Department of
Primary Industries and Regional Development

GOVERNMENT OF WESTERN AUSTRALIA

Environmental weed risk assessment

Buffel grass (*Cenchrus ciliaris*)

Family: Poaceae

Common name: Buffel grass

Cultivars include: American, also USA, Common (early maturing, medium height), Biloela (late maturing, tall); Bella (late maturing, medium); Gayndah (mid-season maturing, medium-short), West Australian (very early maturing, short)

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Species summary:

Buffel grass (*Cenchrus ciliaris*) is a perennial grass forming tufted tussocks to 1m which is native to large parts of Africa, Arabian Peninsula, western Asia, Middle East and the Indian sub-continent (Humphreys 1967). Seedheads form a dense, hairy cylindrical spike, with straw-coloured burrs or fascicles comprising 1-4 spikelets which are light and fluffy.

Buffel grass has limited cold tolerance and prefers high temperatures with rapid growth at 30°C/25°C day/night falling to slow growth below 15°C/10°C (Sweeney and Hopkinson 1975). Buffel grass is adapted to arid and semi-arid climates with a long dry season and annual rainfall (100–) 300–750 (–1,000) mm providing the winter rainfall is less than 400mm. It is very drought tolerant and responds quickly to light rains when temperatures are adequate for growth (Cook et al. 2020).

For many decades buffel grass has been widely sown for livestock production and land rehabilitation across large areas of northern Australia. Palatability is moderate but it is well regarded as pasture because it grows rapidly under warm, moist conditions and persists under heavy grazing and drought (Humphreys 1967). It has spread and is now widely naturalised across semi-arid and arid areas of northern Australia (Friedel et al. 2008). Buffel grass is widely regarded as a conflict or contentious species being both commercially valuable and also an environmental weed of native ecosystems (Grice et al. 2012). For example, buffel grass was extensively planted for dust control in central Australia (Centre for Arid Zone Research 2001)), but now also imposes economic costs through the need to manage fire risks and to protect biodiversity assets and infrastructure (Miller et al. 2010; Marshall et al. 2012).

Buffel grass was introduced into Western Australia (WA) by Afghan camel drivers in the late 1800's and has been actively planted as a pasture since 1910 (Friedel et al. 2008). The 'West Australian' ecotype which was introduced by the Afghan cameleers is widely naturalised and under dry conditions new plants behave as ephemeral annual grasses.

Western Australian Herbarium (1998–) reports its widespread presence in IBRA (Interim Biogeographical Regions of Australia) regions including Carnarvon, Central Kimberley, and Central Ranges, Dampierland, Gascoyne, Geraldton Sandplains, Gibson Desert, Great Sandy Desert, Little Sandy Desert, Murchison, Nullabor, Ord Victoria Plain, Pilbara, Swan Coastal Plain, Tanami, Victoria Bonapart and Yalgoo.

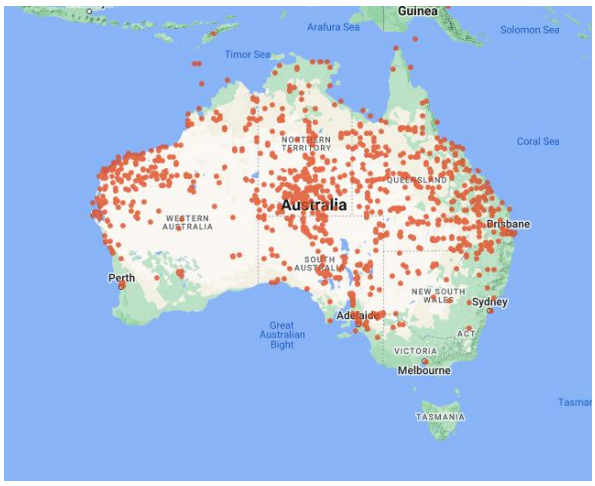


Figure 1. The distribution of buffel grass (*Cenchrus ciliaris*) in Australia from the Australasian Virtual Herbarium (https://avh.ala.org.au/)

Section 1: Invasiveness

1. Does the species have a documented environmental weed history?

a) Is an environmental weed in Australia

b) Is an environmental weed overseas

c) Species not known to be an environmental weed but there are environmental weed species in the genus

d) Genus has no known environmental weeds

Buffel grass is a contentious species as on one hand it is the most widely sown pasture grass across northern Australia (Humphreys 1967) and has been important in revegetating eroded and degraded landscapes (Hacker 1989), often with great success, e.g. 'Spectacular recovery in Ord River Catchment 2004' (Payne et al. 2004a). Initially these restored areas were dominated by the exotic grasses used in the re-vegetation process, however in the medium-term the native species are gradually re-colonising and displacing the exotic grasses. However, buffel grass is also recognised as one of Australia's most serious environmental weeds.

