Department of
Primary Industries and
Regional Development

GOVERNMENT OF
WESTERN AUSTRALIA

Environmental weed risk assessment

Caatinga stylo (*Stylosanthes seabrana*)

Family: Fabaceae

Common name: Caatinga stylo

Cultivars: Unica, Primar

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Date completed: May 2022

Species summary:

Stylosanthes seabrana is a perennial legume native to Bahia Region of Brazil. The common name ‘Caatinga’ is a type of subtropical vegetation (xeric shrubland and thorn forest), and an ecoregion characterized by this vegetation in interior north-eastern Brazil.

Caatinga stylo is a short-lived perennial and generally lives between 2 to 4 years. It has a woody base and trifoliate leaves with elongated leaflets. The two varieties released in Australia in 1996 have an erect growth habit to ~1m and are resistant to anthracnose disease (Edy and Mass 1997; Edye et al. 1998; Maass and Mannetje 2002; Cook et al. 2020).

Caatinga stylo is well-adapted to tropical and subtropical environments with summer-dominant rainfall of 700–1,200mm (range 400-1,400mm), but grows best in years with a long growing season (FAO EcoCrop Database; Cook et al. 2020). They are drought tolerant but do not grow in seasonally flooded soils. Caatinga stylo can tolerate frost, however, does it not grow in cool temperatures and drops leaves in winter. Plants that are frosted to ground level regrow when moisture and temperature conditions are suitable in spring. Seedlings may die during heatwaves in early summer (Cook et al. 2020).

Caatinga stylo is cultivated in Australia (Queensland).and is used as grazed pasture legume and summer ley legume on fine-textured soils. It is adapted to medium- to fine-textured soils, particularly heavy clays, but also clay loams, loams and sandy-earths. However it is not adapted to sandy soils and while it prefers more fertile soils, it can grow on soils that are fairly low in phosphorus and calcium (Cook et al. 2020).

Stylosanthes seabrana is not recorded as a weed in Australia and there is no mention of this species in any of the weed literature pertaining to Australia. It most likely has only been grown to a very limited extent in Western Australia to date and the authors are not aware of any commercial stands. There are no records of it being naturalised in Australia.

Figure 1. The distribution of *Stylosanthes seabrana* in Australia from the Australian 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

Stylosanthes seabrana is not recorded as a weed in Australia and there is no mention of this species in any of the weed literature pertaining to Australia or in the 'Global Compendium of Weeds' (Randall 2017). It is not listed in invasive naturalised plants in south-east Queensland (Batianoff and Butler 2002) or Biosecurity Queensland (2021).

Stylosanthes seabrana is not listed in 'Western Weeds' (Hussey et al. 2007), or Environmental weeds of Western Australia (Keighery 1991) or the Naturalized vascular plants of Western Australia (Keighery et al. 2004), or the Western Australia Herbarium (1988).

As "*Stylosanthes seabrana* can produce a high number of hard seeds, it may ultimately pose a weed threat, however there is no evidence that this has occurred. Also its production is usually constrained by lack of appropriate rhizobium" (Cook et al. 2020).

However, there are other species in the Genus which have been reported to be environmental weeds. For example, the 'Global Compendium of Weeds' (Randall 2017) notes that *Stylosanthes hamata* has been reported as naturalised, a weed of agriculture and a weed of the natural environment in Australia.

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

Stylosanthes seabrana has highly specific Rhizobia requirements (CB 3481) which limits its ability to spread away from sown areas and as a result it is likely that it will only successfully establish in highly disturbed areas. Cook et al. (2020) states that as, "*Stylosanthes seabrana* can produce a high number of hard seeds, it may ultimately pose a weed threat, however there is no evidence that this has occurred".

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

S. seabrana has moderate palatability and as a small sub-shrub it is generally only lightly grazed, stock preferring the associated grasses when they have green-leaf. The main contribution is to improve the quality of associated grass and provide higher quality feed as grasses mature in grazing situations and in improving soil fertility for succeeding crops (Cook et al. 2020).

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 replicated field trials at multiple sites in the west Kimberley, Caatinga stylo initially grew well especially on a cracking clay in the Fitzroy Valley, but as a short-lived perennial legume the original plants died after 2 to 4 years and although there were many recruits most of these failed to persist through an extended dry season and below average wet season (G. Moore unpublished data). In high rainfall areas in the north Kimberley this result may change, and they may have better persistence, but no field evidence to suggest either way.

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 replicated field trials at multiple sites in the west Kimberley, Caatinga stylo initially grew well, seeded and produced many recruits, however there was no spread outside of the trial area after 4 to 5 years (G. Moore 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

Caatinga stylo is adapted to medium- to fine-textured soils, particularly heavy clays, but also clay loams, loams and sandy-earths. However it is not adapted to sandy soils and while it prefers more fertile soils, it can grow on soils that are fairly low in phosphorus and calcium (Cook et al. 2020). *Stylosanthes seabrana* has highly specific Rhizobia requirements (CB 3481) and does not nodulate with the background native Rhizobia which will also limit its growth.

