



The lantana profile

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Lantana—A Weed of National Significance

Lantana (*Lantana camara* L.) is one of Australia's most damaging invasive weeds. It is an aggressive invader that has naturalised in eastern Australia under a wide range of climatic conditions⁶⁷ and is recognised as a major weed of pastures, plantations and native forests.^{5,15,42} Since its introduction to Australia as an ornamental plant in the early 1840s,⁶⁶ lantana has spread to infest more than four million hectares of eastern Australia, from southern New South Wales to northern Queensland, and has invaded areas of the Torres Strait Islands, Northern Territory and Western Australia.¹⁴ In recognition of its impacts on primary industries, conservation and biodiversity, and the extent of its distribution in Australia, lantana has been named a Weed of National Significance.⁷⁰

Lantana originates from tropical and subtropical America and is now classed as a serious weed in more than 60 countries.³² It is considered a major problem to agriculture where it occurs in East Africa, Fiji, Hawaii, India, the Philippines, South Africa and Zambia³² and there are currently more than 650 hybrid varieties identified.³³ Consequently, lantana is considered to be one of the *ten worst weeds worldwide*.⁵⁹

Without a concerted effort on behalf of land managers across the plant's distribution, lantana will continue to infest new areas of natural ecosystems and productive land, and increase in density in areas that have already been invaded. Preventing any further spread in Australia is an extremely high priority for the sake of our natural biodiversity and grazing industries.



Lantana excluding pasture—Tallawah, Queensland.



Lantana invades disturbed rainforest—Springbrook National Park, Queensland.



Lantana in woodland pasture—Glen Ruth, Queensland.



The real cost of lantana

The economic, environmental and social impacts of lantana range widely across land use situations, affecting land managers, local, state and federal governments, community groups, and industry.

Economic impacts

Australian grazing sector

Productivity costs

In agricultural situations, lantana invades pastures and grazing lands, fence lines, riparian areas, cultivated land and orchards.

It has been estimated that lantana infestations cost the Australian grazing sector more than \$104 million per year (2005–06 values) in lost productivity, with landholders incurring an average cost of \$42.78/ha per year where lantana is present.³

This consists of:

- \$6.40/ha in stock poisoning
- \$5.50/ha in increased mustering costs
- \$19.55/ha in reduced carrying capacity
- \$11.33/ha in increased maintenance expenditure.

However, there is considerable variation in these figures depending on the density of infestation and level of management activity. Another study estimated that increased mustering costs alone can be as much as \$65 per hectare in densely infested areas for the beef industry and \$55 per hectare for the dairy industry.⁵⁵



Small dozers used to clear lantana from between rows to allow access in hoop pine plantations—Yarraman, Queensland.



Toxic effects of lantana to livestock—Tallawalah, Queensland.

Increased control costs

It is estimated that land managers in the grazing industry spend more than \$17 million annually on lantana control.³

Where control initiatives are undertaken, landholders spend on average:

- \$44.00/ha in the treatment area in light infestations (scattered lantana)
- \$62.60/ha in the treatment area in medium infestations (lantana starts to impede ability to walk on a property)
- \$75.10/ha in the treatment area in heavy infestations (lantana prohibits any movement on a property).³

Australian silvicultural industry

In commercial forestry, lantana raises production costs, increases the risk of damage by fire and impedes access. In commercial hoop pine plantations of coastal south-east Queensland, where lantana competes with seedlings for light and reduces access during harvest time, it is estimated that lantana's presence accounts for 30 per cent of the establishment costs and up to 50 per cent of the harvesting costs.⁷⁹



Economic costs to environmental systems

Environmental systems play an important role in supporting ecosystem function, biodiversity and providing amenity and recreational value. However, it is difficult to put an economic value on the protection of these assets.

Lantana and ecotourism

The economic impact lantana poses to the Queensland and New South Wales ecotourism industries has not yet been assessed. However, with a growing number of important conservation areas including World Heritage Areas under threat from lantana, this cost is likely to be significant.



Active growth—Springbrook National Park, Queensland.