> "Though buffel grass (*Cenchrus ciliaris*) is an economically important pasture species, it is also one of the most environmentally serious weed species in central and northern Australia. Its dominance and resistance to fire, drought and heavy grazing on poor soils made it a suitable arid zone pasture grass, but these characters also make it a serious arid zone weed. It is regarded as an environmental weed in Queensland, the Northern Territory and northern Western Australia."
>
> "….In Western Australia it is regarded as one of the top ten environmental weeds in the Kimberley, Pilbara and Gascoyne regions, while in the Northern Territory it is actively managed by community groups and has invaded significant conservation areas. It is also listed as a priority environmental weed in at least six Natural Resource Management Regions in Australia" (Weeds of Australia).

Randall (2017) records that buffel grass has been found to be in Australia, as naturalised, a weed of the natural environment, a weed of agriculture, to have escaped from cultivation, and to be an invasive species. In South Australia (SA) buffel grass is a declared plant under the Natural resources management Act 2004 and Biosecurity SA (2012) has a strategic plan to reduce the weed threat. It is reported as a widespread weed of roadsides, creek lines, river edges and most vegetation types from Geraldton to the Pilbara, Kimberley and adjacent desert (Hussey et al. 2007).

2. What is the ability of the species to successfully establish and compete with other plants, especially amongst intact native vegetation?

a) High - species can establish and displace intact native vegetation

b) Moderate - species can establish amongst intact native vegetation, but may not displace the native vegetation

c) Low - species can only establish where there is little or no competition or in areas where the native vegetation is in poor condition or has been disturbed

d) Very low - species can only successfully establish in vegetation which has been highly disturbed (e.g. roadsides, degraded or cleared areas)

e) Don't know

Hussey et al. (2007) states that in WA "it has become a widespread weed of creeklines, river edges and most vegetation types from Geraldton to the Pilbara, Kimberley and adjacent desert". However, buffel grass usually spreads into native ecosystem, that are degraded by one or a combination of grazing, fire, erosion, flooding and/or natural events. The review by Marshall et al (2012) tackles whether buffel grass acts essentially as a coloniser or as an invader.

> "The apparent dependence of buffel grass establishment on disturbed soil surfaces makes its ecological label as an 'invader' controversial. Invasive species are considered such when they can successfully establish, become naturalised and spread to new natural habitats apparently without further assistance from humans and are generally new introductions into an eco-region (Radosevich et al. 2007). So, the question becomes whether buffel grass could expand its range without human disturbance. One example that suggests it cannot is that of the Centro Ecologico de Sonora housing development in Mexico. …….establishment in the area was triggered only by major disturbances caused during the development of the new housing project (De La Barrera 2008)"
>
> "In Australia, buffel grass displays the characteristics of both invaders and colonisers; in the tropical north of the Northern Territory (the 'Top End') Buffel grass spreads from sown pastures either slowly or not at all. Conversely, in central Australia and western Queensland it spreads readily (Cameron 2004)" from Marshall et al. (2012).

Given the range of responses, Answer (b) seems appropriate.

3. Grazing tolerance and palatability

a) Very high - Unpalatable (or toxic), rarely grazed

b) High - Will persist under heavy continuous grazing due to plant structure (like rhizomatous grasses) or has limited palatability

c) Moderate - Tolerant of grazing as, usually, only young growth (annuals) or young re-growth (perennials) is grazed, for example after fire or early in wet season; or plants are occasionally browsed

d) Low - Readily grazed during the wet season with some preferential grazing, during the dry season some plants are grazed while others are left ungrazed

e) Very low - Comparatively good feed quality and preferentially grazed at all growth stages; or has low tolerance to grazing and plants are easily killed. Plant numbers decline over successive years if overgrazed.

f) Don't know

Buffel grass can be slow to establish, and grazing may need to be delayed 4–6 months after sowing, and up to 9–12 months, depending on establishment conditions (Cook et al. 2020). However, once established buffel grass is adapted to frequent defoliation (Brown and Bettink

2009) and is very tolerant of regular cutting or grazing (Cook et al. 2020). Young growth is very palatable for stock while at maturity the palatability is fair. When actively growing it can be set stocked or rotationally grazed. Petheram and Kok (1991) describe buffel grass as tolerant to heat, drought and heavy grazing but grazing tolerance and palatability may vary between cultivars.

