed or slashed, with maximum growth rates in warm to hot conditions.
- Stock will graze fresh leaf growth but avoid older growth, assisting Coolatai grass to become dominant in pastures.
- Accurate identification of grasses is essential before control.
- Small infestations can be grubbed.
- A single dose of herbicide may not kill mature Coolatai grass tussocks, but combining physical and chemical treatment can be effective. Correct timing is essential.
- Coolatai grass could become established in new regions unless preventive measures are applied.
- In regions where Coolatai grass is widespread, sites of high biodiversity value should be a priority for control measures.



Coolatai grass can replace diverse native understorey in grassy box woodlands: Travelling Stock Reserve, Manilla, NSW.

Photo: V. Chejara

The weed

Grasses in the genus *Hyparrhenia* are often known as thatching grass because in Africa the tough dry stalks are commonly used for roof thatch. In Australia, *H. hirta* is generally known as Coolatai grass, after a property in northern NSW where it was introduced in the 1890s. Sometimes (especially in WA) it is known as Tambookie grass, but this is the name of the related grass *H. filipendula*, native to coastal Queensland and NSW.

Coolatai grass is a perennial tussock grass, up to 1.5 m tall, that spreads by seed. Its main growth period is in late spring to summer, but where winters are not severe it can remain green all

year. It is deep-rooted (up to 3 m) and drought-resistant. It readily resprouts from its tough basal crown after defoliation or seasonal dormancy and can respond rapidly to summer rainfall.

Leaves are pale greyish-green, hairless or nearly so; older leaves are rough to the touch. The leaf blade is flat, 1–5 mm wide, with a prominent mid-vein and a long membranous ligule at its base where it adjoins the sheath. The inflorescence is long and much branched; each branch ends in a pair of racemes made up of grey-white, hairy flowers along a stalk. At the base of each branch is a floral leaf that may turn reddish in colour. Five to eight pairs of spikelets are closely packed along each raceme; one in each pair

has an awn. The tiny (approximately 2 mm long) grain is dispersed inside an awned, hairy husk.

Weed identification and similar species

Related species

In addition to Coolatai grass, one native and one introduced species of *Hyparrhenia* occur in the wild in Australia. Tambookie grass (*H. filipendula*) is the native species. Jaragua grass (*H. rufa*) is a tropical pasture species introduced from Africa. Coolatai grass is the only one that currently occurs in southern Australia.

How to identify *Hyparrhenia* species in Australia

	Tambookie grass (<i>H. filipendula</i>)	Coolatai grass (<i>H. hirta</i>)	Jaragua grass (<i>H. rufa</i>) (2 subspecies)
STATUS	NATIVE	WEED	WEED (tropical)
Plant habit	Tufted grass to 1.5 m tall	Dense tussocks to 1.5 m tall	Tussocks to 2 m tall; annual or perennial
Flower racemes	In pairs, 15–25 mm long, upper raceme on a thin stalk, 7–8 mm long	In pairs, 15–50 mm long	In pairs, 20–50 mm long
Spikelets / racemes	Smooth or hairy	White hairs	Rust-coloured hairs
No. of awns per raceme	1–3	5–7, rarely 8	9 or 10
Awn	40–50 mm long	15–25 mm long	16–22 mm long
Current distribution in Australia	NSW, Qld	ACT, NSW, Qld, SA, Vic., WA	NT, NSW, Qld

Note: illustrations on page 3



Coolatai grass (*Hyparrhenia hirta*): NSW.
Photo: V. Chejara



Jaragua grass (*Hyparrhenia rufa*): Hawaii.
Photo: Forest and Kim Starr

Distinguishing between native and Coolatai grasses

A range of tall, native perennial grasses occur in habitats invaded by Coolatai grass.

A combination of key features distinguish the weed from these species:

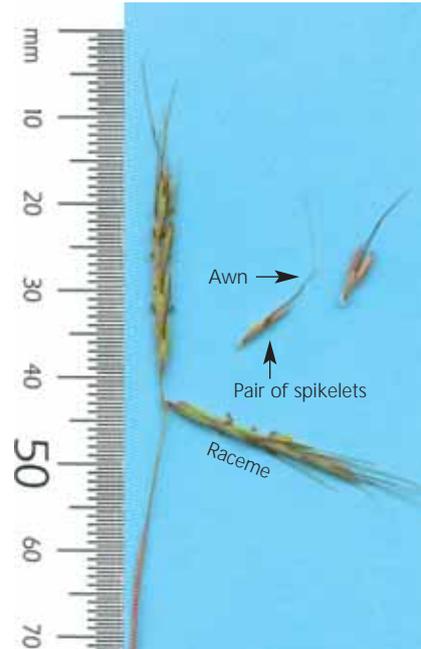
- it has floral leaves at branching points of flowering stems
- the paired, grey—white, hairy flower racemes form a 'V' at the end of the branches, each raceme has 5–7 brown awns
- leaves are flat or folded with a prominent midrib, **not aromatic**
- the ligule at the leaf—stem junction is a membrane, 2–4 mm long.

