DEPARTMENT OF
ENVIRONMENT AND NATURAL RESOURCES

Thatch grass (*Hyparrhenia rufa*):
NT Weed Risk Assessment Technical Report

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CHARLES DARWIN UNIVERSITY

NORTHERN TERRITORY GOVERNMENT

This report summarises the results and information used for the weed risk assessment of Thatch grass (*Hyparrhenia rufa*) in the Northern Territory. A feasibility of control assessment has also been completed for this species and is available on request.

Online resources are available at https://denr.nt.gov.au/land-resource-management/rangelands/publications/weed-management-publications which provide information about the NT Weed Risk Management System including an explanation of the scoring system, fact sheet, user guide, a map of the Northern Territory weed management regions and FAQs.

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Cover photo (top): Infestation in Queensland (J. Clarkson, Queensland Parks and Wildlife). Cover photo (bottom): Infestation near Fogg Dam, Northern Territory, (L. Elliott, Department of Land Resource Management).

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Weed Risk = High

Section A: Invasiveness	67 %
Section B: Impact	58 %
Section C: Potential distribution	48 %
Total score = A x B x C x 1000 =	184

Taxon:	*Hyparrhenia rufa*
Common name:	Thatch grass
Other names:	Jaragua, thatching grass
Family:	Poaceae (grass family)
Lifeform:	Tree/Shrub/Vine/Herb/Grass (Perennial or annual for grass and herb)
Environment:	Terrestrial
Origin:	Africa
Description:	Erect, densely tufted perennial or occasionally annual grass 1-2.5 m tall. Leaves flat, elongate, 30-60 cm long, 2-8 mm wide, narrowed at base, very rough margins. Flower 20-40 cm long, pairs of racemes on sinuous stalks. Racemes c.2 cm, reddish-brown. Spikelets, mostly 5-7 in each raceme, 3-44 mm long, covered with rusty-brown hairs. Awn 15-20 mm long with 2 bends, twisted, red-brown, sparsely covered with stiff hairs
Habitat:	In the native range, it occurs in seasonally flooded grassland and open woodland. It is drought tolerant and withstands dry seasons of several months, seasonal burning and temporary flooding. It invades roadsides, open woodlands and grasslands.
Distribution:	Widely distributed through Central and South America where it invades grasslands and savannas. In Australia, it is mainly found in the coastal districts of Queensland along the east coast (Figure 2). In the Northern Territory, it is still currently restricted to a relatively small number of locations around Darwin and other parts of the Top End.
Legislation:	Not declared in Australia.
Other:	Naturalised in Northern Territory, Queensland and New South Wales.
	Commonly cultivated throughout the tropics for cattle fodder, previously trialled in the Northern Territory but no longer recommended or used.

Summary of weed risk information by section

Invasiveness: In some parts of the world, it is an aggressive invader that transforms savannas. In others, it occupies disturbed areas and roadsides, at least initially. It is highly adapted to fire and easily replaces native vegetation with frequent burning.

Impact: Promotes and is aided by fire, forming monocultures and replacing native vegetation. Tall dense swards burn readily and intensely.

Potential distribution: Tropical savannas and tropical riparian areas are considered most suitable. In the Northern Territory, this broadly corresponds to areas with greater than 500 mm annual rainfall.

