2022

Urochloa mosambicensis - environmental weed risk assessment 2022

Department of Primary Industries and Regional Development, Western Australia

Department of
Primary Industries and Regional Development

GOVERNMENT OF WESTERN AUSTRALIA

Environmental weed risk assessment

Sabi grass (*Urochloa mosambicensis*)

Four 'types' which differ in morphology, and soil and moisture requirements are recognised:

Stolonifera type: Sward-forming, stoloniferous, sometimes rhizomatous

Mosambicensis type: Stoloniferous and tufted

Pullulans type: Tufted, often with robust stolons

Rhodesiensis type: Small and low yielding

Family: Poaceae

Common name: Sabi grass

Cultivars: Includes 'Nixon' and 'Tarwan' which are *mosambicensis* types, 'Saraji' (*stolonifera* type)

Assessment prepared by: Geoff Moore

Assessment reviewed by: Greg Keighery

Date completed: June 2022

Species summary:

Sabi grass is a creeping, tropical, perennial grass of variable size and growth habit usually with short stolons or tufted and sometimes rooting and branching from the lower nodes. Sabi grass is native to central and southern Africa (i.e. Kenya, Tanzania, Uganda, Malawi, Mozambique, Zambia, Zimbabwe, Botswana, South Africa and Swaziland). It is now naturalised in the tropics and subtropics including USA (Hawaii, Texas), Australia (north), India, Sri Lanka, Myanmar, Thailand, Indonesia and Fiji (McIvor 1992; Cook et al. 2020).

Sabi grass is a drought-resistant, palatable pasture grass also suitable for hay making. It is mostly used for permanent pasture but is also effective for erosion control and other applications where rapid establishment and good groundcover is advantageous like minesite rehabilitation (Harwood et al. 1999; Hall 2008; Cook et al. 2020). Sabi grass is adapted to a range of well drained soils, including sands, sandy loams, clay loams and some clay soils. It does not tolerate flooding or waterlogging. Rainfall requirements vary from 360mm to >1,000mm depending on the type and it is commonly grown in areas with a pronounced warm season and a 5-to-9-month dry season. It has poor frost tolerance and rapidly hays off when moisture is limiting, with the plant and leaf structures deteriorating rapidly (McIvor 1992; Cook et al. 2020).

Sabi grass has only been grown commercially to a limited extent in Western Australia, however it is has naturalised on disturbed sites in the Ord Valley, Koolan island and along the Lennard River at Windjana Gorge (Hussey et al. 2007). It is more widely grown in the Northern Territory (Cameron 2010) and is naturalised across northern Australia (Figure 1).

Figure 1. Distribution of Sabi grass (*Urochloa mosambicensis*) in Australia
(Source: 'The Australasian Virtual Herbarium')

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

Not listed in Weeds of Australia (398 weed species) https://weeds.org.au/weeds-profiles/

> "Naturalised Distribution: Widely naturalised in northern Australia (i.e. in northern Western Australia, large parts of the Northern Territory and Queensland, and in some inland parts of northern and central New South Wales). Also naturalised on Christmas Island and elsewhere in tropical regions, including in south-eastern USA (i.e. Texas).
>
> Sabi grass (*Urochloa mosambicensis*) is regarded as an environmental weed in parts of Queensland, the Northern Territory and Western Australia"
> Weeds of Australia website Fact sheet Index (lucidcentral.org)

In the Global compendium of weeds Sabi grass is listed as an agricultural weed, cultivation escape, environmental weed, naturalised, weed (Randall 2017). It is not listed in NSW Weedwise website (https://weeds.dpi.nsw.gov.au/). Sabi grass is not listed in 'Weeds of Australian rangelands' (Martin et al. 2006).

Western Australia:

"….Occurs on disturbed sites in the Ord Valley, Koolan island and along the Lennard River at Windjana Gorge" (Hussey et al. 2007). Keighery and Longman (2004) list Sabi grass as naturalised in three IBRA regions within WA; North Kimberley, Victoria Bonaparte and Central Kimberley. Listed in 'Environmental weeds of Western Australia' as naturalised in Local government Reserves (Keighery 1991).

Cook et al. (2020) states that; "although listed in some weed lists, it is too palatable and insufficiently aggressive to become a serious weed. However, it is regarded as an environmental weed in parts of northern Australia." *U. mosambicensis* is not listed as a 'high impact' grass species in northern Australia (van Klinken et al. 2013). Swarbrick (1983) lists *U.*

mosambicensis as a widespread weed across northern Australia of gardens (lawns, parks), irrigated crops and disturbed or ruderal areas.