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

This is likely to be the main mechanism of dispersal. As a hard-seeded legume Caatinga stylo is likely to behave in a similar way to other hard-seeded legumes, whereby hard-seed allows passage through the rumen with a proportion of the seed softening and germinating in dung. Cook et al. (2020) reports that Caatinga stylo has a lower hard-seed level than either *S. scabra* or *S. hamata*.

In a study Gardener (1993) found ingestion of shrubby stylo seed by cattle and that digestion had little effect on the hard seed passing through the gut.

> "Seed content in the cattle faeces reached a peak at the end of the wet season and accounted for 8% of seed production. Only 1.5% of the seed excreted in the grassland grew into established plants despite most seeds being viable. Varying the amount of grass had little effect on establishment. The two short-lived herbaceous species, *S. guianensis* and *S. hamata*, were more efficient colonizers (i.e. produced more seedlings per unit biomass) than the more perennial shrubby types of *S. scabra* and *S. viscosa*" (Gardener 1993).

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

a) Common

b) Occasional

c) Unlikely

d) Don't know

Caatinga stylo is well adapted to fine-textured soils and as these soils occur on the levees and ???and following intense rainfall there is widespread runoff some dispersal by water is likely.

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

a) Common

b) Occasional

c) Unlikely

d) Don't know

Caatinga stylo sed has no adaptations for 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

No information found that described dispersal by people and vehicles, however due to having high seed production and hard-seed levels, there is a some chance of it being dispersed by people and vehicles.

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

a) Common

b) Occasional

c) Unlikely

d) Don't know

Hall (2007) reports that Caatinga stylo can make good quality hay, although there are no reports as to how common hay production is in Queensland where it is commercially grown.

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

When sown in December, both cultivars (Primar and Unica) flowered in March and April with mature pods forming from early May with Primar being more advanced than Unica. Primar flowers 2–4 weeks earlier than Unica in the establishment year, and can be harvested in early July, while Unica can be harvested in late July. In subsequent years appears to flower and set seed through much of the growing season (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

Hall (2007) reports that Caatinga stylo is a prolific seeder, responds to irrigation and fertiliser, with potential seed yields of 'seed crops' greater than 500kg/ha. Seeds are 1.5mm long, cream coloured, kidney shaped and form in pods. There are about 450,000 seeds-in-pod and 690,000 dehulled seeds per kilogram (Cook et al. 2020). Thus, well managed seed crops could produce >22,000 seeds per square metre.

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

Hard-seed levels in *S. seabrana* are usually much lower than in other stylos such as *S. scabra* and *S. hamata*, although some types can have >70% hard-seed and may require scarification to achieve 50% germination. Caatinga stylo seeds well, developing a large bank of soil seed, with seed lasting in the soil for 2 or more years (Cook et al. 2020).

9.4 Can the species' reproduce vegetatively?

a) Yes – rapid vegetative reproduction

b) Yes – slow

c) No

d) Don't know

No information found that mentions reproduce vegetatively.

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

With the absence of the specific Rhizobia it requires in soils under native vegetation the growth of Caatinga stylo is unlikely to result in vigorous growth. However, depending on the surrounding native vegetation Caatinga stylo could be visually obvious in some circumstances, although in many vegetation types it is unlikely to be conspicuous.

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

With the absence of the specific Rhizobia it requires in soils under native vegetation the growth of Caatinga stylo is unlikely to result in vigorous growth which would suppress or displace the native vegetation, given the native vegetation is well adapted to that environment.

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

As a small perennial herbaceous legume (up to 1.2m), but often limited in height by grazing (Cook et al. 2020), Caatinga stylo is unlikely to provide a new strata within the rangelands of northern WA.

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

As an herbaceous legume with a woody base which typically grows from 0.4 to 0.7m (occasionally to 1.2m in height), it will not adversely affect physical movement in a rangeland setting.

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

With its highly specific Rhizobia requirements and slow seedling growth, Caatinga stylo is unlikely to produce a large biomass and change fire behaviour in a rangeland setting.

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 known livestock disorders (Hall 2007).

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

With the absence of the specific Rhizobia in soils under native vegetation the growth of Caatinga stylo is unlikely to be greater than the native grasses and herbs.

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

As a perennial legume Caatinga stylo could potentially increase soil nutrient levels, but this is unlikely as it has highly specific Rhizobia requirements and does not effectively nodulate with the native Rhizobia in Australian soils (Hall 2007; Cook et al. 2020).