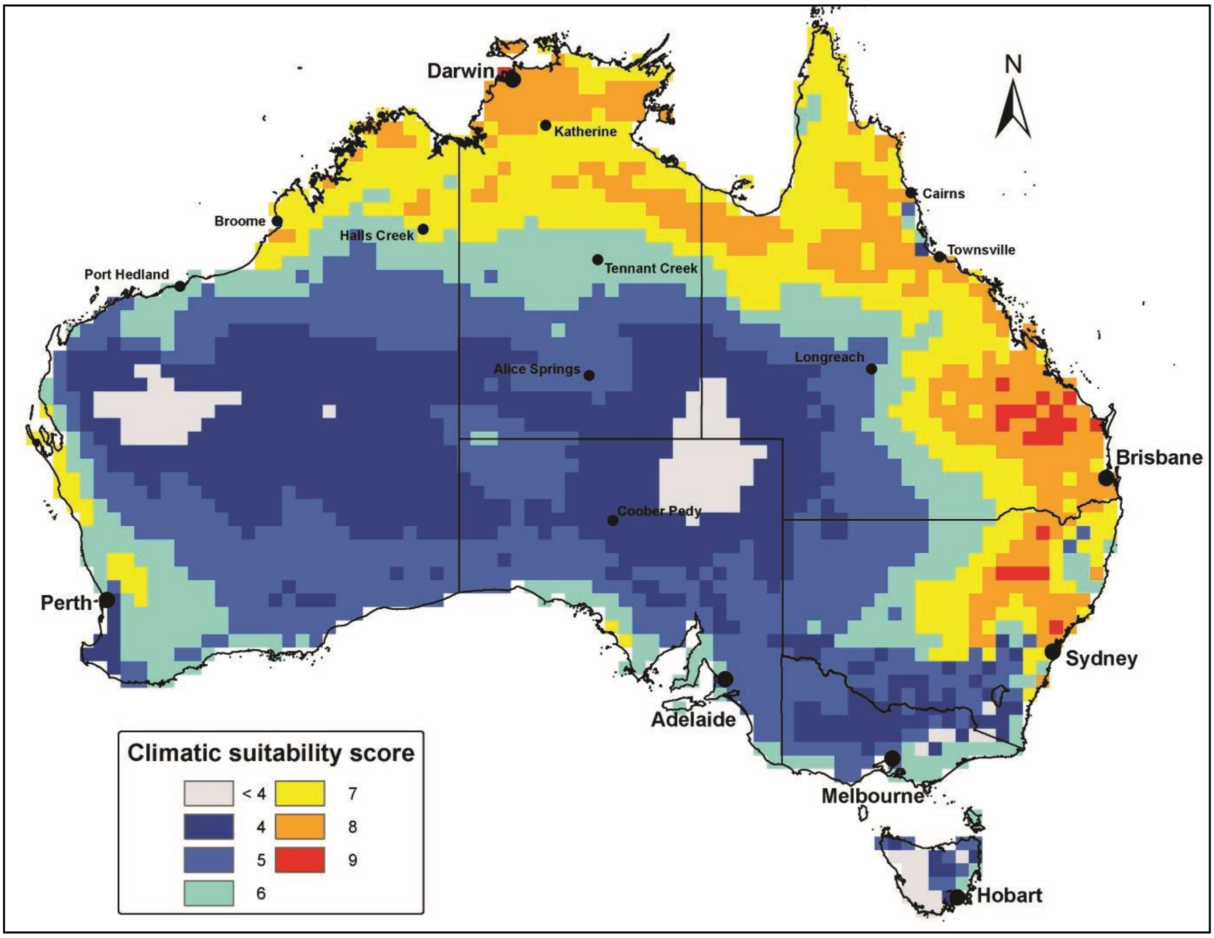

Figure 1. Potential distribution of Thatch grass (*Hyparrhenia rufa*) in Australia using CLIMATCH. Areas of suitable climate are indicated by a climatic suitability score of 7 or above out of 10 (source: NT Weed Management Branch 2007).