The best assessment we have to date of the ‘value’ of these assets comes from a 2003 Queensland economic survey which demonstrated that Queenslanders would be willing to pay \$72.5 million per annum to protect high conservation areas from lantana infestation.²

Biodiversity impacts

Lantana has a serious impact on native biodiversity and recent research shows that it threatens more than 1400 native species and 100 threatened ecosystems. This includes 279 plants and 93 animals listed under state and/or national threatened species legislation.⁷³

In natural ecosystems, lantana invades forest edges, coastal zones and riparian areas, penetrates disturbed rainforest and invades open eucalypt woodland. In dense thickets, lantana excludes native species through smothering^{6,62} and allelopathic effects^{27,28} (i.e. toxicity to other plants). It dominates understoreys, prolongs succession²⁶ and reduces biodiversity.^{6,15,25,40,63,64,67} Lantana thickets may also increase the intensity of wildfires,⁶⁷ which can have disastrous effects on fire-intolerant native flora and fauna. Conversely, in some environments lantana retards the invasion of fire, suppressing the germination of native species that require the catalyst of fire.

A national ‘Plan to Protect Environmental Assets from Lantana’ has been developed to focus management attention toward species at greatest risk from lantana invasion. Further information, including a list of the species affected by lantana, can be found at: www.environment.nsw.gov.au/lantanaplan

The endangered mahogany glider (*Petaurus gracilis*) is just one of several Wet Tropic native species at risk from lantana invasion. In this environment lantana blocks fire, a major catalyst in the germination process of the animal’s primary food tree *Albizia procera*, thus reducing the availability of food trees for the endangered gliders.



Mahogany Glider—North Queensland.



Social impacts

The social impacts of widespread weeds such as lantana can have a significant effect on general wellbeing and should be an important consideration in the decision-making process associated with priority management areas.

Important social impacts of lantana include:

- increases in individual and social stresses associated with economic loss
- impacts on valuable cultural heritage areas
- reduced recreational opportunities such as hiking, bush walking and camping
- reduced aesthetic appeal of many natural areas, affecting eco-tourism opportunities.

Perceived benefits of lantana—the pros and the cons

As habitat

Lantana thickets can provide a substitute habitat for a range of animals, including bandicoots, whipbirds, quail, wrens, birdwing butterflies and brush turkeys, where it has replaced the natural understorey vegetation.

However, due to the structural and nutritional simplification caused by lantana invasion, these habitats cannot support the range of animals found in most environmental systems. In addition, lantana provides a refuge for feral animals such as cats, pigs, rabbits, foxes and wild dogs, which compound the negative impacts on native plant and animal populations.

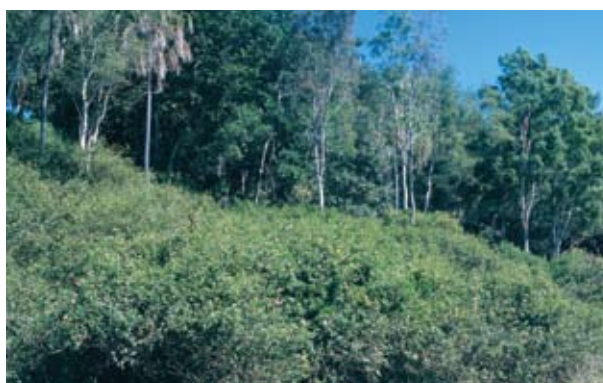


Lantana provides substitute habitat.

Natural area restoration projects occurring in heavily infested regions should ensure lantana is controlled gradually and the food and structural habitat provided by lantana is replaced to provide continued support for native species.

As a buffer

In some disturbed rainforest areas, lantana prevents invasion by grass and other weeds, and can form a useful temporary buffer along forest edges for bush regeneration projects.



Lantana can provide a buffer along forest edges.

However, this management technique should be treated with caution as there is the potential for seed spread into breaks and disturbed sections of the rainforest, further affecting the integrity of the system. In areas of more open vegetation, such as sclerophyll forests, this technique should not be employed as lantana will readily invade open-canopy systems.