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

Sabi grass has widely naturalised in northern Australia and elsewhere in tropical regions (Weeds of Australia website). McIvor (1992) states that sabi grass is a common roadside weed in Africa and often grows in disturbed or overgrazed areas. Sabi grass is not listed in 'Weeds of Australian rangelands' (Martin et al. 2006), or as a 'high impact' grass species in northern Australia (van Klinken et al. 2013).

Sabi grass mainly grows on disturbed sites, and there is little evidence that it can establish among intact native vegetation, and no evidence that it can displace native vegetation.

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

Sabi grass tolerates heavy grazing and close defoliation and can be used for continuous or rotational grazing (McIvor 1992). Livestock selectively graze *U. mosambicensis* when it is young, and still find it more palatable than many other warm-season grasses when mature (Cook et al. 2020). Palatability is very good, even when dry (Skerman and Riveros 1990). The voluntary intake of sabi grass was 50% higher than *Heteropogon contortus* (black speargrass) in northern Australia (Whiteman and Gillard 1971).

In a long-term grazing experiment at two sites in the semi-arid tropical woodlands of Queensland, sown *U. mosambicensis* persisted strongly at one site ('Cardigan') but failed to persist at the second site ('Hillgrove') under the same management. Sabi grass was ranked the second most palatable of the 8 native and exotic grasses in the experiment (McIvor 2007).

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

In a long-term grazing experiment at two sites in the semi-arid tropical woodlands of Queensland, the persistence of *U. mosambicensis* was markedly different. At one site *U. mosambicensis* failed to persist, while at the second site the basal cover increased over time (McIvor 2007).

In replicated field trials in the west Kimberley and Pilbara which were established under irrigation, sabi grass showed moderate to poor persistence after 5 years across range of sites where the long-term average annual rainfall is from 300 to 600mm (G. Moore unpublished data). Better persistence would be expected at higher rainfall sites.

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

Stoloniferous forms spread locally by stolons, while free-seeding types disseminate widely as shown by extensive naturalization (Cook et al. 2020; Weeds of Australia website). Sabi grass has strong colonising ability and can rapidly fill gaps in the pasture, but persistence can be variable (McIvor 2007).

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

Despite growing naturally on soils with low available phosphorus, large responses to applied P have been measured with Sabi grass (McIvor 1984). On very low fertility soils, applications of up to 35kg P/ha may be necessary to maximise production and a critical P level in the tissue of 0.2% of the DM is proposed. Without superphosphate on low P soils, yields can be <0.5t DM/ha, whereas with applied P, comparable yields of >5t DM/ha have been measured (Cook et al. 2020).

Sabi grass can survive on low N soils by virtue of non-symbiotic nitrogen fixation in the rhizosphere, but responds well to applied N.

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

There was negligible excretion of viable seed when Sabi grass seed was placed in the rumen of cattle. The initial germination of the seed was 32.4%, but after being excreted in the faeces only 0.1% of the seed germinated (Gardener et al. 1993), so no potential spread through animal dung.

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

a) Common

b) Occasional

c) Unlikely

d) Don't know

Sabi grass is not tolerant of waterlogging or flooding (McIvor 1992), so does not normally grow adjacent to streams and waterways. However, it is naturalised along the Lennard River at Windjana Gorge (Hussey et al. 2007). 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) Common

b) Occasional

c) Unlikely

d) Don't know

The seed size, weight (2.5mg/seed) and specific gravity (Gardener et al. 1993) indicates the seed is not adapted for long-distance dispersal by wind.

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

a) Common

b) Occasional

c) Unlikely

d) Don't know

Sabi gass is observed growing on roadsides and McIvor (1992) states that it is a common roadside weed in Africa. As a result, 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 sabi grass.

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

Sabi grass can be used for hay making, so seed could potentially be spread in fodder.

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

Sabi grass can establish quickly and as a result the minimum generation time is less than 12 months. However, Sabi grass seed has post-harvest seed dormancy and remains dormant for 6–12 months after harvest, due to physical obstruction of the embryo by the enclosing lemma and palea. For commercial seed production, germination of fresh seed can be improved by removal of these glumes (McIvor 1992; Cook et al. 2020).

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

For the cultivar 'Nixon' there are approximately 1 million seeds/kg (Cameron 2010). In the Northern Territory (NT) 'Nixon' commences flowering three to four weeks after the first rains of the wet season and continues to produce inflorescences until soil moisture is exhausted in the dry season (Cameron 2010).

Sabi grass is free seeding and with commercial seed production, "three, and up to 5 harvests per season are possible with day neutral varieties, but only a single harvest from short-day varieties. Seed is harvested by direct heading, producing seed yields of (80–) 100–190 (–220) kg/ha/harvest, and 300 kg/ha or more per year" (Cook et al. 2020).

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

No information available.

9.4 Can the species reproduce vegetatively?

a) Yes – rapid vegetative reproduction

b) Yes – slow

c) No

d) Don't know

The stoloniferous and rhizomatous types can spread vegetatively to form new plants spreading several metres per year.

