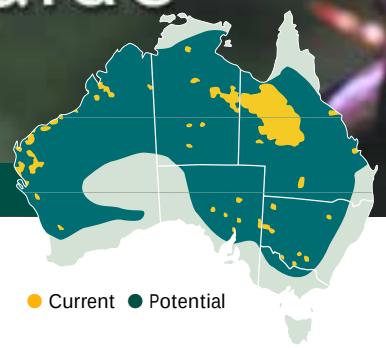
Weed Management Guide

Mesquite – *Prosopis* species



Mesquite (*Prosopis* species)

The problem

Mesquite is a *Weed of National Significance*. It is regarded as one of the worst weeds in Australia because of its invasiveness, potential for spread, and economic and environmental impacts. There are four species and several hybrids of *Prosopis*, which are all collectively known as mesquite.

Mesquite's economic impacts stem from its habit of forming dense, impenetrable thickets which, combined with its large thorns, prevent stock accessing watering holes and make mustering difficult. Mesquite also reduces the productivity of pastoral country by taking over grasslands and using valuable water resources. Other nuisances from mesquite include damage to animal hooves and vehicle tyres from thorns, and the poisoning of livestock which consume excessive amounts of seed pods.

Environmental impacts include land erosion resulting from the loss of grassland habitat that supports native plants and animals; and the provision of safe refuges for feral animals such as pigs and cats.

The weed

The various mesquite species come in a range of shapes and sizes. They can be found as multi-stemmed shrubby bushes or single stemmed trees with a spreading canopy, growing from 3 to 15 m tall. Branches have a characteristic zig-zag structure, and the overall impression is of a rather untidy plant, with single branches extending outside the main canopy.

Mesquite can form impenetrable thickets, preventing access and reducing productivity of land.
Photo: CSIRO

Mesquite leaves are fern-like. They occur at each point where the branch changes direction (the zig-zag) in groups of one to three pairs, often with one or two thorns. The greenish cream–yellow flowers are arranged on a cylindrical-shaped spike which resembles a 'lambs tail', 50–80 mm in length. The seed pod (up to 200 mm long) is straight or slightly curved with only very slight constrictions between the seeds. The bark is smooth and dark red-green in young stems, and rough and grey in older stems. The taproot is large and much branched and generally grows to a depth of 20 m.

Identification of mesquite is complicated because there is often variation in growth form, even within the same species, and hybrids (or crosses) between the main species.

Key points

- Mesquite, which includes four species and several hybrids, is one of four prickle bushes that have infestations scattered throughout semi-arid Australia. (See the back page for more information.)
- It is a nuisance in rangelands where it forms dense impenetrable stands, particularly around waterways.
- Animals eat the seed pods and spread the seeds.
- Historical control efforts by mechanical and chemical means have been expensive and ultimately ineffective.
- Control requires an integrated management approach, including mechanical, chemical and biological techniques and the use of fire and grazing strategies.

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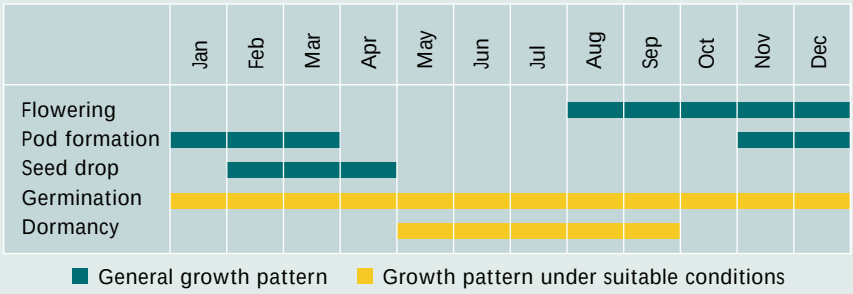
Growth Calendar



Because mesquite is found over such a large area, and consists of several species and hybrids, there is much variation in its growth calendar. Its seeds can germinate year round as long as the soil is moist. The young seedlings are generally slow growing as resources are invested into establishing the root system. This can be extensive in mature trees, in some cases exceeding a depth of 50 m. Where winters are cold, mesquite may shed its leaves in late autumn or early winter and undergo a dormant period until early spring.

Flowering in mesquite occurs mainly in spring and early summer. The seed pods take two to three months to mature and generally drop in late summer. The seeds are dormant when dropped – the hard outer casing must be damaged to allow moisture into the seed before germination can occur. Animal consumption, fire or wet conditions are all ways of breaking the seed casing. If the seed casing is not broken, seeds lying in soil can remain viable for very long periods.

