Department of
Primary Industries and Regional Development

GOVERNMENT OF WESTERN AUSTRALIA

Environmental weed risk assessment

Rhodes grass (*Chloris gayana*)

Family: Poaceae

Common name: Rhodes grass

Cultivars: Includes Pioneer, Katambora, Finecut, Topcut, Nemkat, Reclaimer (all diploids); Callide, Mariner, Toro (all tetraploids)

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Species summary:

Rhodes grass (*Chloris gayana*) is a warm season or sub-tropical (C4) perennial grass which is both tufted and has stolons (runners). The degree of stoloniferous growth not only varies between varieties but can also vary between different environments and management practices. Vegetative growth is generally 30 to 100 cm in height, while seed heads are 60 to 180 cm in height.

There are two groups of Rhodes grass based on the ploidy level; diploids and tetraploids. The diploids come from sub-tropical regions and are generally more robust with higher frost, drought and salinity tolerance (Moore *et al*. 2006). The diploids are generally insensitive to day-length and as a result flower from late spring through to autumn. On the other hand the tetraploids are from tropical regions and are late flowering in response to short days (<12 hours) (Loch *et al*. 2003). Rhodes grass is a morphologically variable out-crossing species and there are a number of both diploid (e.g. Pioneer (variable), Katambora, Finecut, Topcut, Nemkat, Reclaimer) and tetraploid (e.g. Callide, Mariner, Toro) varieties.

Rhodes grass is native to southern and eastern Africa where it occurs in open grasslands and woodlands (Bogdan 1969). It grows on a wide range of soil types where the average annual rainfall varies from 450 to 1600mm. The cultivar now known as Pioneer is believed to have been introduced into Australia by soldiers returning from the Boer war (Loch *et al*. 2003).

In Australia Rhodes grass has been widely used as a perennial pasture grass for summer rainfall regions and more recently in southern Australia in areas with mild winters (Moore *et al.* 2014). It is a major species in the Queensland grazing industry (Humphries 1980) and one of the most widely grown sub-tropical grasses in southern Western Australia (Moore *et al.* 2006). If cut at or just before early flowering it can make good quality hay, but is generally not suitable for silage (Cook *et al*. 2005). With its spreading habit and good groundcover it is also useful for soil stabilisation and erosion control and was purposefully sown on roadsides in northern NSW by the Soil Conservation Service to stabilise road verges.

Rhodes grass is the main perennial grass under centre pivot irrigation in northern Western Australia (Pilbara and Kimberley) where it is used for both hay production and direct grazing. Producers' grow Rhodes grass because of the reliable establishment, good production with irrigation and because the management is relatively flexible. Growth over 'winter' depends on the prevailing temperatures, but it has little or no production for ~3 months in the inland Pilbara. There are no commercial dryland stands of Rhodes grass in northern WA, although it could potentially be grown in the high rainfall north Kimberley on more fertile soils.

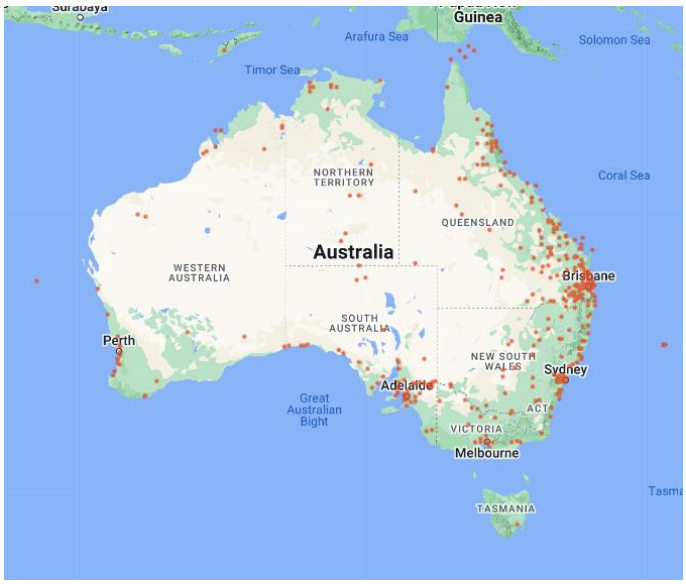


Figure 1 The distribution of Rhodes grass (*Chloris gayana*) in Australia from the Australasian Virtual Herbarium (https://avh.ala.org.au/)