4. What is the species' ability to persist as a long-term sward or stand without management?

a) Plant numbers increase substantially with successive reproductive cycles to form a near monoculture over a significant area

b) Plant numbers remain at a steady level, persisting as a significant component of a mixed sward/stand

c) Plant numbers decline slowly over successive years so that it becomes a minor component of the vegetation

d) Plant numbers decline rapidly over successive years so that only occasional plants can be found

e) Don't know

Buffel grass is widely naturalised across Australia in Western Australia, the Northern Territory, Queensland, New South Wales and South Australia (Biosecurity SA 2012), establishing self-sustaining populations and spreading without management.

In drier environments spread is likely to be episodic, for example, there was a large expansion of the area of buffel grass in the Ashburton Catchment after a major flood in 1997 (Payne et al. 2004). In the late 1970s large areas of the 'Cheela land system' were assessed as being severely degraded and eroded, however the proportion of the system dominated by perennial Cenchrus species increased from 5% in 1978 to 64% in 2002 and it was considered a spectacular recovery of a formerly degraded landscape (Payne et al. 2004). However, in the long-term the transition to buffel grass is not necessarily permanent, for example, WARMS sites on the Ashburton River have experienced a sequence from saltbush shrubs prior to the 1997 flood, to buffel grass dominance after the flood, and a subsequent decline in buffel grass and establishment of the woody weed *Acacia victoriae* (W. Fletcher personal communication 2017, cited in Sudmeyer Unpublished).

5. Is the plant likely to spread or rapidly colonise a site?

a) High risk – plants with a history of spreading rapidly with many plants successfully establishing under favourable conditions >200m from the sown area within 5 years for herbaceous perennials or 10 years for woody perennials

b) Medium risk – some plants will spread outside the planted area and successfully establish under favourable conditions >100m from the sown area within 5 years for herbaceous perennials or 10 years for woody perennials

c) Low – No or minimal spread of sown species. Outside the planted area a few plants will spread and successfully establish within 100m of the planted area under favourable conditions within 5 years for herbaceous perennials or 10 years for woody perennials

d) No spread of sown species more than 10m outside the planted area within 5 years for herbaceous perennials or 10 years for woody perennials

e) Don't know

In a rangeland context, spread is likely to be episodic and to take advantage of when there is both favourable seasonal conditions and landscape disturbance. For example, when the irrigation at Woodie Woodie (east Pilbara) was shut-down because of the mine closure in 2016

buffel grass rapidly colonised the centre pivot formerly used for growing lucerne which did not persist without irrigation (G. Moore personal communication).

Buffel grass seed production is prolific with new plants able to rapidly flower and produce seed. Cook et al. (2020) reports that buffel grass spreads readily by seed, which is well adapted to dispersal by wind or water movement. Seed is also moved by livestock through adhesion to fur, or through ingestion and defecation. Dispersal by machinery, such as graders and mowers, can spread seed along roadsides and tracks where it readily colonises disturbed environments.

Cook et al. (2020) also reports that there is no natural spread on soils of pH_w <7, even though establishment with cultivation is possible on these soils. Buffel grass spread can also be limited by soils with low phosphorous levels as the seedlings have a higher P requirement than mature plants (Christie 1975).

Buffel grass can rapidly spread but this will not always be the case as it usually requires a level of soil disturbance and also suitable soil conditions.

6. Will the species establish and reproduce in low-nutrient Australian soils without the addition of fertiliser or inoculant?

a) Establishment, growth and seed production uninhibited in low-nutrient soils

b) Establishment, growth and seed production reduced in low-nutrient soils

c) Establishment, growth and seed production severely diminished in low-nutrient soils

d) Establishment, growth and reproduction not likely in low-nutrient soils without soil additives

e) Don’t know

Buffel grass requires good soil fertility and the seedlings have a higher phosphorus requirement than mature plants (>10 mg/kg) (Christie 1975; Cook et al. 2020). As a result, on infertile sandy soils in the west Kimberley with P levels <2 (Smolinski 2021) naturalised buffel grass plants are observed confined to the leaf drop of leguminous trees like Bauhinia (*Lysiphyllum cunninghamii*).