It is often difficult to distinguish different species of grasses when not in flower, especially as seedlings and it is useful to preserve an identified, dried specimen of the weed grass, which can serve as a reference for comparison with local native grass species in the field. As well as the fertile parts, include young and mature leaves, showing the leaf sheath, leaf blade and the ligule where they join, the base of stems and stem nodes.

Mount the sample on card with a plastic protective covering.



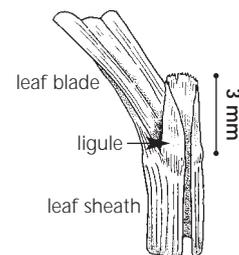
Coolatai grass flower racemes form a 'V' at the ends of the branches.
Photo: S. Warner



Racemes are approximately 1.5–5 cm long with 5–7 awned spikelets.
Photo: Andrew Storrie



The ligule is at the base of the leaf blade.
Photo: Jackie Miles and Max Campbell



Coolatai grass leaves have a membranous ligule, 2–4 mm long.
Drawing: Andrew Craigie

Summer-active native grasses that may be confused with Coolatai grass



Barbed wire grass (*Cymbopogon refractus*) and other lemon-scented grasses (*Cymbopogon* spp.) have linear, paired (or sometimes three) racemes and floral leaves, but the leaves smell like lemon when crushed.

Photo: Jackie Miles and Max Campbell



Kangaroo grass (*Themeda triandra*) seedlings may look similar to Coolatai grass. Ligule is a membrane, up to 1 mm long. Inflorescence has floral leaves but is otherwise distinctive—flower heads are triangular in shape, rust-coloured when mature and not hairy.

Photo: Jackie Miles and Max Campbell



Red-leg grass (*Bothriochloa macra*) is widespread in eastern Australia. It may look similar to Coolatai grass when young. Stems are reddish and flower heads have more than two racemes.

Photo: Jackie Miles and Max Campbell

Other native grasses with finger-like racemes (generally more than 2) occur in the genera *Eulalia*, *Dichanthium* and *Chloris*. Note: *Chloris* also includes some introduced species.



Coolatai grass often spreads along roadsides: Bingara to Narrabri Rd, NSW.
Photo: Les Tanner

How it spreads

Coolatai grass spreads by means of tiny seeds with hairy, awned husks that adhere to clothing, animals, vehicles and tools, especially when wet. Human activities such as slashing or traffic assist in spreading the weed, especially along roadsides. It spreads along drainage lines, indicating that water can also transport the seeds. In pastures and stock routes livestock can spread seeds.

Coolatai grass is self-fertile, enabling new populations to arise from a single plant. Large populations can produce sufficient seed to spread rapidly, in spite of the apparently low proportion of florets that set viable seed. Seed can germinate readily in different light regimes, over a wide range of temperatures, pH levels and under marginal water stress. Seedlings can emerge from a depth of up to 9 cm. Seedling recruitment can occur within established stands and in soil with a plant litter layer.

Where it grows

The original range of Coolatai grass is extensive, including Mediterranean Europe, southern and northern Africa and into west Asia. It includes areas

receiving low to relatively high rainfall, with maxima in summer or winter. In southern Africa, Coolatai grass occurs in undisturbed ecosystems and is widespread in native pastures, but also colonises degraded grasslands. It is naturalised in America but is not currently reported as a significant weed there.

Coolatai grass was introduced into Australia as a potential pasture plant. Before its negative aspects had become apparent it had escaped cultivation and become naturalised, firstly in Qld or northern NSW. It now also grows wild in a range of climatic conditions in WA, SA, Vic. and the ACT. Introduced for light soils, it has been recorded on a wide range of soil types including hard rocky soils and deep sands.

Potential distribution

Coolatai grass is spreading in the agricultural and near-urban regions of WA and SA, near the Murray River in Vic., and in NSW and Qld. Without effective detection, prevention and containment programs, it has the potential to become more abundant within its current range and to spread into new areas. Like most other grass weeds, it tends to become dominant

in open habitats such as woodlands and grasslands, not in closed forests or dense shrub understorey.