Species benefiting from lantana: 142

Species at risk from lantana: 1480



In farm management

In some agricultural contexts, infestations of lantana are thought to prevent soil compaction, and are valued as a source of organic matter for pasture renovation or improvement. The weed is also considered to be useful in steep areas and stream banks for stabilising soil and preventing erosion. In some cases, it suppresses weeds perceived to be worse.

Once again, these management techniques should be considered carefully. There must be the capacity, on behalf of the land manager, to eventually control lantana infestations for there to be any advantage in reduced soil compaction and increases in organic matter. In addition, lantana may reduce deep erosion; however, as the surface soil below lantana infestations is relatively devoid of ground cover, it is prone to desiccation and loss of humus layers due to surface run-off.

As a garden ornamental

The sale and distribution of all varieties of *Lantana camara*, including horticultural varieties, has been banned in all states and territories of Australia. *Lantana montevidensis* (creeping lantana) is also restricted in selected areas (For further information on legislative restrictions in your state, refer to Appendix 5). However, lantana is still valued for its colour and low maintenance requirements and remains a common fixture in many public and private gardens.

Garden plantings of lantana pose a risk in two main ways: through the spread of seed by birds and mammals; and through the introduction of ‘enhanced’ genetic material into wild populations. While many of the ornamental varieties were marketed as sterile, research indicates that a portion of the pollen produced is still viable and when cross-fertilisation occurs between ‘sterile’ and weedy varieties, viable seed and fertile offspring can be produced.^{48,60} This has the potential to increase drought and frost tolerances in weedy lantana populations and to reduce the effectiveness of biocontrol agents.



The sale of *Lantana camara* has been banned in all states and territories in Australia.



Lantana as a garden ornamental—Adelaide, South Australia.



Description

***Lantana camara*—a species complex**

The weed known as *Lantana camara* in Australia is a highly variable hybrid plant probably originating from two or more lantana species from tropical America. The Latin name *Lantana camara* refers in the strict sense to one Caribbean species, but in Australia, as in other countries, the name has been used mostly as a convenient reference for the highly variable weedy species complex. At least 29 varieties (indicated by flower colour, structure of leaf hairs, thorniness, and length of bracts) are reportedly present in Australia, and have been divided into five main types identified by flower colour: pink, white, pink-edged red, red and orange (see Figure 2).

Physical description

- Lantana is a heavily branching shrub that grows 2–4 m high as compact clumps or dense thickets. It is able to climb to 15 m with the support of other vegetation.
- Lantana has arching stems that are square in cross-section, with pithy centres and short, backwardly hooked prickles or spines. Aged stems can be up to 15 cm in diameter.
- The leaves are 2–10 cm long with toothed edges, bright green on the upper surface and paler green, hairy and strongly veined on the underside. They grow opposite one another along the stems, and their size and shape depends on the type of lantana and the availability of light and moisture.
- The plant has a shallow root system made up of a short taproot with lateral roots branching out to form a mat.
- The inflorescences (clusters of 20–40 individual flowers) are about 2.5 cm in diameter. Tightly packed, angular flower buds open from the outside towards the centre of the inflorescence as they mature.
- Single-seeded hard green fruit, of about 5–7 mm, grow in clusters and ripen to shiny black or purple fleshy berries.
- Crushing the stems and leaves produces a strong characteristic smell.

Leaf variation in the five colour types

Variations in leaf colour, size and texture can generally be associated with the different lantana colour types:

Pink lantana—large, pale green leaves with a velvety texture

White lantana—small, tough leaves, less velvety than those of pink lantana

Pink-edged red lantana—small, tough leaves, darker than those of pink lantana

Red lantana—large, dark green leaves with a velvety texture

Orange lantana—small, tough leaves that are rough and hairy.



Leaf sizes and shapes can vary.