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

There are numerous references to Rhodes grass as a weed in the literature. Rhodes grass is widely naturalised in both Australia and overseas. The 'Global Compendium of Weeds' (Randall 2002), notes that Rhodes grass has been reported as a weed of the natural environment; agricultural weed; cultivation escape; naturalised and an invasive species in Australia.

Rhodes grass is widely naturalised in Africa (Cook *et al*. 2005) and elsewhere in the tropics and sub-tropics in open woodland, grassland, riverine and lake margins on a wide range of soils. It is listed as a weed in the Geographical Atlas of World Weeds (Holm *et al*. 1979) and in Australia by Lonsdale (1994). It invades disturbed ground, can be a weed of cultivation and is naturalised in a wide range of environments across Australia. Rhodes grass has been described as an environmental weed in Victoria (Carr *et al*. 1992; Richardson *et al*. 2006); both naturalised and an environmental weed in South Australia (Muyt 2001; Barker *et al*. 2005), while in Queensland it is listed as naturalised, a cultivation escape and an environmental weed (Bantianoff and Butler 2002; Werren 2001).

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

Rhodes grass seedlings are comparatively slow growing, so to achieve good establishment seed needs to be sown into paddocks with 100% weed control. Under favourable conditions with good establishment full groundcover can be achieved within 8 to 12 weeks. However, Rhodes grass seedlings are weak competitors and are vulnerable to being pulled out by grazing animals as they have a weak primary root system.

The spread of Rhodes grass is largely from the stoloniferous growth, but this results in a maximum spread of a few metres per year. Stolons can root down in moist soils to form new plants if not disturbed.

Rhodes grass seed can germinate over a wide range of temperatures (optimum is 15-40˚C but a small proportion of seeds may germinate at lower temperatures) and low soil water content (Moore *et al* 2006; Watt 1974; Watt and Whalley 1982). This may give it a competitive advantage for establishment in some situations.

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

Young growth is highly palatable, but feed quality and palatability declines with flowering and after the plants have set seed they are less attractive to domesticated grazing animals. Tetraploid varieties are more readily eaten than diploid varieties, particularly when mature (Cook *et al*. 2005). A weak primary root system means that early grazing can result in seedlings and young plants being pulled out.

Established stands can withstand periods with set stocking (Moore *et al.* 2006), but it will depend on the season, frequency and grazing intensity. Once established the creeping habit of Rhodes grass assists its capacity to survive heavy grazing but production is reduced by frequent defoliation (Cook *et al*. 2005). If underutilised or soil fertility declines mature plants may become rank and unpalatable (Humphries 1980).

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

When grown under irrigation and well managed Rhodes grass is very competitive and the sward density is maintained. However in a rangeland environment, a Rhodes grass stand is likely to decline slowly without management: including regular fertiliser application and control of grazing (i.e. rotational grazing). The sward is likely to be colonised by native grasses (e.g. Triodia species), broadleaf plants and woody shrubs. Without irrigation a stand may decline rapidly over the extended dry season due to moisture stress in areas where the average annual rainfall is less than 800 mm. In the high rainfall north Kimberley Rhodes grass may persist on the more fertile soils.

Rhodes grass can often establish and successfully persist in a mixed sward. However, there is some evidence that in a mixed pasture Rhodes grass is a strong component in the first couple of years, but over time it declines. In some situations Rhodes grass can be out-competed by other species or plant numbers decline due to environmental conditions (Moore *et al*. 2006; 2014).