In Australia, most large populations currently occur in areas with annual average rainfall of 400–800 mm, but the species occurs in arid regions elsewhere. *H. hirta* forms adapted to low rainfall may already be present in Australia as 'sleeper populations', be stored in Australia's germplasm collections (in SA and Qld) or be introduced in the future.

Growth cycle

Coolatai grass mainly grows and flowers during late spring to autumn, depending on adequate moisture being available. It grows rapidly after summer rains and if the winter is relatively mild the plant may be green all year. With low temperatures the leaves may dry off, but generally the plant survives and will regrow from the base. Plants may produce seed in their first growth season. Seed is produced over an extended period and shed as it matures. The fast germinating character of Coolatai grass in relatively warm conditions provides a competitive advantage in rapidly capturing soil moisture from summer rainfall, especially in sandy soils.

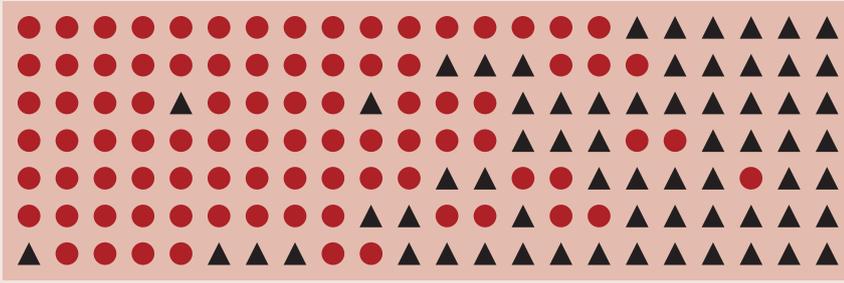


Coolatai grass may remain green and flower during mild wet winters. Flowering tussock, 0.9 m tall: Mount Lofty Ranges, SA.
Photo: S. Warner

Strategic weeding in native vegetation

● Native vegetation

▲ Weeds



→ Weed from the least weed infested bush towards weed-dominated areas

What to do about it

There are many locations where Coolatai grass has not yet become established although conditions may be suitable. Through coordinated and consistent action, its spread can be prevented. In those regions where the weed is already widespread, total eradication is not a realistic goal. However, at the local scale a long-term management program can help to contain it, reduce its harmful effects and encourage native vegetation to recover. In parts of NSW and Qld, pastures require intensive management to graze young Coolatai grass leaf growth and minimise the accumulation of unpalatable mature growth including seed heads.

Prevent Coolatai grass spreading

- Learn to recognise Coolatai grass and report new populations to your local council or natural resource management authority if you find it. Accurate weed identification is essential—in some cases, the grass was initially thought to be native when first detected.
- Ensure that Coolatai grass is not planted. More suitable, non-weedy species are available for pasture, landscaping and soil stabilisation.
- Remove small, isolated infestations before they seed.

- Contain existing infestations—monitor areas to which the weed may spread. Particular vigilance is needed along dispersal routes such as roadsides and drainage lines.
- Practise weed hygiene in areas that need to be slashed such as roadsides:
 - where possible, slash before seeds develop
 - slash into rather than away from patches of Coolatai grass
 - always clean vehicles and clothing before moving to uninfested areas.

Reduce established infestations

Where large infestations of Coolatai grass occur in native vegetation a planned, strategic approach is essential to ensure that after treatment, it is replaced by plant cover other than new Coolatai grass seedlings, regrowth or other weeds. Sites of high biodiversity value should be identified and targeted first. As well as the information presented in this guide on Coolatai grass biology and control methods, a 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:** weeds and native plants, including grasses.

- **Map Coolatai grass infestations:** indicate weed density throughout the site, identify sections where the weed is just beginning to invade, the main dispersal agents and pathways.
- **Map native vegetation condition:** assess its capacity for recovery after Coolatai grass is removed.
- **Identify sites of high biodiversity value:** such as rare flora or fauna habitat or threatened plant communities.
- **Define buffer zones around waterways.**

2. Develop the site action plan

- Identify goals and priorities based on the site information.
- Define priority areas for control, by overlaying maps of Coolatai grass density, native vegetation, site values and risks.
- Plan to weed strategically:
 - work from isolated Coolatai grass plants towards core infestations
 - protect the healthier native vegetation and habitats of rare fauna and flora first
 - work down the slope so that seeds are not being washed down into previously weeded areas.
- Work in stages. The size of the area targeted at each stage should be manageable enough to follow up thoroughly.
- Include control of other weeds so that they do not establish where Coolatai grass has been removed. Plan your monitoring and restoration before you begin to weed.
- Select the most suitable control method in each area, to avoid damage to native vegetation and waterways. Plan appropriate disposal of weed material.
- Prepare a weed management calendar to maximise the effectiveness of control activities and protect native species.



