



Environmental weed risk assessment

Centro (*Centrosema pascuorum*)

Family: Fabaceae

Common name: Centro, Cavalcade, Centurion

Cultivars include: Cavalcade, Bunday

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Species summary:

Centro is a warm season, annual herbaceous legume native to drier regions of South and Central America (Clements and Williams 1980). It has a twining growth habit with relatively fine stems up to 2m long. The leaves are trifoliate and the leaflets are long (50–100mm) and narrow (5–10mm wide), which can give centro a 'grassy appearance' (Cameron 2009). Centro is commonly referred to by the cultivar name, 'Cavalcade'.

The crimson flowers are mostly self-pollinated and there are approximately 15 seeds per pod (long slim pods 3.5-7cm long, 3-4mm wide). When the pods are mature, they shatter and the seeds scatter up to one metre (Cameron 2013). In the top end of the Northern Territory, 'Cavalcade' commences flowering in mid-March, while 'Bunday' is a later flowering cultivar with hairy stems and smaller seeds starts flowering mid-April.

C. pascuorum can tolerate seasonal flooding and is well adapted to fertile soil types and is suitable for mixtures with grasses, or in pure stands for ley-farming. Centro is well adapted to tropical regions of Northern Territory (NT), Queensland, and Western Australia (WA) with annual rainfall of 700-1500 mm (Anning 1982; Clements et al. 1984) but is less persistent in lower rainfall areas and lower temperatures (Clements et al. 1985). It is grown extensively through the Top End of the NT, making up over 90% of the legume hay produced (Cameron 2005). Centro is also used to produce legume cubes for the live export trade. The centro grown in the NT is almost all dryland (rainfed).

Centro has been recorded from disturbed sites around Broome and Kununurra (Hussey et al. 2007). Keighery and Longman (2004) record it as naturalised in the IBRA Regions of Victoria Bonaparte and Dampierland in northern WA.

There has been limited centro grown in northern WA, either dryland or under irrigation, but it is now being evaluated over summer under irrigation in the low rainfall coastal agro-climatic zone. As a warm-season, annual legume it is well suited to all of the climatic zones with a growing period from September–October through to April–May. It has poor frost tolerance with limited growth over the cooler dry season.



Figure 1 The distribution of centro (*Centrosema pascuorum*) 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

In Lonsdale (1994) centro was the only legume which was considered as a useful pasture plant without being weedy. According to Tropical Forages (Cook et al. 2005) *C. pascuorum* has none or low weed potential. It is not listed in the comprehensive Weeds of Australia website [Fact sheet Index \(lucidcentral.org\)](http://www.lucidcentral.org/). Evaluated as a low weed risk by the Northern Territory Weed Risk Assessment method (Cameron 2009).

Centro is naturalised in disturbed sites in northern WA (Hussey et al. 2007; Keighery and Longman 2004), but not listed in Environmental weeds of Western Australia (Keighery 1991). In NSW, *C. pascuorum* is reported as an agricultural weed and naturalised (Hosking 2003). It is on the list of exotic plants that have naturalised within the wet tropics bioregion in north Queensland (Werren 2001).

On the other hand, common centro (*Centrosema molle*; synonym *C. pubescens*) was introduced as a pasture legume but is now regarded as an environmental weed in the tropical regions of northern Queensland and the Northern Territory. It is actively managed by community groups in the Northern Territory and is listed as an 'undesirable plant' in the Wet Tropics World Heritage Area of northern Queensland (Weeds of Australia website [Fact sheet Index \(lucidcentral.org\)](http://www.lucidcentral.org/)). *C. pascuorum* has not been assessed on the Pacific Island Ecosystems at Risk (PIER) weed risk assessment system, but the related *C. molle* has been assessed as a high risk with a score of 11 (PIER 2018).

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

Centro has been recorded from disturbed sites around Broome and Kununurra (Hussey et al. 2007) but is not recorded as being present in reserves or National Parks in 'Environmental weeds of Western Australia' (Keighery 1991).

There is no evidence from within Australia or overseas that it will establish in native vegetation without significant disturbance.

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

Centro has moderate tolerance to grazing and cutting (Cook et al. 2005). It is a palatable legume and well accepted by stock but requires some form of rotational grazing to persist and tends to die out in continuously grazed mixed pastures (Cameron 2009). In the NT, broadleaf weeds such as sida (*Sida acuta*), senna (*Senna obtusifolia*) and portulaca (*Portulaca oleracea*) can be difficult to control in a centro pasture (Cameron 2013).

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

The density of centro stands decline over time even under good management. For example, centro fodder production requires re-seeding every 3-4 years to maintain a pure sward (Cook et al. 2005). Pure centro swards are invaded by grass weeds (Martin 1996). Under irrigation at Katherine in the NT, cultivar Bunday produced 15.2t DM/ha and Cavalcade 18.7t DM/ha with 4 cutting cycles over 12 months with an average of 16.5% and 15.6% CP, respectively. However, there was little production from May until the temperature increased in September–October and even though the plants remained green over winter, the stands were invaded by weeds and plant numbers declined (Anon unpublished).