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

There appears to be little spread by seed from Rhodes grass even though the plants are freely seeding. Rhodes grass spreads mainly from vegetative growth by runners (stolons).

Rhodes grass is a tufted perennial which develops vigorous stolons. Along each stolon new plants can arise at nodes where roots form and once the new plant is established the stolon dies off. Moore *et al*. (2006) reports that in WA and NSW stolon growth may result in spread of 1-3m per year.

The occasional widely spaced Rhodes grass plants along roadsides in WA suggest that recruitment from seed can occur. Although some plants may seed freely trial results indicate that recruitment from seed is not common (Moore *et al*. 2006). In a study conducted on a red Chromosol on the North-West Slopes of NSW, Katambora Rhodes grass was found to recruit from seed, albeit weakly, with ~50% of seedlings surviving (G. Lodge, unpublished data).

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

Rhodes grass is considered a 'high fertility 'species in its natural habitat and is very responsive to N fertilizer application (Minson 1973; Loch *et al.* 2003). Rhodes grass can tolerate soils with low fertility, but will be unproductive and may eventually die out, particularly if grazed regularly (Cook *et al*. 2005). It is the most salt-tolerant of the commonly sown tropical grasses, with some cultivars tolerating soil salt levels where electrical conductivity exceeds 10 dS/m. (Cook 2007) and where the pH is less than 4.3.

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.

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

Frey (2005) considers dispersal by wild animals an occasional occurrence while the Tropical forages database (Cook *et al*. 2005) notes that seed is readily dispersed by adhering to animal fur. Rhodes grass is preferentially grazed by kangaroos and wallabies.

There was negligible excretion of viable seed when Rhodes grass seed was placed in the rumen of cattle (Gardener *et al*. 1993), so no potential spread through animal dung.

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

a) Frequent

b) Common

c) Occasional

d) Unlikely

e) Don't know

Rhodes grass is not tolerant of prolonged waterlogging, so is not normally grown adjacent to streams and waterways. However, it is associated with creeks in south-east Queensland (Batianoff and Butler 2003) and is tolerant of flooding for up to 15 days (Cook *et al*. 2005). It is also associated with wet/high rainfall areas in South Australia (Jessop *et al*. 2006). Seed and

vegetative propagules could be carried by waterways or dispersed by flood water. The small seed could be readily washed with organic matter across slopes and along drainage lines.

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

a) Frequent

b) Common

c) Occasional

d) Unlikely

e) Don't know

Rhodes grass seed heads are borne well above the leaf growth and the light and seed is easily dispersed by wind. Flowering varies with ploidy level, with diploids insensitive to daylength and flowering throughout the growing season. Tetraploids generally respond to shortening daylength with an intense flush of flowering in April and another in October-November in the southern hemisphere (Cook *et al*. 2005).

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

a) Common

b) Occasional

c) Unlikely

d) Don't know

Both seed and plant fragments can be spread in soil by vehicles, machinery and also on footwear when soil conditions are wet. Farm machinery, slashers and other equipment involved in road work and maintaining road verges may pick up and spread propagules from pastures and disturbed roadsides colonised by Rhodes grass. Rhodes grass (is widely naturalised and found on roadsides throughout the tropics and sub-tropics (Cook *et al*. 2005). It is also common on roadsides in northern NSW and Queensland and occasionally in WA.

8.2 How likely is long-distance dispersal (>100 m) as fodder or accidentally in contaminated produce?

a) Common

b) Occasional

c) Unlikely

d) Don't know

Rhodes grass is usually grown as a pasture species, but it has been grown under irrigation in northern Australia for hay production. Most of the fodder production (hay, haylage) in northern Western Australia is produced from Rhodes grass or hybrid sorghum, with a small amount of lucerne and other crops. This fodder is then transported around the region and fed out when mustering cattle in both permanent and temporary yards.