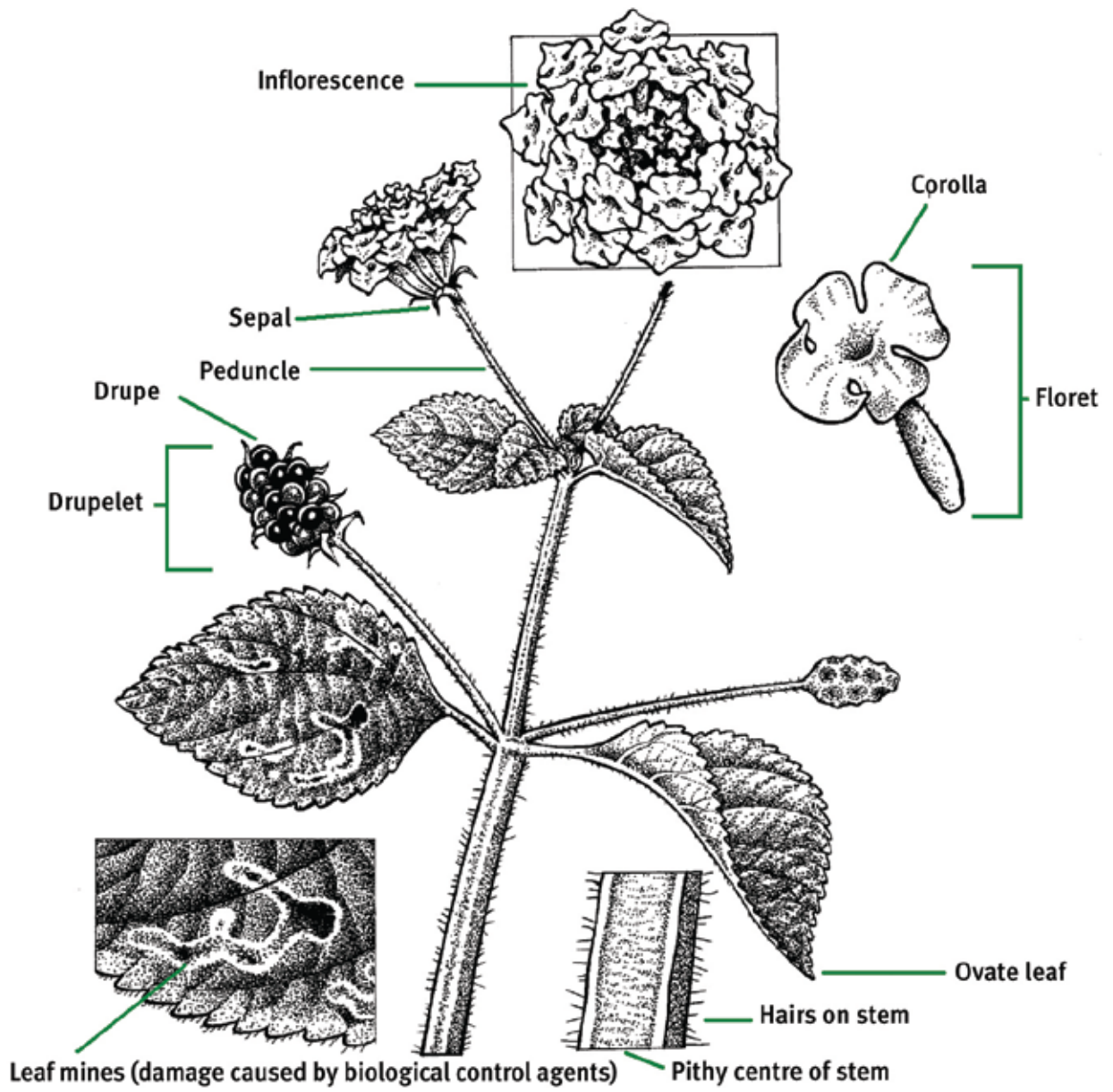


Figure 1: Anatomical drawing of lantana



Colour types of lantana

Identification of lantana types by flower colour can be difficult, as the colours of the inner buds as well as the inner and outer flowers must be considered. The five main colour types are known as pink, white, pink-edged red, red and orange.