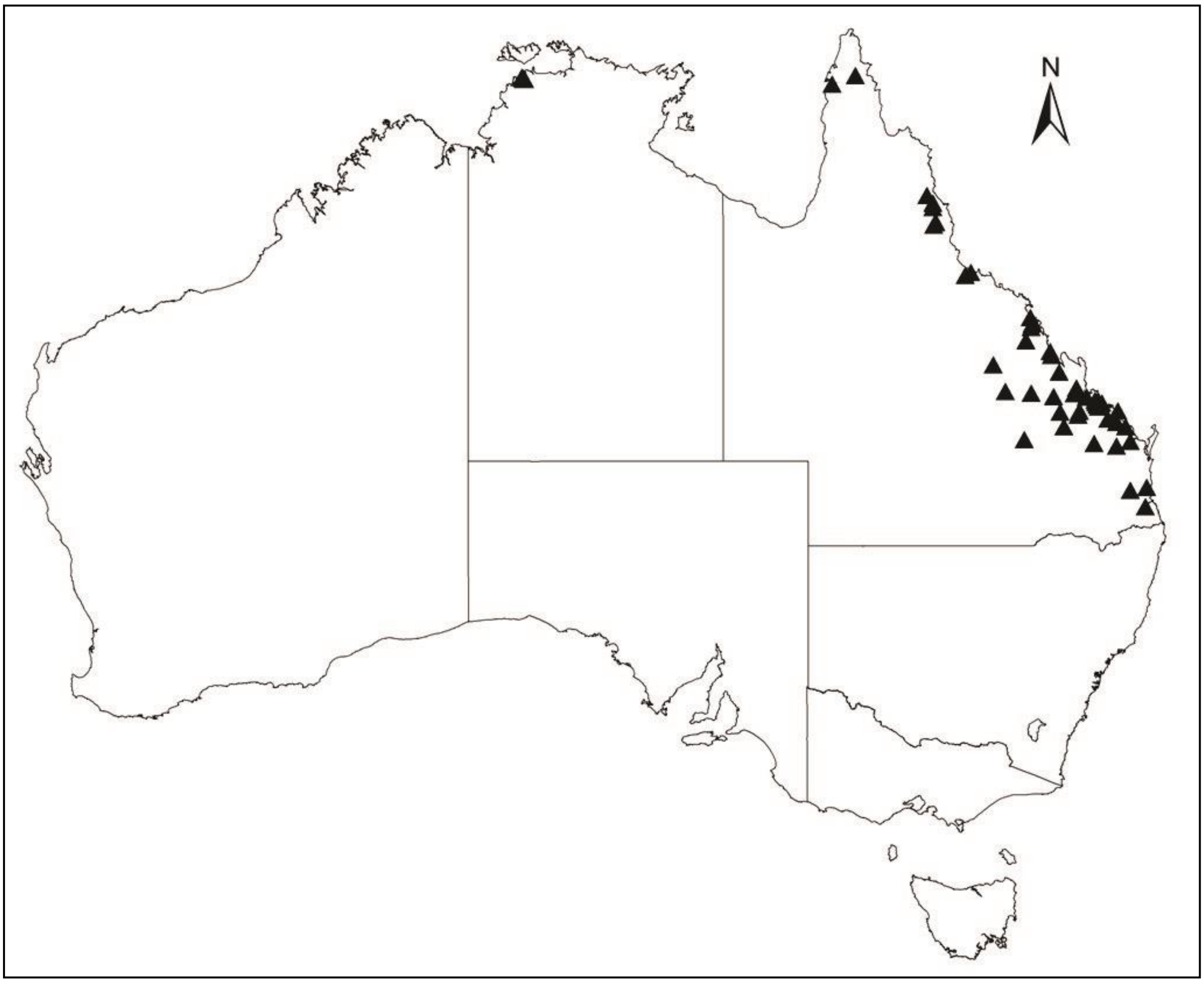

Figure 2. Current records of thatch grass (*Hyparrhenia rufa*) in Australia, represented by black triangles (source: Australian Virtual Herbarium 2013, viewed 21/01/2013, http://avh.ala.org.au/).

Weed Risk Assessment - Determinations

Invasiveness	*Determination*
1. What is the ability of the plant to establish amongst intact native environments?	High
2. What is the reproductive ability of the plant?	
a) Time to seeding	1 year or less
b) Annual production of viable seed per square metre or plant	High
c) Vegetative reproduction	None
3. Do propagules of the plant have properties that allow them to be dispersed long-distance by natural means?	
a) Flying animals (birds, bats)	No
b) Other wild animals	Yes
c) Water	No
d) Wind	Yes
4. How likely is long-distance dispersal by human means?	
a) Deliberate spread by people	Unlikely
b) Accidentally by people and vehicles	Common
c) Contaminated produce	Occasional
d) Domestic/farm animals	Occasional

Impacts	
1. What is the plants competitive potential?	High
2. What is the plant's potential to modify the existing fire behaviour and alter the fire regime?	Some potential
3. What is the plant's potential to restrict the physical movement of people, animals, vehicles, machinery and/or water?	Low
4. What is the plant's potential to negatively affect the health of animals and/or people?	None
5. Does the plant potentially have negative effects on natural and cultural values?	
a) reducing habitat quality for native animals	High
b) threatened species or communities	More than 1
c) sites of natural significance	More than 1
6. Is the plant presumed to have negative effects on environmental health?	
a) soil chemistry/stability	Yes
b) water quality	No
c) hydrology	Yes

Potential distribution	
1. What is the climate suitability score (which indicates out of 10 the proportion of the NT environment that is suitable for the plant)?	4.1
2. How many broad habitat types in the NT will the plant potentially naturalise in (up to 5) ?	Three
3. What is the potential of the plant to occur throughout its favoured habitat in the NT (from those identified in question 2)?	Some

Weed Risk Assessment - Evidence Used

A INVASIVENESS

A1 What is the ability of the plant to establish amongst intact native environments?