3. Implement the action plan

- Remove Coolatai grass from the least infested and high biodiversity value areas first. Ensure that activities do not spread weed seeds or disturb ground cover. Adapt to local seasonal conditions so that herbicide is applied when Coolatai grass is actively growing.
- Each year, follow-up weed regrowth 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. 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. Recovery of local native grasses and other species may require active restoration following removal of Coolatai grass. The rate of recovery sets the pace of weeding.

Manage pastures containing Coolatai grass

For further detail, refer to the guideline on *Management for Coolatai grass on the North West Slopes of NSW* (McCormick et al 2002).

The grazing value of pastures dominated by Coolatai grass is maximised if plants are kept in the vegetative, actively growing phase as long as possible, through intensive grazing in early summer. In some situations, fertiliser and legumes have been added to maintain productivity. It is important to ensure that more palatable pasture species are not disadvantaged and to avoid extensive areas of bare soil that

would favour Coolatai grass and other weeds. This is more practical if paddocks are small and stock can be removed when they have consumed the green feed. The use of supplements also allows continued grazing to reduce the bulk of low quality material. Burning of pastures before the growing season may remove dry matter and temporarily encourage fresh Coolatai grass leaf growth, but such management will not reduce its dominance without other control measures. Herbicide treatment of small patchy infestations in pastures may assist in reducing their rate of spread.

Control methods

Mature Coolatai grass tussocks are difficult to destroy because old, dry growth can shield growing leaves from contact with herbicide and a single application may not be sufficient to kill the plant. Small infestations can be removed manually, while a combination of physical and chemical treatment can be successful for extensive infestations. Spot spraying or grubbing enables tussocks to be treated individually, minimising risk of damage to other species. No biological control methods are available for Coolatai grass.



Old, dry stalks and leaves of Coolatai grass are persistent and prevent efficient herbicide application to actively growing leaves: Mount Lofty Ranges, SA.
Photo: S. Warner

Physical removal of small or sparse infestations

While it is labour intensive, physical removal has the advantage that each plant can be grubbed in one visit. Remove the weeds before seeding if possible. Bag flower heads and then grub all individual plants with a mattock, removing the base of the tussock with minimal disturbance to soil and native plants. Contain whole plants in bags and dispose of them safely. Follow up to check for regrowth and for seedlings.

Combined treatment of extensive infestations

Herbicide treatment is only effective if applied when the weed is actively growing. Efficient application of herbicide to mature Coolatai grass is difficult unless accumulated dry leaf material is removed first (by slashing or burning). In some situations, where permitted, it may be practical to burn rather than slash old growth prior to herbicide treatment. Deciding if and when to burn requires careful consideration of a range of issues and consultation with fire authorities. Stands of Coolatai grass should only be burnt as a component of a comprehensive vegetation management plan. Burning may stimulate germination of native or weed species so these would need to be managed when targeting regrowth of Coolatai grass.



Infestations can be grubbed when they are small: Cobbler Creek Recreation Park, SA.
Photo: S. Warner

Registered herbicides for Coolatai grass

Current herbicide label registration for Coolatai grass is limited in application to small patchy infestations in perennial pastures, only in NSW. The active constituent (flupropanate) has some residual herbicide action in the soil that would have an impact on associated vegetation and subsequent regeneration.

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 may include use of glyphosate as a spot spray by trained community groups, landowners and conservation managers for treatment of Coolatai grass in native vegetation, perennial pastures and other non-crop situations. 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 (see table below). Also consult community groups working on Coolatai grass in your region. Glyphosate is non-selective and care is needed to prevent contact with off-target species.

The following treatment has been developed for Coolatai grass:

1. Mow / slash or burn in spring at start of growing season, before flowering. Contain or destroy the slashings if they contain seeds.
2. Wait for regrowth (4–6 weeks).
3. Check for native plants in the vicinity of the tussocks and protect them from spray.
4. Spot spray glyphosate diluted in water plus surfactant*.
5. Wait for regrowth and check for native plants.

6. Repeat spot spray with glyphosate mixture.

7. Follow up after the next significant rainfall—grub survivors and seedlings, or repeat the treatment cycle when the weeds are actively growing.