Buffel grass has a high demand for available soil nitrogen and phosphorus and once the population is established, soil nitrogen may be depleted and growth can begin to decline (Biosecurity SA 2012). However, buffel grass will germinate and reproduce in low nutritive soils and has naturalised widely in a range of Australian soils without the addition of fertilizer. It has an extensive root system (Cook et al. 2020) which can exploit the available water and soil nutrition. Cook et al. (2020) also reports that there is no natural spread on soils of pH_w <7, even though establishment with cultivation is possible on these soils.

7.1 How likely is long-distance dispersal (>100m) by flying animals (birds, bats)?

a) Common

b) Occasional

c) Unlikely

d) Don’t know

No information found that described dispersal by birds or bats. The bristly burrs give the seed a fluffy appearance and may help the seed attach to fur or feathers, but it is not readily eaten by seed eating birds or bats.

7.2 How likely is long-distance dispersal (>100m) by stock, native and/or feral animals?

a) Common

b) Occasional

c) Unlikely

d) Don't know

Cook et al. (2020) reports that buffel grass seed may be moved by livestock through adhesion to fur. The bristly burrs may adhere to skin or fur or be incorporated into soil attaching to hooves or hides (Brown and Bettink 2009; Biosecurity SA 2012).

In a controlled experiment buffel grass seed was placed directly into the rumens of cattle, but 0% of the fed seeds were excreted in the faeces and germinable (Gardener et al. 1993).

7.3 How likely is long-distance dispersal (>100m) by water?

a) Common

b) Occasional

c) Unlikely

d) Don't know

Wind and water are the primary agents of seed dispersal for buffel grass (Cook et al. 2020; Friedel et al. 2008). Buffel grass invades riparian areas and seed maybe carried in bodies of water or be spread across flood plains. Buffel grass seed is spread by water, however buffel grass is intolerant of flooding and soils with poor internal drainage (Humphreys 1967).

7.4 How likely is long-distance dispersal (>100 m) by wind?

a) Common

b) Occasional

c) Unlikely

d) Don't know

The feathery seed heads readily break up when mature and the light ripe seed (fascicles with 1-4 spikelets) can be carried on the wind or distributed along roadsides by the draught from vehicles (Friedel et al. 2008; Cook et al. 2020).

8.1 How likely is long-distance dispersal (>100m) accidentally by people and vehicles?

a) Common

b) Occasional

c) Unlikely

d) Don't know

The small light seed in the bristly burr may attach to clothing and vehicles or be incorporated in mud attached to boots, vehicles and machinery. Seed may be spread with mowers during road verge cutting and other operations.

8.2 How likely is long-distance dispersal (>100m) accidentally through the movement of produce or materials for infrastructure?

a) Common

b) Occasional

c) Unlikely

d) Don't know

Buffel grass is not usually cut for hay, although it is possible. Buffel grass readily colonises disturbed areas such as roadsides and Hussey et al. (2007) notes that it often found along roadside table drains. Seed may be incorporated into materials used in road building such as sand and gravels or spread during road grading. Buffel grass is widely naturalised and seed may also be incorporated and transported as a contaminant in hay or other produce.

9.1 What is the species' minimum generation time?

a) ≤1 year

b) 2-3 years

c) >3 years or never

d) Don't know

Flowers are produced for much of the year (Hussey et al. 2007). Puckey and Albrecht (2004) found that new buffel grass plants can grow and set seed in as little as 3 to 6 weeks. Seed can germinate at any time of the year providing temperatures are adequate (Brown and Bettink 2009).

Under moisture limiting conditions, buffel grass can act as an ephemeral annual. This appears to be especially the case with the 'WA ecotype' which is widely naturalised in the WA rangelands.

9.2 What is the species' average seed set in a favourable season?

a) Prolific seed production high (e.g. >1000 m^{-2}/year for woody species, >5000 m^{-2}/year for herbaceous species)

b) Moderate – low seed production

c) None (or seed is sterile)

d) Don't know

Buffel grass is self-fertile, producing many foxtail seed heads with the individual spikelets being shed when ripe. Flowers are produced for much of the year (Hussey et al. 2007). Puckey and Albrecht (2004) found that new buffel grass plants can grow and set seed in as little as 3 to 6 weeks, and it can behave as an ephemeral annual grass under stressful conditions. so copious seed can be produced in favourable periods.