When the native savannas in Venezuela are disturbed, usually by fire, African grasses establish in the bare areas . . . Their establishment is facilitated by a better germination than the native grass. Once established, the African grasses successfully compete for resources in the sites with the most favourable water and mineral nutrient supply and the native grass dies out. *H.rufa* competes well in the warmer, drier lowlands…	Baruch et al. (1985)
H. rufa and *M.minutiflora* are able to invade otherwise intact native-dominated savanna ecosystems.	D'Antonio & Vitousek (1992)
Has become established in disturbed areas in the tropical dry forests throughout Costa Rica.	Barnett et al. (2001)
These grasses (including *H.rufa*) escaped from planted areas and eventually became invaders, aided in part by the opening of native communities by fire and deforestation.	Williams & Baruch (2000)
In Hawai'i, *H.rufa* spreads from pastures along roadsides and in disturbed areas.	Starr et al. (2003)
In Venezuela, four African grasses are the most prominent invaders: ….*Hyparrhenia rufa* (Nees) Stapf. in lowland savannas with poor soils and marked dry seasons. The successful encroachment of the alien grasses generally took place only in the wetter and/or more fertile habitats of the savanna. In more stressful sites, the indigenous community persists.	Baruch (1996)
Jaraguas remarkable aggressiveness and self-seeding ability is demonstrated by its capacity to compete with native savanna grasses.	Parsons (1972)
Invasion of native grasslands by these grasses has been documented in Brazil, Colombia, and Venezuela where *Hyparrhenia rufa* (Jaragua) and *Melinis minutiflora* (Molasses grass) have displaced native pasture grasses such as *Trachypogon plumosus*….Ecophysiological studies demonstrate that these grasses tolerate frequent defoliation better than native grasses. *Hyparrhenia* has also invaded Central American woodlands and pastures.	D'Antonio & Vitousek (1992)
Grows as a roadside weed.	Jacobs & Wall (2007)
Habitat: dry to mesic roadsides, disturbed areas.	Pacific Island Ecosystems at Risk (2006) Smith (1979)
Easily establishes in tropical areas, and aggressively invades natural areas.	Global Invasive Species Programme (2003)
Found on disturbed ground and roadsides.	Smith (2002)
Will establish after a burn in natural grassland.	Skerman & Riveros (1990)
Invaded habitats: grassland, savanna, disturbed sites.	Weber (2003)

A2a Reproductive ability: Time to seeding?

No specific information	No reference

A2b Reproductive ability: Annual production of viable seed per square meter or per plant?

Weed Risk Assessment - Evidence Used

The grass produces seeds abundantly.	Weber (2003)
It produces abundant viable seed from which it is easily established.	Skerman & Riveros (1990)

A2c Reproductive ability: Vegetative reproduction?

Root stocks can also be planted.	Skerman & Riveros (1990)

A3a Propagule dispersal: Flying animals (birds, bats)

No specific information	No reference

A3b Propagule dispersal: Other wild animals

No specific information	No reference

A3c Propagule dispersal: Water

No specific information	No reference

A3d Propagule dispersal: Wind

The seed are able to disperse on the wind after fires and germinate well in these conditions.	Starr et al. (2003)
Seeds are dispersed by wind.	Smith (2002)

A4a Human dispersal: Deliberate spread by people

…commonly cultivated throughout the tropics for cattle fodder.	Starr et al. (2003)
Outside of Brazil, it has perhaps reached its maximum development in the drier western side of Central America, especially in Guanacaste and in Nicaragua where it is recognized as the base of a substantial live-stock industry.	Parsons (1972)
A number of C4 African grasses, most importantly, *Hyparrhenia rufa …*were brought in to support grazing in savanna regions and in cleared forests (Central and South America).	D'Antonio & Vitousek (1992)
Hyparrhenia rufa was introduced to the Northern Territory to determine its performance as an improved pasture plant in pasture trials.	Cameron et al. (1984)

A4b Human dispersal: Accidentally by people and vehicles

Spread is also by vehicles and machinery eg. road graders.	Smith, N. M. (2002)
Seeds with long bristles are capable of catching on people…that walk past the plant.	Starr et al. (2003)
It is dispersed by seed with uncommon ease.	Parsons (1972)