Flowers and seed pods of *Prosopis pallida* at Hugenden, Qld, in August.
Photo: Colin G. Wilson

How it spreads

Mesquite mainly reproduces via seeds, producing one main crop annually. Each seed pod generally carries between 5 and 20 seeds, with potentially hundreds of thousands of seeds produced per mature plant.

Humans have assisted the spread of mesquite throughout Australia and the rest of the world. It was originally planted as an ornamental, shade or fodder tree around stations in the Northern Territory and Queensland at the start of the 19th century, and in Western Australia and New South Wales a little later. Mesquite has since spread throughout mainland Australia, with the worst infestations on pastoral land in the Pilbara in Western Australia, the Barkly Tablelands in the Northern Territory, and in northwestern, central and southwestern Queensland.

Flower spike of *Prosopis pallida:* Charters Towers, Qld, in December.
Photo: Colin G. Wilson

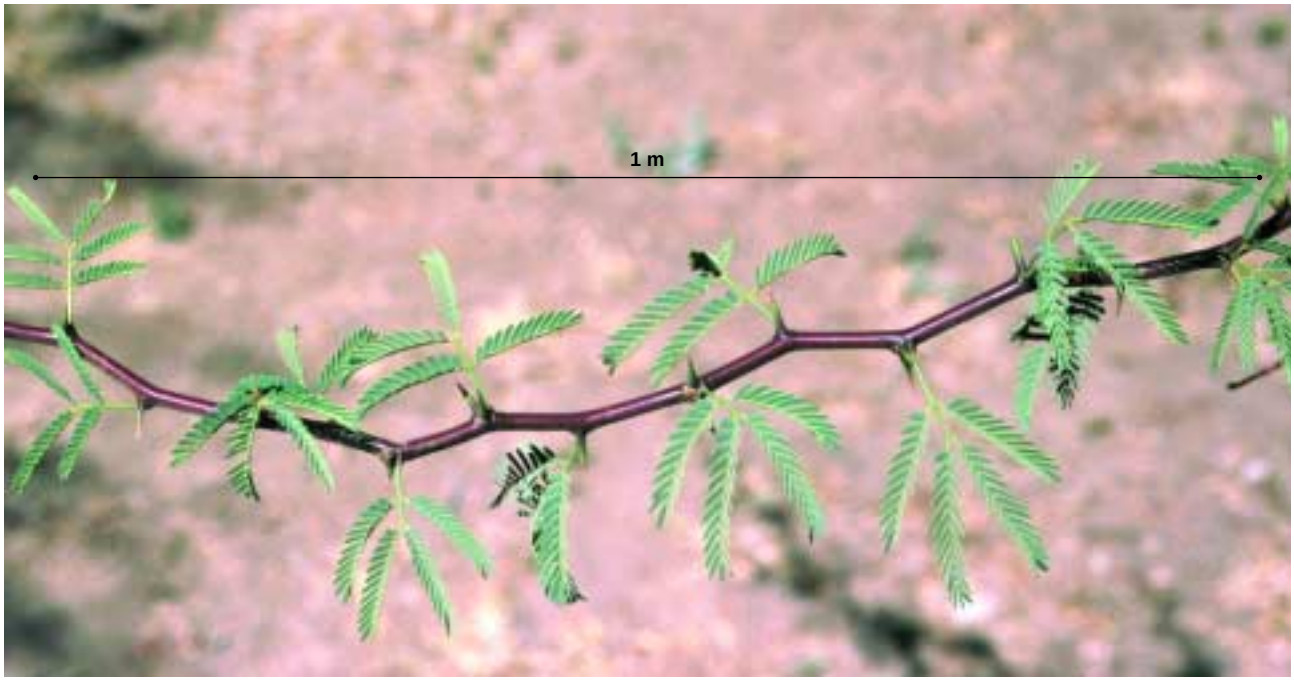
Animals consume the nutritious seed pods and excrete viable seed in their droppings, helping to spread mesquite over shorter distances. Cattle are mainly responsible, although horses, pigs, goats, sheep, emus and kangaroos are also known to consume the seed pods. As long as the seeds themselves are not damaged by chewing, digestion actually helps germination, particularly as the expelled seeds are deposited in moist, nutrient-rich dung.

Apart from deliberate plantings, animals – mainly cattle – are most responsible for spreading mesquite

Seed pods can also be spread by flooding.

Where it grows

Mesquite has been planted and has subsequently escaped in every mainland state. In general, mesquite species are well adapted to hot climates and a wide range of soil types and annual rainfall (150–1200 mm). They are often described as hardy because they can tolerate droughts and waterlogging, low nutrient soil and highly saline or alkaline soil. In northern Australia, mesquite prefers semi-arid to arid rangelands that are prone to flooding and soils that have good moisture retention.