Rhodes grass makes good quality hay if cut at or just before very early flowering giving up to six, 25 to 50 day harvests under favourable conditions (Cook *et al*. 2005). Therefore high quality hay should contain few or no seed heads and as a result little or no viable seed, however some Rhodes grass hay crops are cut later than ideal and contain many mature seed heads.

Rhodes grass is a common contaminant in seed lots of some other sub-tropical grasses, like Premier digit grass (*Digitaria eriantha*) and Floren bluegrass (*Dichanthium aristatum*).

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

Studies conducted in northern NSW have shown Katambora Rhodes grass to produce seed in the year of establishment, but it is capable of spreading via stolons within ~12 weeks (G. Lodge, unpublished data). The seed germinates quickly (1-7 days depending on temperature) and shows comparatively good seedling vigour compared with most other perennial grasses, often achieving full ground cover within 8 to 12 weeks of sowing (Moore *et al.* 2006, Cook *et al*. 2005).

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

Rhodes grass seed is very small and light. With Katambora Rhodes grass there are about 4 million seeds (spikelets)/kg while for most other varieties there are 7-10 million seeds/kg. With seed crops mechanically harvested yields of 100-200 kg/ha can be achieved (Cook *et al*. 2005). For seed production the number of harvests per year depends on the ploidy level. The diploids are largely day length insensitive, so they can have up to three seed crops a year, while with tetraploid varieties two crops are possible. Given these levels of seed production in commercial seed crops, an unmanaged stand is likely to produce >5,000 seeds/m^2 in favourable seasons.

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

Rhodes grass does not form a persistent long-term seedbank. A study on the north-west slopes of NSW found that the mortality of Katambora Rhodes grass seed in the floret was high when stored either on, or under, the soil surface over winter (Lodge and Harden 2009).

Seed matures 23-25 days after flowering and post-harvest seed dormancy varies with the ploidy level. The seed of diploid types has no or minimal post-harvest seed dormancy, while seed of the tetraploid types may not reach maximum germination for 3-6 months (sometimes up to 18 months) after harvest (Cook *et al*. 2005). Under ideal storage conditions Rhodes grass seed is not long-lived, but it can remain viable for up to 4 years depending on storage conditions (Cook *et al*. 2005; Nichols *et al*. 2012).

9.4 Can the species' reproduce vegetatively?

a) Yes – rapid vegetative reproduction

b) Yes – slow

c) No

d) Don't know

Rhodes grass plants spread through vigorous runners (stolons). New plants can form at nodes on the stolons and in turn can become independent from the parent plant once they have a strong root system.

The degree of stoloniferous growth varies between varieties, different environments and management practices (Moore *et al*. 2006). Typically spread from stolons is likely to be in the range of 1 to 3m per year. The ability of Rhodes grass to spread naturally from stolons is very good and its creeping habit provides good soil stabilisation.

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

In Australia Rhodes grass is most commonly associated with disturbed sites. It is unlikely to reach a high plant density in low fertility, woody and/or shaded vegetation. Rhodes grass can invade disturbed ground and be a weed of cultivation. However, it usually dies after 4-5 years if not further disturbed or fertilised, and rarely invades intact natural areas (Cook *et al*. 2005).

In a rangelands context, Rhodes grass is a non-indigenous perennial grass which is visually distinctive, so it could degrade the appearance of natural ecosystems. There are many other tufted perennial grasses in the WA rangelands, some with a similar appearance (e.g. feathertop Rhodes grass, *Chloris virgata*).

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

A dense sward of Rhodes grass will inhibit the germination of annual weeds in an agricultural situation, however it is unlikely to form a dense sward in native vegetation where the soils are of inherently low fertility. In the tropics and sub-tropics Rhodes grass can form dense swards and spread vigorously in disturbed areas or fertilised agricultural systems, but may be less dominant in the infertile soils of natural rangeland environments.

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

The tropical and sub-tropical rangelands of north Western Australia include large areas of grassland with shrub and tree strata with a native grass understory so that any incursion by Rhodes grass would not usually add a new strata to the ecosystem. However the presence of this non-indigenous species could alter the composition and abundance of the native species.