A4c Human dispersal: Contaminated produce

No specific information	No reference

Weed Risk Assessment - Evidence Used

A4d	**Human dispersal: Domestic/farm animals**	
	Seed with long bristles are capable of catching on … animals that walk past the plant.	Starr et al. (2003)

B IMPACTS

B1	**What is the plant's competitive potential?**	
	Especially in the drier areas, where the dry season lasts five months or more, it has held a strong competitive advantage.	Parsons (1972)
	It forms dense swards ... that displace native grasses and forbs, preventing the establishment of other species and transforming native savannas into species pure stands.	Weber (2003)
	It outcompetes and smothers other weeds, and – since it is a fire-adapted species – it readily replaces native plants after fires.	Global Invasive Species Programme (2003)
	It competes successfully with weeds and smothers them.	Skerman & Riveros (1990)
	The opportunistic water use of alien grasses contrasts with that of native grasses and probably contributes to the higher competitive potential of the former in the seasonal tropical savannas.	Baruch et al. (1985)
	Some African grasses, such as … *H.rufa*, have allelopathic effects which act either directly, retarding the growth of potential woody competitors or indirectly through secretion of antibiotics that suppress the growth of nitrifying bacteria (Marinero 1964, Boughey *et al.* 1964, cited in Baruch 1996).	Baruch (1996) Boughey et al. (1964) Marinero (1964)
	The higher growth rates and nutrient concentration of the introduced grasses (including *H.rufa*) are consistent with their ability to establish rapidly, compete successfully for resources, and displace *T.plumosus* from moist, fertile sites. Conversely, the slower growth rate, lower nutrient concentrations and superior water relations characteristics are consistent with the capacity of *T. plumosus* to resist invasion by introduced grasses in poorer sites.	Baruch et al. (1985)
	Jaraguas remarkable aggressiveness and self-seeding ability is demonstrated by its capacity to compete with native savanna grasses.	Parsons (1972)

B2	**What is the plant's potential to modify the existing fire behaviour and alter the fire regime?**	
	May carry wildfire (Smith 1979 cited in Pacific Island Ecosystems at Risk 2006).	Pacific Island Ecosystems at Risk (2006) Smith (1979)
	All four of these grasses (including *H.rufa*) burn readily and resprout rapidly following fire; the consequent grass-fire interaction is thereby capable of maintaining cleared forest land as a derived savanna or grassland, preventing succession back to forest. In Central America, *Hyparrhenia* has received the most attention from ecologists, since when it is not heavily grazed it forms tall, dense stands that burn readily and intensely. In contrast, fires in comparable sites dominated by native grasses are patchy and less intense. *H. rufa-fueled* fires can burn into successional and even intact tropical dry forest and represent a serious threat to preservation of this ecosystem in Guanacaste National Park in Costa Rica and elsewhere.	D'Antonio & Vitousek (1992)

Weed Risk Assessment - Evidence Used

Even more than the other exotic grasses in the New World tropics, jaragua appears to be aided by fire. After a number of years, it may tend to weaken and eventually be invaded by other species unless regularly burned. Stockmen, who know this well, fire jaragua ranges each year in the dry seaon and graze it rather closely during the rainy period to avoid it becoming rank and fibrous with progressively less nutritive value.	Parsons (1972)
… the large standing dead biomass left by alien grass communities (including H.rufa) at the end of the dry season facilitates combustion and increases fire intensity, altering the microclimate and resulting in larger losses of nitrogen and sulfur through volatilization compared to that of the native grasslands (Medina 1993 cited in Baruch 1996).	Baruch (1996) Medina (1993)
H.rufa is an aggressive fire adapted grass. As non-native fire adapted grasses increase in an area, fire loading, frequency and fire size is increased. Native plants, not well adapted to fire tend to decrease. *H.rufa* is common in Hawai'i Volcanoes National Park and contributes to the fire regime there.	Starr et al. (2003)
The high biomass production of African invader grasses such as Hyparrhenia rufa is one of their main features that contributes to their high competitive potential. Hyparrhenia rufa has invaded and displaced native grasses such as *Trachypogon plumosus* to form closed, almost monospecific stands. The opening of the native savanna by fire favoured Hyparrhenia colonisation due to its higher germination potential and fast seedling growth. In turn, the large biomass of taller *Hyparrhenia rufa* grasses caused more intense fires during the dry season which opened more of the native savanna. Such a positive feedback loop led to a fire-invasion cycle, where herbaceous biomass was increased as a result of burning. Even under grazing *Hyparrhenia rufa* was advantaged because of its growth compensation mechanism.	Getzin (2002)
After fires, *H.rufa* and other fire adapted non-native grasses, dominate the understory, which in turn adds to the fuel load, frequency and size of future fires. Most native plants are not well suited to fire and eventually few remain.	Starr et al. (2003)

B3 What is the plant's potential to restrict the physical movement of people, animals, vehicles, machinery and/or water?