		<p>Pink <i>Lantana camara</i></p> <p>Bud: pink/parchment</p> <p>Middle ring: yellow throat, pale yellow petals</p> <p>Outer ring: orange throat, pale or dark pink petals</p>
		<p>White <i>Lantana camara</i></p> <p>Bud: cream</p> <p>Middle ring: yellow throat, pale yellow petals</p> <p>Outer ring: orange or yellow throat, lilac petals</p>
		<p>Pink-edged Red <i>Lantana camara</i></p> <p>Bud: pink to dull red</p> <p>Middle ring: orange throat, pale yellow to orange petals</p> <p>Outer ring: orange throat, with two-toned pink to red colour petals (inner darker than outer)</p>
		<p>Red <i>Lantana camara</i></p> <p>Bud: blood red</p> <p>Middle ring: yellow throat with yellow petals</p> <p>Outer ring: red throat with red petals</p>
		<p>Orange <i>Lantana camara</i></p> <p>Bud: orange</p> <p>Middle ring: yellow to orange throat, yellow petals</p> <p>Outer ring: orange throat, orange petals</p>

Figure 2: Identifying lantana types by colour



Lantana montevidensis (creeping lantana)

Purple or lilac flowers with white or yellow centres generally indicate another weedy species, *Lantana montevidensis*, or creeping lantana. *L. montevidensis* is a scrambling low woody shrub that is invasive in coastal and subcoastal areas. It features:

- stems that are square in cross-section, and without prickles
- leaves up to three centimetres long
- short, profusely flowering branches that form mats.

This manual deals only with *L. camara*. Information about *L. montevidensis* is provided here to help identify the two species.

Ornamental lantana

Both *L. camara* and *L. montevidensis* have been developed as ornamentals in Australia. They are available in a similar range of flower colours (lilac, pink, red, orange, yellow, and white—some of which are illustrated below) to the weedy varieties, making it difficult to distinguish between them; however, the ornamental varieties of both species are generally smaller, more compact plants with smaller leaves.

The ornamental yellow *L. camara* hybrid and the lilac and white ornamental *L. montevidensis* varieties are commonly seen in public places and gardens.

		<p>Lilac <i>Lantana montevidensis</i> (creeping lantana)</p> <p>Bud: lilac</p> <p>Middle and outer ring: white throat, lilac to mauve petals</p>
		<p>Ornamental yellow <i>Lantana</i> spp.</p> <p>Bud: pink/parchment</p> <p>Middle and outer ring: ochre yellow throat and petals</p>
		<p>Ornamental lilac <i>Lantana montevidensis</i></p> <p>Bud: lilac</p> <p>Middle and outer ring: white to yellow throat, lilac to mauve petals</p>
		<p>Ornamental white <i>Lantana montevidensis</i></p> <p>Bud: white to cream</p> <p>Middle ring: yellow throat, white petals</p> <p>Outer ring: pale yellow throat, white petals</p>

Figure 3: *Lantana montevidensis* (creeping lantana) and ornamental lantana



Brisbane, 1889

Distribution: current and potential infestations

Early history

Lantana has been a weed in Australia for at least 160 years. It was first recorded in 1841 at the Adelaide Botanic Gardens, and, in 1889, dense stands were mapped close to the mouth of the Brisbane River. By 1897, it was described in Brisbane as a ‘most troublesome weed’ that could form ‘impenetrable thickets on the banks of streams, deserted farms and the edges of scrubs’.⁸

Current distribution

Lantana is widely distributed east of the Great Dividing Range, covering more than four million hectares from Eden in New South Wales, along the length of coastal New South Wales and Queensland, to the Torres Strait Islands, including some areas in central western Queensland. Isolated infestations have been reported in the Northern Territory (in and around Darwin, and on the Gove Peninsula) and in Western Australia (around Albany, Perth and Geraldton), in Victoria near Orbost and South Australia near Adelaide (the latter two have been removed as of 2009). See Figure 4.