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

With Rhodes grass the foliage is generally <0.6 m with seed heads 1.2 to 1.8 m in height. It is not spiky and is unlikely to cause any greater obstruction than native tussock-forming grasses. Rhodes grass can form dense swards, but these would have little effect on physical movement through an area of people, animals or water.

5. Does the species have, or show the potential to modify the existing 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

The relationship between grass invasion and fire has received considerable attention in the literature. In comparison to other vegetation types, many tropical pasture grasses produce large fuel loads and burn hotter and often later in the season than native grasses, are relatively flammable and can regenerate quickly after fire (Low 1997). Rhodes grass as a tufted and stoloniferous grass does not produce the bulk of the large tufted or bunch grasses like Gamba grass (*Andropogon gayanus*) which produces large amounts of biomass that dries out quickly

and can readily burn. In general, Rhodes grass produces considerably less biomass than the medium to large bunch (tufted) grasses.

There is some evidence that Rhodes grass can survive fire, although hot fires can kill small plants growing in the stolon nodes (Angell 2004; Loch *et al*. 2003; Cook *et al*. 2005). The plant density reached in native vegetation is unlikely to have a major impact on fire frequency or intensity.

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

No livestock disorders have been reported and Rhodes grass contains a low level of oxalate, so is not hazardous for horses (Moore *et al.* 2006, Cook *et al*. 2005).

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

Rhodes grass will provide food for domesticated, native and feral or pest grazing animals, but it is unlikely to significantly increase pest numbers.

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

Rhodes grass plants tend to grow rapidly in the first year or two and utilise the available nutrients. The biomass production in subsequent years declines as the nutrient levels are rundown. Plant persistence can also be adversely affected in low nutrient soils.

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

This species has been used extensively as a soil stabiliser, so is unlikely to cause silting of waterways. It is an excellent binder of soil, and has purposefully been sown in NSW to reduce water erosion.

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

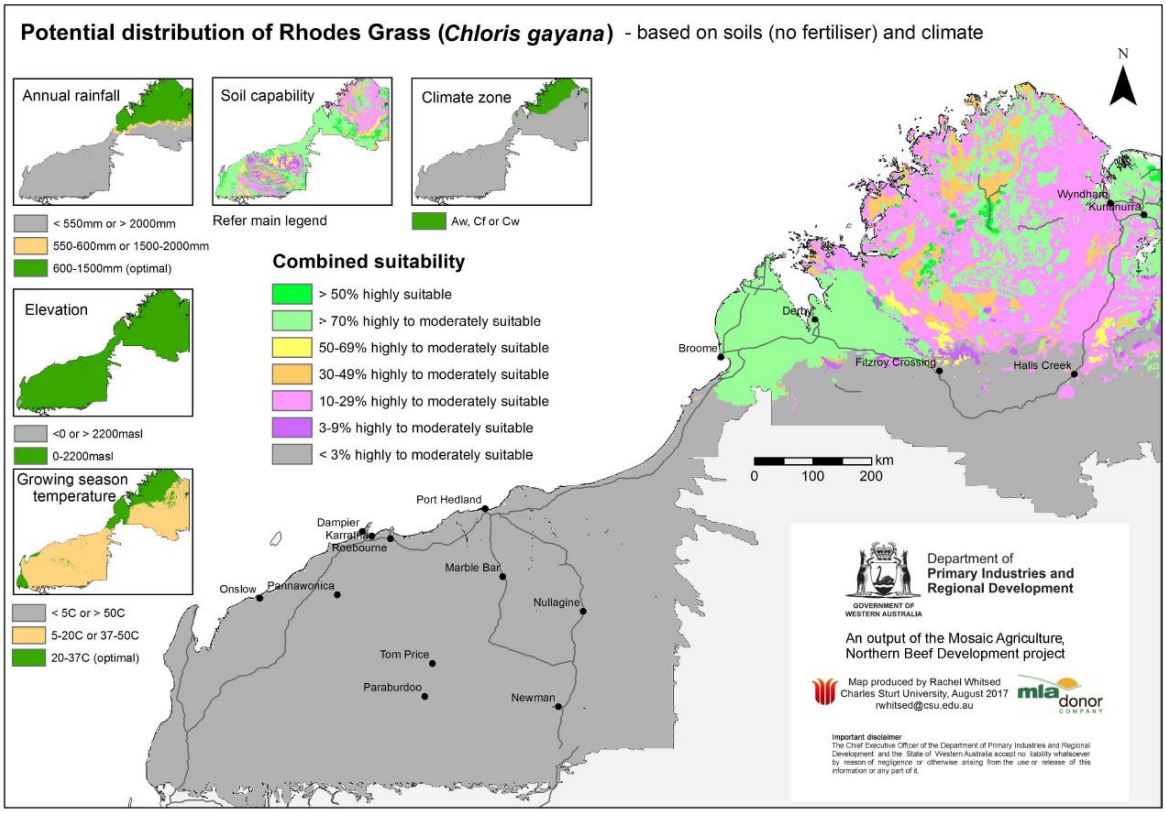
a) Will significantly lower the water table and/or reduce groundwater recharge to the water table.