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

- a) High risk – plants with a history of spreading rapidly with many plants successfully establishing under favourable conditions >200m from the sown area within 5 years for herbaceous perennials or 10 years for woody perennials
- b) Medium risk – some plants will spread outside the planted area and successfully establish under favourable conditions >100m from the sown area within 5 years for herbaceous perennials or 10 years for woody perennials
- c) Low – No or minimal spread of sown species. Outside the planted area a few plants will spread and successfully establish within 100m of the planted area under favourable conditions within 5 years for herbaceous perennials or 10 years for woody perennials
- d) No spread of sown species more than 10m outside the planted area within 5 years for herbaceous perennials or 10 years for woody perennials
- e) Don't know

In the legume field nursery trials in the west Kimberley and Pilbara to assess weed risk there was no persistence of centro at three sites (Derby, East Pilbara, Fitzroy Valley) after 4 years, while it was only just alive at the La Grange site (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

Centro is well adapted to the dry tropics, tolerates seasonal flooding and adapts to a wide range of soil conditions including heavy clays but excluding very acid, low-fertility soils (Cook et al. 2005). Centro can nodulate with background Rhizobia where legumes have been growing previously or native legumes are present (Cameron 2013).

Centro is adapted to a wide range of soils, from sand to heavy clay and from slightly acid to alkaline soils (pH 5–8.5), but requires medium to high soil fertility and establishment and growth is improved with phosphorus fertilizer (Cook et al. 2005). Generally, superphosphate at the rate of 100kg to 250kg/ha should be applied at sowing on virgin or previously unfertilised areas (Cameron 2013).

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

As an annual legume with a component of hard-seed, centro is likely to behave similarly to other hard-seeded tropical legumes whereby some of the hard-seed is passed through the rumen and excreted in the faeces (Gardener et al. 1993). For example, with the related species *Centrosema molle* (syn. *C. pubescens*) which has a similar seed size – when placed in a steer's rumen 22% of the seed was excreted in the faeces and of the excreted seed 49.8% was germinable and 33% was hard-seed (Gardener et al. 1993).

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

- a) Common
- b) Occasional**
- c) Unlikely
- d) Don't know

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

- a) Common
- b) Occasional
- c) Unlikely**
- d) Don't know

The seed pods shatter violently, but this only disperses the seeds over approximately 1m. The seeds could be occasionally blown short distances on the soil surface but have no adaptations specifically for wind dispersal.

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

- a) Common
- b) Occasional**
- c) Unlikely
- d) Don't know

This may happen occasionally, but no evidence that a significant factor.

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

The main use of centro in the Top End of the NT is dryland hay production, making up over 90% of the legume hay produced (Cameron 2005). Centro is also used to produce legume cubes for the live export trade. The centro grown in the NT is almost all dryland (rainfed). There is currently little or no dryland or irrigated centro hay production in northern WA, but this could change in the future.

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

As an annual legume growing over the wet season in the tropics, centro flowers and sets seed within 5-6 months.

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

- a) Prolific seed production high (e.g. >1000 m²/year for woody species, >5000 m²/year for herbaceous species)**
- b) Moderate – low seed production
- c) None (or seed is sterile)
- d) Don't know

Cavalcade (public) is a quantitative short-day plant that flowers with a 12-hour photoperiod or less. In longer days (13-hour photoperiod), buds may be produced but they abort at high temperatures (33/28°C day/night) and no seeds are produced (Mannetje and Jones 1992).

The long linear pods can shatter violently on maturity scattering seed up to 1m thus allowing dispersal of seeds. Cavalcade is reported to have 48,000 seeds/kg and cultivar Bunday 58,000 seeds/kg (Cook et al. 2005). With seed crops, yields of up to 1000kg/ha have been recorded (Cameron 2013).

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

There is no information available.

9.4 Can the species' reproduce vegetatively?

- a) Yes – rapid vegetative reproduction
- b) Yes – slow
- c) No
- d) Don't know

Centro can have adventitious roots forming on trailing stems (Cook et al. 2005), but these do not form new plants.

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

There is no evidence from Australia or overseas that centro will establish in native vegetation without significant disturbance so is unlikely to adversely affect the biodiversity. Centro is a legume with a grass-like appearance (Cameron 2013) so is unlikely to be visually obvious in a rangeland environment in northern WA where perennial and annual grasses are ubiquitous.

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

Centro is unlikely to inhibit the establishment of other species in a rangeland setting. Some soil disturbance is crucial to ensure good establishment and it is advisable to control weeds during establishment (Cook et al. 2005; Cameron 2013). Under agricultural conditions centro fodder production requires re-seeding every 3-4 years to maintain a pure sward (Cook et al. 2005), as pure centro swards are invaded by grass weeds (Martin 1996).