The zig-zag structure of the stem is typical of all mesquite species. Most species also have spines guarding the base of the leaf.
Photo: Colin G. Wilson

However, different species have different distributions, which reflect their initial plantings but also variation in their preferred climate and surroundings. For example, *P. pallida* is widely distributed across the north of Australia from the east coast of Queensland through the Northern Territory to the west coast of Western Australia. However, it is not found in any of the southern states, whereas *Prosopis velutina* and the hybrid *P. velutina* x *P. glandulosa* var. *torreyana* can tolerate the cooler climate of southeastern Australia.

There are four naturalised species of mesquite and a range of hybrids. Collectively, they are suited to the climate of much of inland Australia

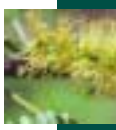
Mesquite has a long life cycle. In its native range plants live at least 30 years, but one specimen in the Brisbane Botanical Gardens is over 115 years old.

The mesquite species that are weeds in Australia are natives of Central America, northern South America and southern North America. Because mesquite has some properties that are considered useful to humans, including uses as building timber, fuel and livestock food, it has been introduced and naturalised around the world. Mesquite has been introduced to Hawaii, Jamaica, the Middle East, throughout Asia including the Indian subcontinent, and Africa including Nigeria, Sudan, Senegal and southern Africa. It is also one of the most serious weeds of the southwestern United States.

Potential distribution

The combination of a long life cycle, ability to survive droughts, high seed production and dormancy of its seeds makes mesquite an extremely resilient invader which can quickly take advantage of a suitable environment and dominate entire ecosystems. All mainland states and territories have climatic conditions that are suitable for mesquite, especially areas north of 28ºS latitude.

An untidy shape is also typical of mesquite: multi-stemmed *Prosopis pallida*, Hughenden, Qld.
Photo: Colin G. Wilson



In basal bark treatment herbicide is sprayed all around the circumference of the lower stem(s), up to a height of 750 mm for mature mesquite: *P. velutina*.
Photo: Rachele Osmond

Mesquite seed pods have only slight constrictions between seeds, and contain up to 20 seeds per pod: *P. glandulosa*.
Photo: Nathan March

What to do about it

Preventing the further spread of mesquite

The strategy to prevent the further spread of mesquite starts with strictly enforced quarantine procedures to avoid further introductions of weedy *Prosopis* species which could potentially cross-breed and produce more hybrids. Other measures aim to prevent the spread of mesquite seed. For example, stock should be quarantined before transport into uninfested areas, and animals should be fenced off from mesquite infestations. Feral animal numbers could be reduced as part of mesquite management. Infestations in upper catchments should be targeted for strategic control to prevent continual reinfestation of downstream sites.

Past control attempts

There have been some successful efforts to eradicate mesquite infestations since control was first attempted in the 1950s. However, it has continued to spread in many places. The experience repeated around Australia is that mesquite reinfests sites if follow-up control is not undertaken. Chemical and mechanical methods have traditionally been used to control mesquite.

If control efforts are not followed up, mesquite will reinvade from its substantial, long-lived seedbank

Integrated management of mesquite

Current research is investigating integration of traditional management practices (chemical and mechanical control) with fire, grazing management and biological control, which are more time- and cost-effective mechanisms. An integrated management strategy for mesquite will vary with the infestation's characteristics, including its size, age, density and habitat. In general, multiple-stemmed mesquite are harder to control than single-stemmed trees.

Chemicals offer effective control

The basal bark and cut-stump techniques used with an appropriate registered herbicide are effective on mature trees. Basal bark treatment (spraying around the entire stem up to 750 mm from the ground) should be used during the growing season (approximately October to April, depending on species and location). The cut-stump technique, where herbicide is immediately applied to a stump that has been cut horizontally very close to the ground, is effective year round. Seedlings can be controlled by spraying foliar herbicide over the entire plant. This is particularly effective for dealing with actively growing, dense stands of mesquite up to 1.5 m tall.