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

Caatinga stylo is well adapted to cracking clay soils which in northern Western Australia are found on levees adjacent to major rivers, and alluvial plains of the main river systems in the Kimberley (Smolinski 2021), however it is not tolerant of flooding (Cook et al. 2020) and is unlikely to reduce water quality or 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?

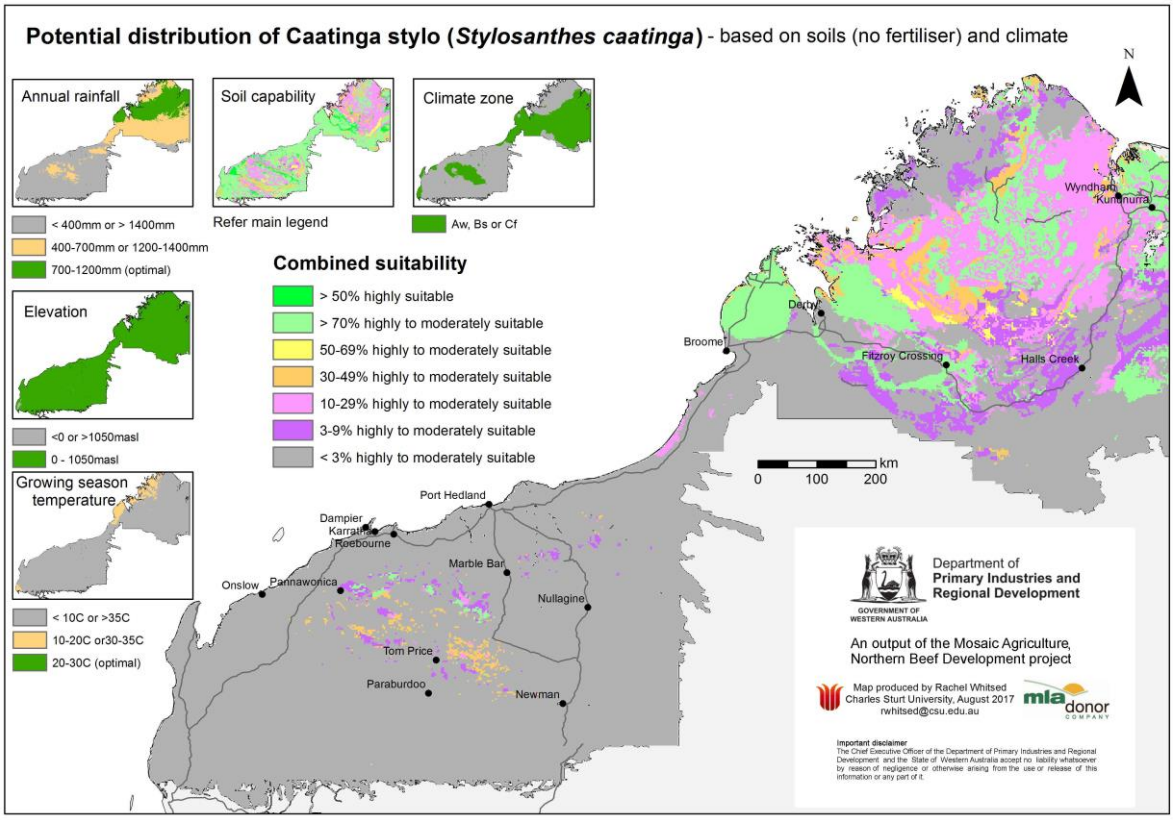
a) Will significantly lower the water table and/or reduce groundwater recharge to the water table.

b) Will have little or no impact on hydrology

c) Don't know

As a small herbaceous legume, Caatinga stylo is unlikely to affect the hydrology in a landscape where woody vegetation is largely ubiquitous.

Potential distribution



Region	Area of suitable soils and climate (million ha)	Potential distribution score
Kimberley (>400mm AAR)	7.6Mha	7.0
Kimberley (<400mm AAR)	0	0.5
Pilbara (>400mm AAR)	0.27Mha	2.0
Pilbara (<400mm 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)

Caatinga stylo: Invasiveness score = 4.3; Impacts score = 1.0

Region	WRA calculation*	Overall score	WRA rating
Kimberley (>400mm AAR)	4.3 x 1.0 x 7.0	**30.1**	**Negligible-low**
Kimberley (<400mm AAR)	4.3 x 1.0 x 0.5	**2.2**	**Negligible-low**
Pilbara (>400mm AAR)	4.3 x 1.0 x 2.0	**8.6**	**Negligible-low**
Pilbara (<400mm AAR)	4.3 x 1.0 x 0.5	**2.2**	**Negligible-low**
Gascoyne – Goldfields	4.3 x 1.0 x 0.5	**2.2**	**Negligible-low**

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

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