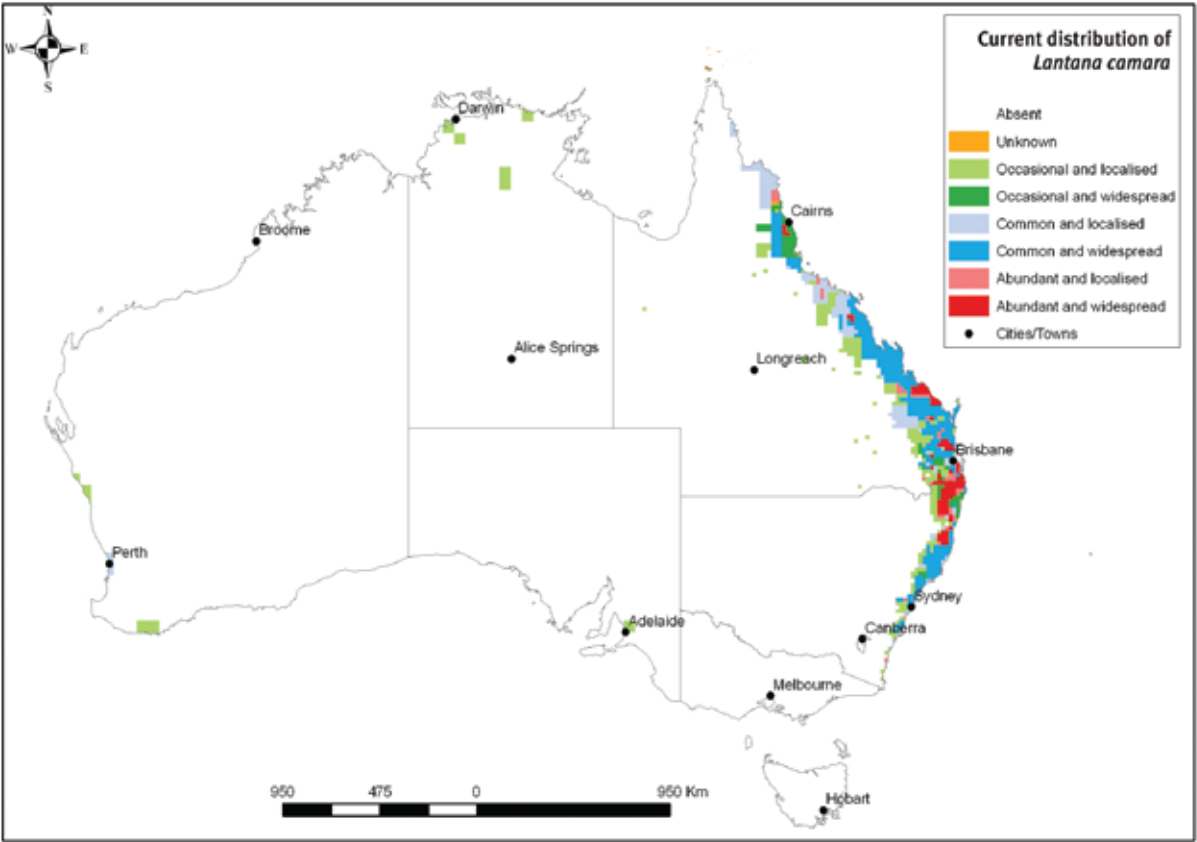


Figure 4: Current distribution of *Lantana camara* (2009)



Potential distribution

The ecological limitations to the distribution of lantana have yet to be clearly defined due to the complex mixture of hybrid varieties that make up the *Lantana camara* species complex. It was believed that lantana had reached its potential range in Australia,⁴ and was progressively infilling this area.⁵ However, more recent climatic modelling indicates lantana has the potential to invade suitable environments across nearly 35 million hectares of the Australian continent (see Figure 5). That lantana is not yet present in these areas does not mean it is unsuited to them; it has been described as a ‘sleeper weed’, awaiting conditions favourable to spread.