Mechanical control is another option

Mechanical control techniques, ranging from blade ploughing to grubbing and chaining, are aimed at removing as much of the root system as possible to prevent

Weed control contacts

State / Territory	Department	Phone	Email	Website
ACT	Environment ACT	(02) 6207 9777	EnvironmentACT@act.gov.au	www.environment.act.gov.au
NSW	NSW Agriculture	1800 680 244	weeds@agric.nsw.gov.au	www.agric.nsw.gov.au
NT	Dept of Infrastructure, Planning and Environment	(08) 8999 5511	weedinfo.ipe@nt.gov.au	www.nt.gov.au
Qld	Dept of Natural Resources and Mines	(07) 3896 3111	enquiries@nrm.qld.gov.au	www.nrm.qld.gov.au
SA	Dept of Water, Land and Biodiversity Conservation	(08) 8303 9500	apc@saugov.sa.gov.au	www.dwlbc.sa.gov.au
Vic	Dept of Primary Industries/Dept of Sustainability and Environment	136 186	customer.service@dpi.vic.gov.au	www.dpi.vic.gov.au www.dse.vic.gov.au
WA	Dept of Agriculture	(08) 9368 3333	enquiries@agric.wa.gov.au	www.agric.wa.gov.au
Australia wide	Australian Pesticides and Veterinary Medicines Authority	(02) 6272 5852	contact@apvma.gov.au	www.apvma.gov.au

For up-to-date information on which herbicides are registered to control mesquite and the best application methods and dosages, contact your state or territory weed management agency or local council. This information varies from state to state and from time to time. Contact details are listed above, including contacts for the Australian Pesticides and Veterinary Medicines Authority, which hosts the PUBCRIS database. This database contains information on all herbicides that are registered for use on weeds in each Australian state and territory.

When using herbicides always read the label and follow instructions carefully. Particular care should be taken when using herbicides near waterways because rainfall running off the land into waterways can carry herbicides with it. Permits from state or territory Environment Protection Authorities may be required if herbicides are to be sprayed on riverbanks.

A 4 m stick rake with cutter bar front mounted on a large bulldozer is ideal for mesquite control. Photo: Jodi Graham

the tree reshooting. Mechanical control has varying levels of effectiveness depending on the size and species of the plant, but will kill mesquite if the roots can be removed to a depth of 300 mm.

Blade ploughing is considered to be the most cost-effective form of mechanical control and has been shown to be effective on *P. velutina* and its hybrid, and on *P. pallida*. Mechanical control can assist the germination and growth of pasture grasses, especially if the area is reseeded following blade ploughing. Mesquite seedling germination will also increase, requiring follow-up control. Ploughs can be pulled or pushed, with maximum costs at approximately $120 per hectare in dense infestations.

In southwestern Queensland *P. velutina* has been mechanically controlled using 'grubber' attachments on bulldozers and tractors, with best results gained in late autumn and winter in a normal wet season year. However, grubbing is only cost-effective for treating light infestations or small areas of dense infestations – costs exceeded $200 per hectare in grubbing one dense infestation of *P. pallida*.

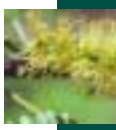
Chain pulling is the cheapest but least effective mechanical control because of low kill rates. Permits may be required to conduct mechanical control if native species will be affected. Weed control contacts (see above) will be able to provide relevant advice.

Burning

Fire can give good control of mesquite, particularly *P. pallida*. If necessary, mechanical control such as chaining can be used before burning to provide enough fuel to generate the heat required to kill mesquite. Fire is relatively inexpensive and, even when it does not kill the entire plant, can reduce seed production by removing vegetation and killing seed lying on the ground surface.

Integrate chemical, mechanical and biological control, fire and grazing management

However, most of the other species of mesquite are more resistant to fire, and



Mesquite spines can puncture truck tyres.
Photo: Colin G. Wilson

Cattle are the main cause of mesquite spread. These seedlings were found growing from dung near Hughenden, Qld, in December.
Photo: Colin G. Wilson

resprout from the rootstock if the crown is removed by fire. Extremely intense fires can kill these more resistant species, including hybrids in the Pilbara, but generally require careful preparation of fuel and attention to safety details and non-target effects. Permits may be required to light fires – check with your local council or state or territory weed management agency.

Grazing management

Grazing management is an important part of the integrated approach to mesquite control for three reasons:

- Cattle are mainly responsible for the spread of seeds and therefore infestations.
- Grazing may need to be reduced before burning in order to allow the build-up of sufficient fuel.
- Grazing should be discouraged after any control efforts, to encourage growth in perennial grasses and help reduce mesquite seedling germination and establishment.

Preventing stock access to infestations during seed drop will help reduce the spread and density of mesquite. Stock should also be quarantined before being transported into unaffected areas. Although no detailed information is available for the passage time of seeds through the gut, a 7–8 day quarantine period is adequate. Seedlings in the holding yards will require treatment.

While horses and sheep can be managed similarly to cattle, other feral and native animals (eg pigs, kangaroos and emus) can all potentially spread seed.