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 that is being used. Particular care should be taken when using herbicides near waterways because rainfall runoff can carry herbicides. Check with local authorities on the width of buffer zone required around water bodies.

*Use appropriate glyphosate formulations near waterways and follow label advice on surfactants.

Contacts

State / Territory	Department	Phone	Email	Website
ACT	Dept of Territory and Municipal Services	(02) 6207 5111 or 132281	N/A	www.tams.act.gov.au/live/environment
NSW	Dept of Primary Industries Dept of Environment and Climate Change	1800 680 244 or 131555	weeds@dpi.nsw.gov.au info@environment.nsw.gov.au	www.dpi.nsw.gov.au/weeds www.environment.nsw.gov.au/pestsweeds/aboutweeds.htm
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
Vic.	Dept of Primary Industries	136186	customer.service@dpi.vic.gov.au	www.dpi.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. Note: Coolatai grass is not naturalised in NT or Tas. 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. Refer to the fact sheet *Off label chemical use in Victoria* (AG1214) at www.dpi.vic.gov.au for sources of advice in that state.

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

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.



Mature Coolatai grass growth is of low palatability; paddock between Warialda and Coolatai, NSW.
Photo: Andrew Storrie

Legislation

Invasion of native plant communities by exotic perennial grasses has been listed as a key threatening process under the NSW *Threatened Species Conservation Act 1995*. In fact, Coolatai grass is a species of special concern. In some local government areas in NSW, Coolatai grass is declared a Class 3 weed and the plant must be fully and continuously suppressed and destroyed.

Coolatai grass is a declared Class 2 plant in SA, requiring notification and control in specified parts of the state. Trade and movement are restricted throughout the state.

The AQIS Permitted Seeds List includes species of *Hyparrhenia* including *H. hirta*. Several other species of *Hyparrhenia*, not yet in Australia are not on the permitted list.

Knowledge gaps

Coolatai grass seed was imported to Australia on a number of occasions from various parts of the world but it is not known how many (or even which) of these introductions became established. There are thought to be numerous different forms of the grass in its native range and investigation is needed into which forms are present in Australia that could become future weed problems. Research is also needed into methods for controlling Coolatai grass, for site recovery post-



Coolatai grass on travelling stock reserve (foreground) and in paddocks (background): NSW.
Photo: V. Chejara

control and for managing pastures sustainably to utilise Coolatai grass while maintaining other valued species and soil condition in the long term.

Acknowledgments

Information and review: C. Nadolny, NSW DECC; V. Chejara and P. Kristiansen, University of New England; L. McCormick and A. Storrie, NSW DPI; J. Virtue, SA DWLBC.

Case study: P. Spark.

Map: Australia's Virtual Herbarium, (*Hyparrhenia hirta*), via Royal Botanic Gardens Melbourne, Council of Heads of Australian Herbaria. www.rbg.vic.gov.au/cgi-bin/avhpublic/avh.cgi. (Outlier records of doubtful or non-current status omitted.)

Diagram of *Hyparrhenia hirta* ligule reproduced with permission from Robertson, M. (2006). *Stop Bushland Weeds*, 2nd edn. The Nature Conservation Society of SA Inc.

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Threatened grassy box woodlands: working at the invasion front

Native grassy woodlands and grasslands were formerly widespread in Australia's agricultural regions. As these vegetation communities contained useful pasture and timber and occurred on the more fertile land, most have been cleared or greatly modified. The few high quality examples that remain are generally small or narrow and are mainly found on travelling stock reserves, roadsides, cemetery reserves and in a few paddocks that have been lightly grazed. They provide habitat for a wide range of native flora and fauna species, many of which are rare. Most occur within rural landscapes, largely surrounded by crops or improved pastures and are vulnerable to a range of threats including invasion by non-native grasses.

In native woodlands, the natural diversity of plant species and forms, including grasses, broad-leaved herbs, mosses, lichens, shrubs and trees of various sizes create complex vegetation structure (vertical layers and horizontal patchiness) and habitat for a range of native fauna. If the vegetation becomes dominated by a few non-native species, this complexity with its natural openings and patches may be lost. Such an effect is apparent in areas that have become dominated by Coolatai grass.

Coolatai grass dominates large areas of pasture, roadsides, travelling stock routes and areas of remnant vegetation on the North Western Slopes of NSW, especially in the Manilla area north of Tamworth. Members of the Manilla Landcare Group noticed that there was some high quality remnant vegetation on the travelling stock reserves near Manilla, areas that would provide important habitat for woodland birds. These reserves have a history of intermittent grazing, and in many areas the vegetation retains much of its diversity and structure. However, in past decades Coolatai grass has been rapidly invading, replacing the native understorey.