In Queensland buffel grass seed numbers of 861seeds/m^2 from a pasture matrix and 25 germinable seeds/m^2 in the soil seed bank in *Eucalyptus populnea* woodlands with established buffel grass, were found (Moor 2000, reported by Franks 2000).

9.3 What is the species' seed persistence in the soil seedbank?

a) >5 years

b) 2-5 years

c) <2 years

d) Don't know

Buffel grass seeds remain viable for 12 months or longer with Winkworth (1971) finding that, although only 10% were viable after 2 years, a small portion of the seeds could remain viable for up to 4 years in the soil. Humphreys (1967) report seed can be viable in dry soils for up to three years.

9.4 Can the species' reproduce vegetatively?

a) Yes – rapid vegetative reproduction

b) Yes – slow

c) No

d) Don't know

The commercial buffel grass varieties and the WA ecotype are tufted grasses and do not have rhizomes and stolons.

Section 2: Impacts

1. Could the species reduce the biodiversity value of a natural ecosystem, either by reducing the amount of biodiversity present (diversity and abundance of native species), or degrading the visual appearance?

a) The species could significantly reduce biodiversity such that areas infested become low priorities for nature conservation and/or nature-based tourism

b) The species could have some effect on biodiversity and reduce its value for conservation and/or tourism

c) The species would have marginal effects on biodiversity but is visually obvious and could degrade the natural appearance of the landscape

d) The species would not affect biodiversity or the appearance of natural ecosystems

e) Don't know

Hussey et al. (2007) describes buffel grass in the Murchison and Gascoyne regions of WA as "often colonising roadside table drains, excluding native everlastings and causing detriment to the ecotourism industry". The South Australian (SA) buffel grass strategic plan (Biosecurity SA 2012) includes a list of native flora and fauna of conservation significance considered to be threatened by buffel grass in arid and semi-arid SA.

2. Does the species have a history of, or potential to reduce the establishment of other plant species?

a) The species can significantly inhibit the establishment of other plants (e.g. regenerating native vegetation) by preventing germination and/or killing seedlings, and/or the species forms a monoculture over a large area

b) The species can inhibit the establishment of other plants and can become dominant.

c) The species can cause some minor displacement by inhibiting establishment, but will not become dominant.

d) The species does not inhibit the establishment of other plants.

e) Don't know

Buffel grass mainly colonises disturbed sites (Marshall et al. 2012) and given favourable seasonal conditions can spread rapidly into disturbed sites and become dominant, for example, in the Ashburton Catchment following a major flood (Payne et al. 2004b). Buffel grass has been sown to revegetate eroded and degraded landscapes (Hacker 1989; Payne et al. 2004a) and while these restored areas were initially dominated by the exotic grasses used in the re-vegetation process, in the medium-term the native species are gradually re-colonising and displacing the exotic grasses.

3. Could the species alter the structure of any native ecosystems at risk of invasion from this species by adding a new strata level?

a) Will add a new strata level, and could reach medium to high density

b) Will add a new strata level, but at low density

c) Will not add a new strata level

d) Don't know

Buffel grass is unlikely to add a new strata level to native ecosystems in the northern WA rangelands where perennial grasses are ubiquitous but can become a significant component of such systems as it spreads and naturalises. As a result, it is unlikely to add a new strata to any native ecosystem that are at risk of invasion, as it mainly establishes in low rainfall areas where there is already a grass under-storey. In low to medium rainfall environments buffel grass has a low growth habit.

4. Could or does the species restrict the physical movement of people, animals, and/or water?

a) Species infestations could become impenetrable throughout the year, preventing the physical movement of people, animals and/or water

b) Species infestations could significantly slow the physical movement of people, animals and/or water throughout the year

c) Species infestations could slow the physical movement of people, animals and/or water at certain times of the year or provide a minor obstruction throughout the year.

d) Species infestations have no effect on physical movement

e) Don't know

Buffel grass is naturalised over large areas in the rangelands and may be an aggressive weed in wetland areas and along water courses, however it is unlikely to impede movement.