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

Sabi grass is a weed of ruderal areas (roadsides) and disturbed vegetation areas and as such is unlikely to directly impact on biodiversity. Where present, on one hand the appearance is not that dissimilar to other tufted and stoloniferous grasses in the WA rangelands. However, it could be visually obvious and may degrade the natural appearance of the landscape.

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 pasture sward of sabi grass may 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. Under favourable conditions, like a disturbed roadside then sabi grass can form dense swards over small areas, but these are localised.

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 northern Western Australia include large areas of grassland with shrub and tree strata with a native grass understory so that any incursion by sabi grass would not usually add a new strata to the ecosystem.

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 sabi grass the foliage is generally less than 0.3–1.0m with seed heads 0.3 to 1.5m in height (Cameron 2010; Cook et al. 2020). It is not spiky and is unlikely to cause any greater obstruction than native tussock-forming grasses. Under favourable conditions sabi grass can form dense swards over small areas, but these would have little effect on physical movement through an area for 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). Sabi grass as a tufted and/or stoloniferous creeping grass does not produce the bulk of the large tufted or bunch grasses like Gamba grass (*Andropogon g*ayanus) which produces large amounts of biomass that dries out quickly and can readily burn. In general, sabi grass pastures produce moderate dry matter production (up to 4-6t DM/ha) without nitrogen fertiliser in the NT (Cameron 2010). Sabi grass is tolerant of fire and recovers after burning (Falvey 1979; Cameron 2010).

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 or toxicity has been recorded (Cook et al. 2020).

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

Sabi grass would provide similar food and shelter to other native perennial grasses in a rangeland context.

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

Sabi grass is likely to grow rapidly in the first year or two and utilise the available nutrients. The biomass production in subsequent years is likely to decline as the nutrient levels are rundown. Plant persistence may 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 as a soil stabiliser and as a groundcover to reduce soil erosion, so is unlikely to cause silting of waterways.

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

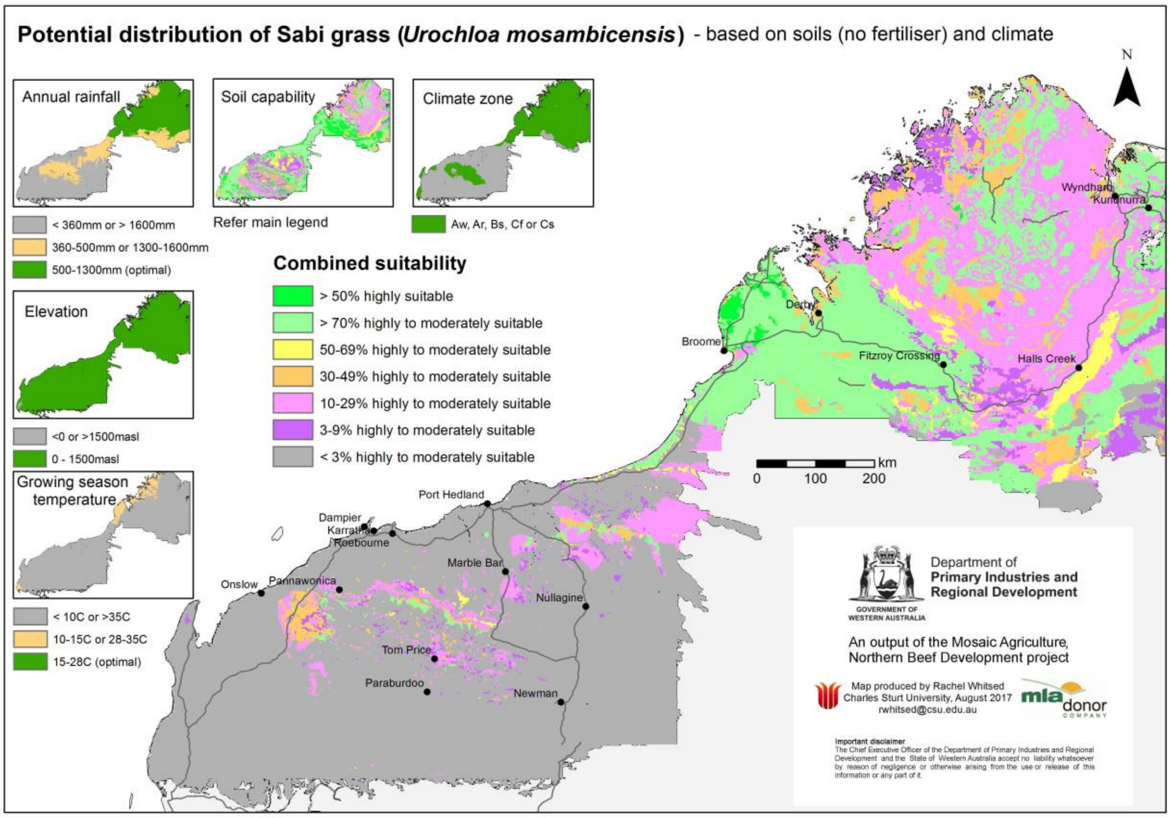
a) Will significantly lower the water table and/or reduce groundwater recharge to the water table.

b) Will have little or no impact on hydrology

c) Don’t know

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 sabi grass would have minimal or no impact on hydrology.