b) Will have little or no impact on hydrology

c) Don't know

Rhodes grass developed a root system to 2.4m on a sandy soil with a gravelly subsoil (DAFWA unpublished data) and to 1.6m on a red Chromosol (Murphy *et al*. 2008). However, in a rangelands context most landscapes have a woody shrub and or tree strata which would have much deeper root systems than the perennial grasses, so Rhodes grass would have minimal or no impact on hydrology.

Potential distribution



Region	Area of suitable soils and climate	Potential distribution score
Kimberley (>550mm AAR)	10.1Mha	8.0
Kimberley (<550mm AAR)	0	0.5
Pilbara	0	0.5
Gascoyne – Goldfields	0	0.5

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)

Region	WRA calculation*	Overall score	WRA rating
Kimberley (>550mm AAR)	5.7 x 2.5 x 8.0	**114.0**	**High**
Kimberley (<550mm AAR)	5.7 x 2.5 x 0.5	**7.1**	**Negligible-low**
Pilbara	5.7 x 2.5 x 0.5	**7.1**	**Negligible-low**
Gascoyne – Goldfields	5.7 x 2.5 x 0.5	**7.1**	**Negligible-low**

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

References:

Angell, K. (2004). Rhodes grass survives hot fires. Department of Agriculture WA.

Barker, W.R., R.M.Barker, J.P. Jessop and H.P. Vonow (Eds.) (2005). Census of South Australian Vascular Plants. 5th Edition. J. Adelaide Bot. Gard. Supplement 1. (Botanic Gardens of Adelaide & State Herbarium: Adelaide).

Batianoff G N and Butler D W (2002). Assessment of Invasive naturalized plants in south-east Queensland. Appendix 1 *Plant Protection Quarterly* **17**, 27-34.

Bogdan, A.V. (1969). Review article: Rhodes grass. Herbage Abstracts **39(1)**, 1-13.

Carr G W, Yugovic J V and Robinson K E (1992). Environmental Weed Invasions in Victoria. Department of Conservation and Environment. Melbourne.

Cook B G (2007) Rhodes grass fact sheet Pastures Australia http://keys.lucidcentral.org/keys/v3/pastures/Html/Rhodes_grass.htm Accessed May 2016

Cook, B.G., Pengelly, B.C., Brown, S.D., Donnelly, J.L., Eagles, D.A., Franco, M.A., Hanson, J., Mullen, B.F., Partridge, I.J., Peters, M. and Schultze-Kraft, R. (2005). Tropical Forages: an interactive selection tool, [CD-ROM], CSIRO, DPI&F(Qld), CIAT and ILRI, Brisbane, Australia.). Fact sheet– *Chloris gayana* http://www.tropicalforages.info/key/Forages/Media/Html/Chloris gayana.htm Accessed April 2017

Gardener C J, McIvor J G and Jansen A (1993) Survival of seeds of tropical grassland species subjected to bovine digestion. *Journal of Applied Ecology* **30**, 75-85.