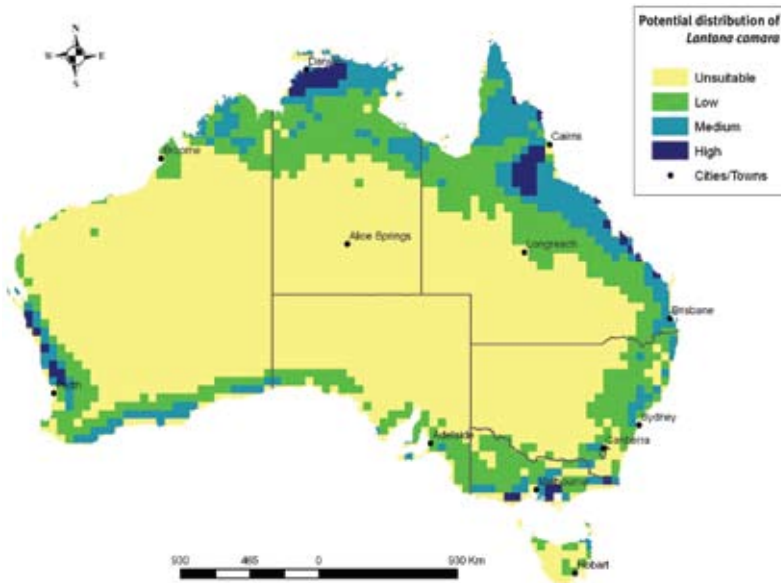


Figure 5: CLIMATE model showing the potential distribution of *Lantana camara* in Australia (courtesy of DEEDI)

Lantana is now present at the headwaters of major west-flowing catchments of the Murray–Darling Basin, and it may be able to spread further west along riparian corridors given favourable climatic conditions, and as a result of inappropriate land management practices. Infestations that were recently discovered in central western Queensland on creeks associated with the Alice and Belyando River systems near the towns of Jericho and Alpha (west of Emerald), demonstrate the weed’s capacity to spread.

The impacts of climate change are likely to exacerbate the problem in future, enabling lantana to invade further south and into high altitude areas.⁴³

Ornamental lantana increases the risks

Although the sale and distribution of lantana has been banned in all states and territories, ornamental lantana is still present in gardens and landscaping in many areas. Some commercial varieties previously thought to be sterile can, in fact, produce viable seed or hybridise with wild varieties, increasing genetic variation in the species complex.^{48,60} This continual variation may enhance the ability of lantana to adapt to new environments and makes the race to find a more effective biological control agent even more difficult.



Ornamental lantana—Emerald, Central Queensland (recently removed by airport administration).



Lantana infestation—Albany, Western Australia (site now under active management).



Reproduction and spread

Lantana invasion appears to be strongly correlated with disturbance. In primary production situations it predominately impacts on unimproved pastures or areas where soil is exposed and competition is reduced. In environmental systems lantana invades where there are significant breaks or gaps in forest canopies.^{25,28,58,64,65}

Dispersal of seed

Seeds are dispersed in a number of ways:

- Fruit-eating birds are the main agents of dispersal, as they spread seed in their droppings.^{15,67}
- Some mammals also eat and disperse lantana seed.
- Studies have shown that germination is more likely if the seed has travelled through the gut of a bird or mammal.⁶⁷



White lantana seeds in emu droppings.

Vegetative spread

- Lantana can spread via a process known as layering, where horizontal stems take root when they are in contact with moist soil.
- Lantana will also reshoot vigorously from the base of vertical stems (and more slowly from the rooted horizontal stems), although it does not sucker from damaged or broken roots.

Pollination

- Insects such as butterflies, moths, bees and thrips pollinate the flower clusters. Self-pollination is not common.
- Approximately half the flowers form clusters of single-seeded berries. A single plant can produce up to 12 000 fruit each year.

Seed viability

- Lantana seed survival of 21.3 per cent has been recorded after 36 months under natural rainfall conditions and 27.2 per cent after 24 months for seeds placed under irrigated conditions.⁷⁶
- Computer modelling of seed survival projections indicate a small percentage of buried seed can survive up to 11 years under natural rainfall and 3 years under irrigation.⁷⁶

Germination

- As bird dispersal of seed is the main vector of lantana spread, the first place lantana is often encountered is along fence lines, under trees and generally where birds perch. Monitoring and control in these areas can prevent spread into clean paddocks.
- Activities that increase light intensity and soil temperature will stimulate germination of lantana seed. These include human disturbances such as clearing, construction and inappropriate burning, and pest animal activity such as pig rooting and rabbit burrowing.
- Seeds need warm temperatures and sufficient moisture to germinate. Germination is reduced by low light conditions.



Regrowth from base of stems.