Forms dense closed stands nearly 3 m tall.	Baruch (1996)

B4 What is the plant's potential to negatively affect the health of animals and/or people?

Ndyanabo (1974) recorded 0.84 percent total oxalic acid in the dry matter, but no toxicity.	Ndyanabo (1974) Skerman & Riveros (1990)

B5a Natural & cultural values: Reducing habitat quality for native animals

… the decrease in species richness and structural heterogeneity accompanying the displacement of the indigenous savanna would lead to a loss of diversity and reduced persistence of the native animal populations that depend on native plants for nourishment and refuge (Medina 1993 cited in Baruch 1996).	Baruch (1996) Medina (1993)

B5b Natural & cultural values: Threatened species of communities

The native partridge pigeon (*Geophaps smithii smithii*) could be impacted by thatch grass as it requires open patchy grasslands.	J. Woinarski, NT Biodiversity Conservation, pers. comm. (2007) Woinarski (2006)

Weed Risk Assessment - Evidence Used

The brush-tailed rabbit-rat (brush tailed tree-rat) *Conilurus penicillatus* could be impacted by thatch grass as it requires open patchy grasslands.	J. Woinarski, NT Biodiversity Conservation, pers. comm. (2007) Woinarski (2007)

B5c Natural & cultural values: Sites of natural and cultural significance

Kakadu National Park and the Tiwi Islands are both areas of conservation significance that would be adversely affected by *Hyparrhenia rufa*.	Harrison et al. (2009) J. Woinarski, NT Biodiversity Conservation, pers. comm. (2007)

B6a Environmental health: Soil chemistry/stability

The higher biomass per unit area of the communities dominated by alien grasses (including *H. rufa*) indicates that the amounts and rates involved in nutrient cycling should be higher than in the native savannas. It is possible that the high nutrient requirements of alien species deplete the soil reserves and there is also a potential for nutrient loss from the large standing dead biomass exposed to rainfall leaching and to volatilization by fire in the communities dominated by alien grasses.	Baruch (1996)

B6b Environmental health: Water quality

No specific information.	No reference

B6c Environmental health: Hydrology

Although detailed studies are not available, it is conceivable that the establishment of communities dominated by alien grasses can alter the water balance of the areas through increased evapotranspiration rates, rainfall interception, and decreasing soil water recharge and runoff in virture of their higher leaf are index, deeper root system and higher transpiration rates than native savanna communities.	Baruch (1996)

C POTENTIAL DISTRIBUTION

C1 What is the CLIMATE suitability score (which indicates the proportion of the NT environment that is suitable for the plant)?

A common roadside weed in Queensland. First introduced into the Northern Territory in the 1960s and is present in the Darwin/Palmerston area.	Smith (2002)
A weed of roadsides in Queensland and now is becoming established in the Darwin region of the Northern Territory.	Smith (2001)
The altitude range is reported as up to 2,000 m (6.562 ft) in Colombia. Minimum rainfall requirements are reported as 600-1,400 mm (24-55 in) annually and it is said to be rather drought tolerant.	Skerman & Riveros (1990)
The CLIMATCH model used by the NT Weed Management Branch predicts that 41% of the Northern Territory is climatically suitable for *Hyparrhenia rufa* (see Figure 1).	NT Weed Management Branch (2007)

C2 How many broad vegetation types in the NT will the plant potentially naturalise in (up to 5) ?

Weed Risk Assessment - Evidence Used

The broad vegetation types that *Hyparrhenia rufa* will potentially naturalise in are: • Tropical riparian areas • Tropical open forests/savanna woodlands Of these, the favoured vegetation type is tropical open forests/savanna woodlands.	NT Weed Risk Management Committee (2007) Rossiter-Rachor et al. (2012)

C3 What is the potential of the plant to occur throughout its favoured habitat in the NT (identified in question 2)?

Hyparrhenia rufa has the potential to occur through some of its favoured habitat.	NT Weed Risk Management Committee (2007)

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