Potential distribution



Region	Area of suitable soils and climate	Potential distribution score
Kimberley	15.5Mha	8.0
Pilbara (>350mm AAR)	1.0Mha	4.0
Pilbara (<350mm AAR)	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)

Invasiveness score = 6.07; Impacts score = 2.5

Region	WRA calculation*	Overall score	WRA rating
Kimberley	6.1 x 2.5 x 8.0	**121.4**	**High**
Pilbara (>350mm AAR)	6.1 x 2.5 x 4.0	**60.7**	**Medium**
Pilbara (<350mm AAR)	6.1 x 2.5 x 0.5	**7.6**	**Negligible-low**
Gascoyne – Goldfields	6.1 x 2.5 x 0.5	**7.6**	**Negligible-low**

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

References:

Cameron AG (2010) Sabi grass (*Urochloa mosambicensis*). Northern Territory Agnote No. E27.

Cook BG, Pengelly BC, Schultze-Kraft R, Taylor M, Burkart S, Cardoso Arango JA, González Guzmán JJ, Cox K, Jones C, Peters M. (2020) Tropical Forages: An interactive selection tool. 2nd and Revised Edn. International Center for Tropical Agriculture (CIAT), Cali, Colombia and International Livestock Research Institute (ILRI), Nairobi, Kenya. www.tropicalforages.inf Accessed April 2022.

Falvey L (1979) Establishment of two *Stylosanthes* species in a *Urochloa mosambicensis* dominant sward in the Daly River basin. *Journal of the Australian Institute of Agricultural Science* **45**, 803-13.

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

Hall TJ (2008) 'Sabi grass'. Pastures Australia Fact Sheet, https://keys.lucidcentral.org/keys/v3/pastures/Html/Sabi_grass.htm Site accessed 2 June 2022.

Harwood MR, Hacker JB, Mott JJ (1999) Field evaluation of seven grasses for use in the revegetation of lands disturbed by coal mining in Central Queensland. *Australian Journal of Experimental Agriculture* **39**, 307-316.

Hussey BMJ, Keighery GJ, Dodd J, Lloyd SG, Cousens RD (2007) 'Western weeds. A guide to the weeds of Western Australia'. Second Edition. The Weeds Society of Western Australia Inc.

Keighery GJ (1991) Environmental weeds of Western Australia. Kowari **2**, 180-188.

Keighery G, Longman V (2004) The naturalized vascular plants of Western Australia 1: Checklist, environmental weeds and distribution in IBRA regions. Plant Protection Quarterly **19**, 12-32.

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

McIvor JG (1984) Effects of phosphorus and superphosphate on the growth of *Urochloa* species. *Australian Journal of Experimental Agriculture* **24**, 571-578.

McIvor JG (1992) *Urochloa mosambicensis* (Hack.) Dandy. In PROSEA 'Plant Resources of the South-East Asia 4 Forages. Mannetje, L.'t and Jones, R.M. (eds). Pudoc Scientific Publishers, Wageningen, the Netherlands. pp. 230-231.

McIvor JG (2007) Pasture management in semi-arid tropical woodlands: dynamics of perennial grasses. *The Rangeland Journal* **29(1)**, 87-100.

Martin TG, Campbell S, Grounds S (2006) Weeds of Australian rangelands. *The Rangeland Journal* **28(1)**, 3-26.

Randall RP (2017) 'Global compendium of weeds' (No. Ed. 3).

Skerman PJ, Riverso F (1990). 'Tropical grasses'. Food and Agriculture Organisation of the United Nations, Rome, 819 p.

Swarbrick JT (1983) Working list of weeds of Queensland, the Northern Territory, and northern Western Australia. *Australian Weeds* **4**, 156-164.

van Klinken RD, Panetta FD, Coutts SR (2013) Are high-impact species predictable? An analysis of naturalised grasses in northern Australia. *PloS one* **8(7)**, p. e68678.

Weeds of Australia database https://keyserver.lucidcentral.org/weeds/data/media/Html/trifolium_repens.htm Site accessed 30 May 2022

Whiteman PC, Gillard P (1971) Species of *Urochloa* as pasture plants. *Herbage Abstracts* **41(35)**, 1-7.

Important disclaimer