Fewer native plant species were recorded in woodland densely infested with Coolatai grass: travelling stock reserve, Manilla, NSW.
Photo: V. Chejara

The landcare group implemented a management program to maintain and improve the condition of native vegetation in travelling stock reserves near Manilla, in cooperation with the Rural Lands Protection Board and with support from the Natural Heritage Trust. Their objective was to prevent small patches and isolated Coolatai grass plants from becoming thick stands, allowing native grasses and other native plants growing in adjoining areas of native vegetation to recolonise the treated areas. They tackled the Coolatai grass at the invasion front. Tussocks were spot sprayed with glyphosate when actively growing, in accordance with the relevant permit, and repeat spraying was conducted where needed. The group visited their sites up to four times per year to follow up regrowth and seedlings. One site is now being cared for by the Friends of Klori. Coolatai grass is common in pastures and on roadsides in the district and will continue to colonise surrounding

lands. Ongoing, intensive efforts will be needed to protect and restore threatened woodland habitats.

The impact of Coolatai grass on native flora and fauna has been studied in infested and non-infested native box woodlands on the travelling stock reserves near Manilla. Recent research at these sites indicated that areas dominated by Coolatai grass had lower diversity and abundance of native flora. Monitoring of native fauna at those sites indicated that in areas dominated by Coolatai grass, the abundance of ground active invertebrates was reduced. From early results, so too were the diversity and abundance of reptiles and frogs. Expert ornithologist Stephen Debus believes that Coolatai grass invasion will also lead to further decline of the ground-feeding vulnerable woodland birds Hooded Robin, Brown Treecreeper, Turquoise Parrot, Speckled Warbler and Diamond Firetail.

Strategic management of Coolatai grass

Quick reference guide

Regional / local status of Coolatai grass	Not yet established	Small, isolated outbreaks	Widely established
Management goals	Prevent establishment	Eradicate	Contain infestations and mitigate threats
Strategies required	Practise weed hygiene Monitor, detect and identify possible new infestations	Manual or herbicide treatment with follow up Prevent re-establishment or invasion by other weeds through passive or active site restoration	Native vegetation: Identify high priority biodiversity assets under threat from Coolatai grass and protect them through implementing long-term site management plans
			Pasture: Manage paddock by paddock to utilise pasture, minimise spread and promote competitive, non-weed species
			Roadsides: Map infestations and practise weed hygiene to prevent spread

Vegetation management or weed control?

A weed removal program can be judged successful if the weeds are ultimately replaced by vegetation that is valued. Adopt a strategic, integrated, long-term approach to restore native vegetation that is self-sustaining and minimise reinvasion by Coolatai grass or other weeds. Natural regeneration of native plants is the best form of restoration, but in sites dominated by weeds over many years, there may be no native plants or seed remaining. In such cases, revegetation will be needed.

Natural regeneration (passive restoration)

Where sparse Coolatai grass tussocks are removed and remnant native species are present, passive restoration may be possible. To assist the process, scatter locally collected native grass hay or seed. Recruitment of native grasses may be episodic and it may take years

of consistent management for native species to replace weeds.

Revegetation (active restoration)

Areas cleared of dense infestations may require active restoration of the plant community, including its original structure. For example, to restore grassy woodland an understorey dominated by native grasses may be the primary objective, but planting of local trees and shrubs at a variable, sparse to moderate density may also be needed. Consider whether the natives are summer or winter active and take into account local seasonal conditions. As with passive restoration, active restoration may take many years to achieve.

Prevent Coolatai grass re-establishment

1. Follow-up physical or chemical treatment after the next significant rainfall because some plants may have been missed and seedlings may regenerate from the seedbank.

2. Restore ground cover vegetation to areas from which Coolatai grass has been removed.

3. Avoid large-scale disturbance that would create extensive areas of bare soil, such as too-frequent fire in native vegetation or overgrazing in pasture.

4. Identify and manage major seed sources and dispersal pathways.

5. Monitor weed-free areas regularly to detect and remove young plants before they seed. Coolatai grass plants can seed in their first season of growth.



Hyparrhenia hirta may grow to more than 1.5 m tall. Dense stands create a fuel hazard and hinder restoration in a previously cultivated area: Cobbler Creek Recreation Park, SA. Photo S. Warner

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