Longevity

- Lantana is long-lived under favourable conditions. Constantly renewed growth at the base of stems ensures its persistence. Plants tend to die only under extremely stressful conditions, such as extended drought or complete shading through canopy closure.

Habitat

- Lantana grows in a variety of coastal and subcoastal areas, thriving in high rainfall areas of tropical, subtropical and warm temperate climates.
- The upper temperature limit for lantana is unknown; however, shoots are frost sensitive and growth is reduced below 5 °C.^{68,80}

- Lantana growth is significantly constrained by water availability and it prefers conditions where soil moisture is available throughout the year. However, it can grow on poor soils and pure sand substrates if there is adequate soil moisture^{68,80} and once established will survive long periods of drought.
- It prospers on well-drained rich clays or volcanic soils (the latter derived from basalt), and particularly rich organic soils developed under rainforest canopies.³⁶
- Lantana has the ability to produce shoots all-year-round under favourable soil, humidity, air temperature and light conditions.⁶⁷
- In contrast, lantana does not grow well in saline or waterlogged soils, where its root mat tends to rot.⁶⁸

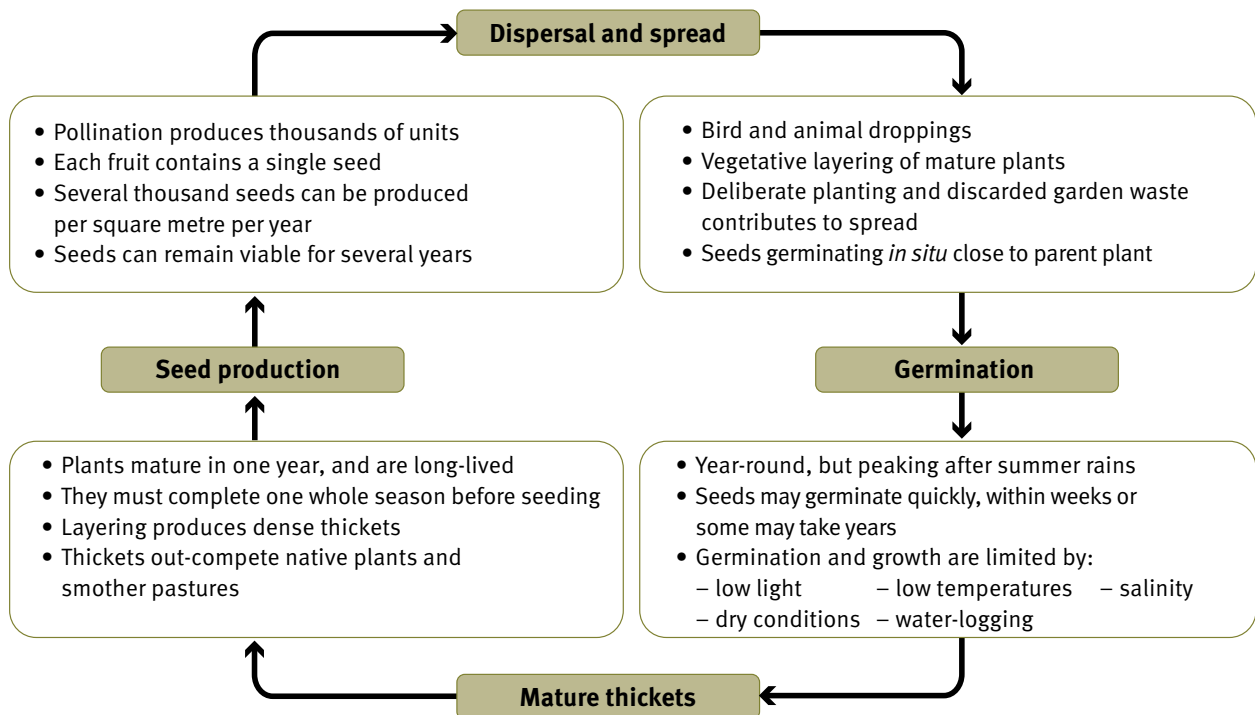


Figure 6: The life cycle of *Lantana camara*