5. Does the species have, or show the potential to modify the existing fire behaviour and alter the fire regime?

a) High - major effect on frequency and/or fire intensity. May greatly increasing the dry season fuel load

b) Moderate effect on frequency or fire intensity

c) Minor or no effect

d) Don't know

Buffel grass can alter the fire characteristics of invaded plant cover by generating highly flammable fuel that is prone to more frequent fires (Hussey et al. 1997). This effect is most pronounced in central Australia where buffel grass has naturalised along waterways which can then acts as conduits of fire rather than as fire breaks (Miller et al. 2010).

> "Perhaps the most damaging act of disturbance is fire. Buffel grass produces a high fuel load that supports more frequent and intense fires than arid landscapes are otherwise likely to be exposed to (D'antonio and Vitousek, 1992). It is often first to remerge on ash beds, hence forming a positive feedback loop which favours its own regeneration and modifies the invaded system irreversibly (Miller et al. 2010)" from Marshall et al. (2012).

Buffel grass is tolerant of and can be favoured by fire. Cover of buffel grass can increase, and populations of associated fire-susceptible species decrease in a fire regime (Cook et al. 2020).

> "….dry buffel grass foliage forms a relatively continuous flammable ground layer that can carry extensive and intense fires. It recovers its biomass very rapidly when moisture is sufficient and can burn when partly green. Therefore, it can carry fire at much shorter

intervals than native understorey. More frequent hot fires alter the native plant community structure because established trees and shrubs can be killed and young ones destroyed before they have produced seed" (Friedel et al. 2008).

6.1 Is the species toxic to animals, have spines or burrs, or host other pests or diseases that could impact on native fauna and flora?

a) Yes – plant poisonous or other adverse factors present

b) No – plant is not poisonous, does not produce burrs or spines or harbour pests or diseases

Cook et al. (2020) reports that buffel grass appears to be allelopathic and may have oxalate levels that can cause 'big head' (*Osteodystrophia fibrosa*) in horses and oxalate poisoning in young or hungry sheep. However, with soluble oxalate levels of 1–2% in the dry matter, there is rarely a problem with mature ruminants (Cook et al. 2020) and buffel grass is considered a desirable grazing species by many graziers and pastoralists.

6.2 Could the species provide food and shelter for pest animals?

a) Yes – could provide more shelter or greater nutritional value than the native vegetation

b) No – could provide similar or less shelter or nutritional value than the native vegetation

c) Don't know

Buffel grass can be more productive than the native species in the rangelands and therefore can provide additional food for native and feral grazers (Marshall et al. 2012).
Buffel grass is able to persist and grow in low rainfall areas of the WA rangelands producing more biomass than the native species and providing additional food for both native and feral grazers.

7.1 Does the species have, or show the potential to have, a major effect on nutrient levels in intact native vegetation?

a) Will significantly increase soil nutrient levels

b) Will significantly decrease soil nutrient levels

c) Will have minimal effect on soil nutrient levels

d) Don't know

Buffel grass has an extensive root system can persist in low nutrient soils and will compete with associated species for nutrients (Cook et al. 2020). It can deplete the soil fertility by producing large amounts of biomass which leads to pasture rundown in the medium-term, for example, rundown of buffel grass pastures in Queensland (Peck et al. 2013).

7.2 Could the species reduce water quality or cause silting of waterways?

a) Could significantly reduce water quality or cause silting or alteration of flow of waterways

b) May have some effect on water quality or silting of waterways in some ecosystems

c) Minor or no effect on water quality

d) Don't know

Buffel grass as a short- to medium-height perennial, tussock grass will have no or minor effect on silting of waterways as it grows on the banks and the more fertile alluvial plains of the river systems rather than in the watercourse. In the arid environment of central Australia buffel grass reportedly does grow in waterways and streambeds (Miller at al. 2010; Marshall et al. 2012), but this is not the case in the WA rangelands.

7.3 Does the species have, or show the potential to have, a major effect on the watertable below intact native vegetation?