Holm L G, Pancho J V Herberger J P and Plucknett D L (1979). A Geographical Atlas of World Weeds. John Wiley and Sons, New York, USA.

Humphries L R (1980) A guide to better pastures for the tropics and sub-tropics. 4th ed. Published Wright Stevenson & Co. (Australia) Pty. Ltd.

Jessop, J., Dashorts, G.R.M. and James, F.J. (2007) Grasses of South Australia. (Wakefield Press) p. 344.

Loch, D.S., Rethman, N.F.G. and van Niekerk, W.A. (2003). 'Rhodes grass' Chapter 25 In 'Warm season C4 grasses'. Agronomy monograph No. 45, Published by ASA, CSSA and SSSA. p. 833-872.

Lodge, G.M. and Harden, S. (2009) Effects of depth and time of sowing and over-wintering on tropical perennial grass seedling emergence in northern New South Wales. Crop and Pasture Science **60(10)**, 954-962.

Lonsdale, W.M. (1994) Inviting Trouble: Introduced pastures species in northern Australia. *Australian Journal of Ecology* **19**, 345-354.

Low T (1997) Tropical pasture plants as weeds. *Tropical Grasslands* **31**, 337-343.

Minson, D.J. (1973). Effect of fertilizer nitrogen on digestibility and voluntary intake of *Chloris gayana*, *Digitaria decumbens* and *Pennisetum clandestinum*. *Animal Production Science* **13(61)**, 153-157.

Moore, G.A., Albertsen, T.O., Ramankutty, P., Nichols, P.G. H., Titterington, J.W., and Barrett-Lennard, P. (2014). Production and persistence of subtropical grasses in environments with Mediterranean climates. Crop and Pasture Science **65(8)**, 798-816.

Moore G, Sanford P and Wiley T (2006) Perennial Pastures for Western Australia Bulletin 4690 Department of Agriculture and Food, Western Australia

Murphy S R, Lodge G M and Brennan M A (2008). Plant root depth of tropical perennial grasses in a temperate environment. In proceedings “XXI International Grassland Congress – VII International Rangeland Congress, 29th June – 5th July 2008, Hohhot China”.

Muyt A (2001). Bush Invaders of South-East Australia: a guide to the identification and control of environmental weeds found in South-East Australia. Publ. R.G. and F.J. Richardson: Meredith, Victoria.

Nichols PGH, Yates RJ, Loo C, Wintle BJ, Titterington JW, Barrett-Lennard EG, Stevens JC, Dixon KW, Moore GA (2012). Establishment of sub-tropical perennial grasses in south-western Australia. Future Farm Industries CRC Technical Report No. 9.

Randall R (2007). The introduced flora of Australia and its weed status. Cooperative Research Centre for Australian Weed Management, University of Adelaide, South Australia

Richardson, F.J., Richardson, R.G. and Shepherd, R.C.H. (2006). Weeds of the South-East. An identification guide for Australia. R.G. & F.J. Richardson. Meredith, Victoria. 438 pp.

Watt, L.A. (1974). The effect of water potential on the germination behaviour of several warm season grass species with special reference to cracking black clay soils. Journal of Soil Conservation Service New South Wales 30: 28-41.

Watt, L.A. and Whalley, R.D.B. (1982). Establishment of small seeded perennial grasses on black clay soils in north-western New South Wales. *Australian Journal of Botany* **30**, 611-623.

Werren, G. (2001) 'Environmental Weeds of the Wet Tropics Bioregion: Risk Assessment and Priority Ranking'. A report prepared for the Wet Tropics Management Authority, Cairns [Source of data: Queensland Herbarium records (HERBRECS) to November 2000.

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