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 an annual twining legume which ungrazed grows to a height of 50-80cm, centro 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 annual legume which grows to a height of 50-80cm under good conditions when ungrazed and the long, narrow leaflets give centro a 'grassy appearance' (Cameron 2009). It is unlikely to restrict the movement of people, animals or water in the rangeland environment.

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

Dry matter production is moderate when compared with many other species and moderately grazed, so the species is unlikely to have an impact on fire regimes in terms of increasing the fuel load (biomass).

Stands of centro are unlikely to survive a fire, but the population will regenerate from soil seed reserves (Cook et al. 2005).

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**

There is no record of toxicity to livestock (Cook et al. 2005) and it does not produce burrs or spines or harbour diseases.

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

There is no evidence that centro provides more shelter than the native vegetation and as only naturalised in disturbed sites would suggest this is unlikely, but as a legume that can nodulate with the background rhizobia the feed quality and especially the crude protein is higher than many native shrubs and grasses.

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 legume which can nodulate with the background Rhizobia (Cameron 2013), centro could increase soil nutrient levels through nitrogen fixation. In an agricultural setting, centro is suitable as a green manure crop and can provide 80–100kg N/ha to a following crop (Thiagalingam et al. 1997).

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

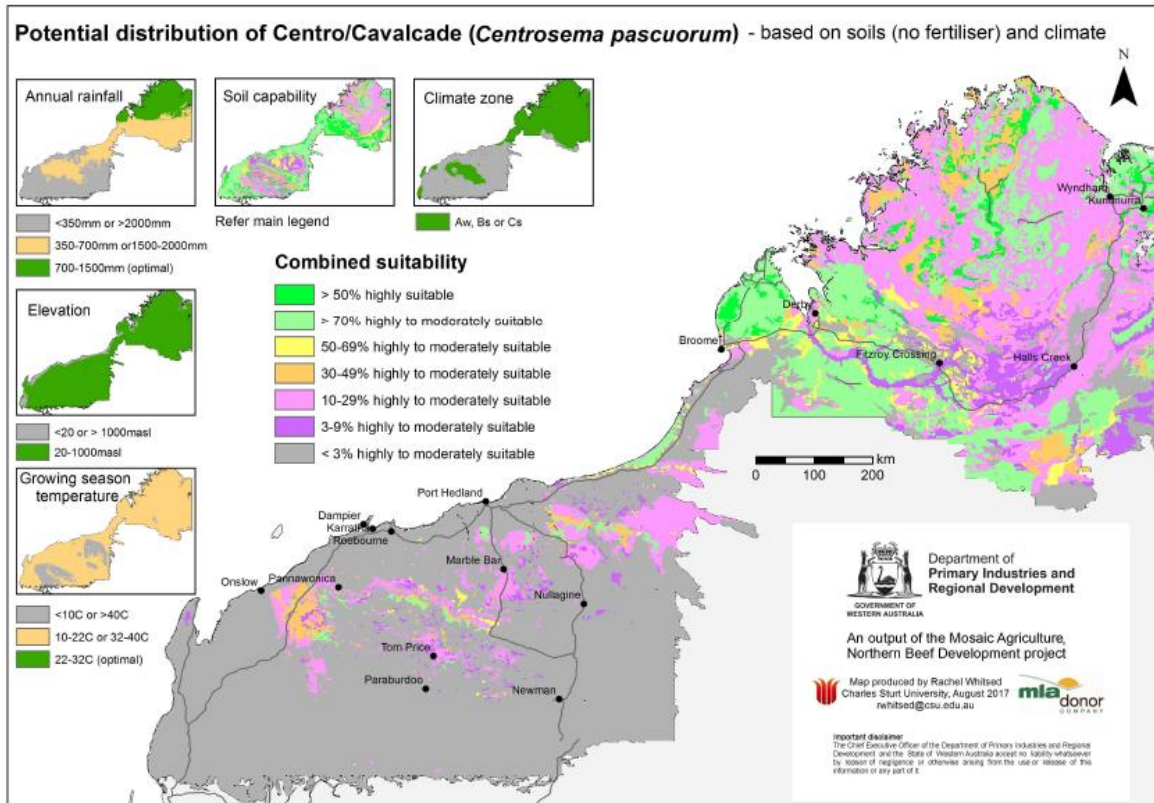
Centro has some tolerance of waterlogging and flooding but is unlikely to reduce water quality or cause silting of waterways (Cook et al. 2005).

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 an annual legume centro will not affect the hydrology.

Potential distribution



Region	Area of suitable soils and climate	Potential distribution score
Kimberley	12.6 Mha	8.0
Pilbara (>350mm AAR)	1.2 Mha	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.

Equation 1: 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	3.9 x 1.0 x 8.0	31.2	Negligible-low
Pilbara (>350mm AAR)	3.9 x 1.0 x 4.0	15.6	Negligible-low
Pilbara (<350mm AAR)	3.9 x 1.0 x 0.5	2.0	Negligible-low
Gascoyne – Goldfields	3.9 x 1.0 x 0.5	2.0	Negligible-low

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

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