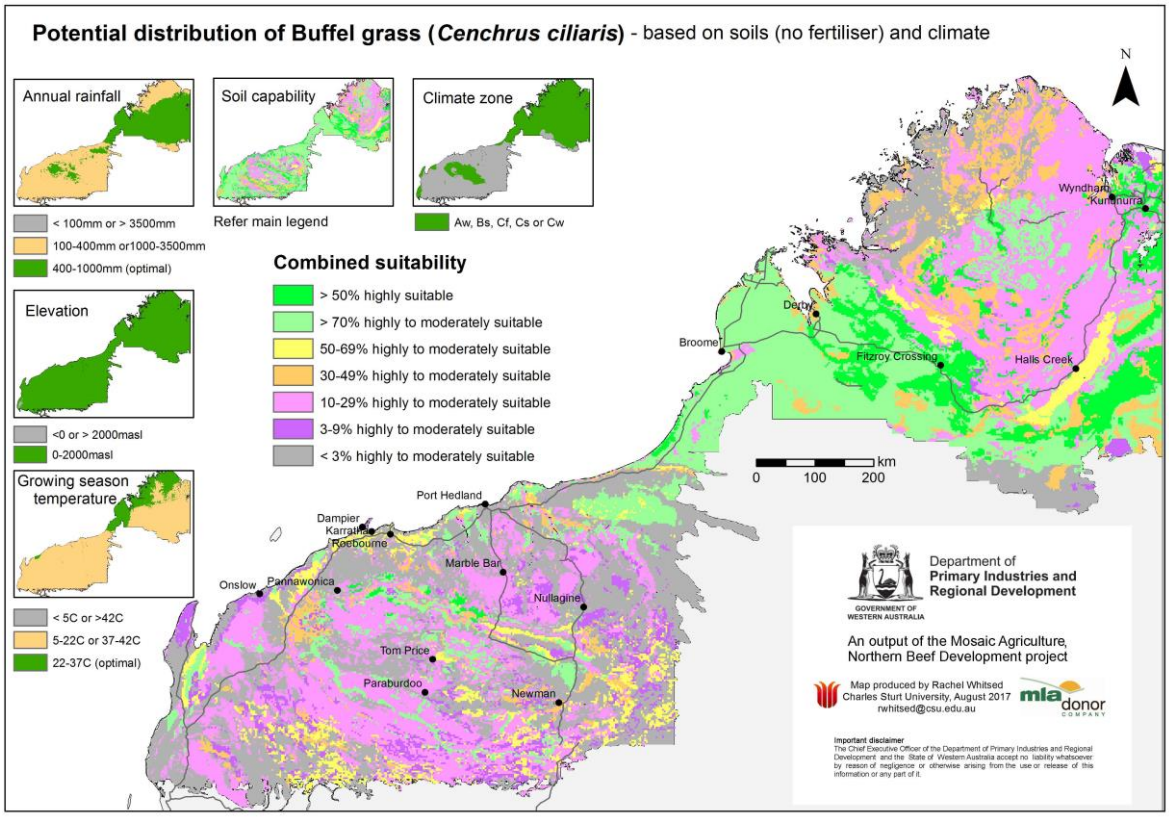
a) Will significantly lower the water table and/or reduce groundwater recharge to the water table.

b) Will have little or no impact on hydrology

c) Don't know

As a perennial grass in a landscape with woody shrubs and trees buffel grass will have little or no impact on the hydrology and groundwater. In the northern rangelands of Australia buffel grass has naturalised mainly in the semi-arid to arid zones. However, it grows most favourably in wetlands and along watercourses although it is not tolerant of prolonged waterlogging (Friedel et al. 2008). In these environments there is usually a low to moderate density of trees which would have much deeper root systems and as a result much more impact on the local groundwater.

Potential distribution



Region	Area of suitable soils and climate	Potential distribution score
Kimberley	15.4 Mha	8.0
Pilbara	4.95 Mha	6.0
Gascoyne – Goldfields	TBD	TBD

Overall weed risk assessment

The overall weed risk assessment (WRA) is calculated from Equation 1.

Equation1: Invasiveness (0-10) x Impacts (0-10) x Potential Distribution (0-10) = Weed risk score (0-1000)

Buffel grass: Invasiveness score = 7.9, Impacts score = 5.0

Region	WRA calculation*	Overall score	WRA rating
Kimberley	7.9 x 5.0 x 8.0	**316**	**Very high**
Pilbara	7.9 x 5.0 x 6.0	**237**	**Very high**
Gascoyne – Goldfields	7.9 x 5.0 x ??	**TBD**	**TBD**

***** Invasiveness (0-10) x Impacts (0-10) x Potential Distribution (0-10) = Weed risk score (0-1000)

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