Biological control

Two insect species from Argentina have been released since a biological control program was initiated by CSIRO Entomology in 1994. A leaf tying moth (*Evippe* sp. #1) that causes defoliation and a leaf sucking bug (*Prosopidopsylla flava*) that causes dieback were released in 1998. The first species has established itself at most release sites and is having an impact on mesquite, particularly in the Pilbara region where seed production and growth rates are reduced. It is doubtful that the second species will establish itself in populations large enough to damage mesquite despite numerous introduction efforts. Two seed-feeding beetles that were released by the Queensland Department of Natural Resources and Mines are widely established but not affecting mesquite.

...case study

Battling mesquite on Mardie Station

The mesquite first planted around Mardie Station homestead in the 1930s was a thornless variety used as shelter and livestock feed. However, since that time the trees have reverted to the wild thorny type and also hybridised. So far, hybrid forms have been identified from the species *Prosopis glandulosa*, *P. velutina*, *P. juliflora* and *P. pallida*. The hybrids grow mostly as multi-stemmed shrubs and occasionally as single-stemmed trees. The Mardie Station mesquite infestation (150,000 ha) is the largest single core infestation in Australia.

At Mardie Station mesquite has spread rapidly after cyclonic rain events, with the densest growth occurring along the floodplain tributaries of the Fortescue River. It grows on saline coastal mud flats, heavy alluvial clay and bare patches of earth where little else will grow.

Mesquite was recognised as a threat to the pastoral industry in the 1940s and extensive mechanical and chemical control efforts commenced in 1952. Although some successes were achieved and areas of infestation were returned to useful herbage, whenever control efforts were relaxed the mesquite came back. All the previous control effort did not manage to prevent the spread of mesquite or recover any land previously lost to mesquite.

A biological control agent (the leaf tying moth *Evippe*) was released in 1998. It rapidly established and has significantly reduced leaf cover and pod production. Ironically, the success of the defoliating moth may reduce the effectiveness of foliar herbicides because there is less leaf area to absorb herbicides. However, new leaf growth that follows rainfall could be strategically targeted for herbicide application.

In response to the previous efforts to control mesquite on Mardie Station, the Pilbara Mesquite Management Committee was formed in April 2000. Representing pastoralists, mining companies, government agencies and CSIRO, it is partly funded through the Commonwealth Government's Natural Heritage Trust. Acknowledging that eradication is unachievable, its priority is the prevention of spread of mesquite into neighbouring properties and reserves, plus the development of a long-term management strategy for the Pilbara region. To this end, a 2 km-wide containment line has been established around current infestations. Also a four-year research project is investigating the best practice management of mesquite, including how best to integrate fire with biological and mechanical control techniques.

To stop mesquite crossing containment lines, staff at Mardie Station quarantine stock in a mesquite-free holding paddock for around one week until any mesquite seed has passed through the gut. All heavy machinery that enters the property is thoroughly washed before leaving the station. The cleaning is so thorough that a mesquite seed was once found in the air conditioning duct of a bulldozer. Staff at the station also work with groups such as Conservation Volunteers Australia to strategically spray mesquite that threatens to break beyond containment lines along the boundary of the station.

The 'Mesquite Best Practice Manual', a comprehensive control and management guide compiled by the Qld DNRM and the National Prickle Bush Management Group was recently launched at Mardie Station.

Legislation

Landholders are legally required to control or treat mesquite across all mainland states and the Northern Territory. Check with your local council or state/territory government agency about the latest requirements for mesquite control.

Acknowledgments

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Maps: Australian Weeds Committee.

The *Evippe* moth biocontrol ties leaves together, reducing growth and seed production.
Photo: Rieks van Klinken

How to control mesquite

Quick reference guide

Prevention of spread

Preventing the spread of mesquite is the most cost-effective management strategy. Quarantining stock before movement into uninfested areas is an important way of preventing further spread.

Integrated management

Given the excessive costs and failures of past control attempts, and the limitations (eg costs, time, effectiveness) associated with individual techniques, the new approach to mesquite involves integrating all control methods together with grazing management systems to minimise impacts over the long term. Integration involves:

- chemical control which, due to expense, is best suited for small, isolated infestations
- mechanical control which is relatively inexpensive but gives varying results with different species
- fire which is inexpensive and can provide excellent control especially if used strategically after mechanical control
- grazing management such as quarantine, exclusion from seed pods or destocking, to promote regrowth of grasses for fuel and to compete with seedlings
- biological control which can damage mesquite, especially in the Pilbara.

Ongoing follow-up control is required because there will be large numbers of mesquite seeds remaining in the soil that can survive for many years. In the past, when mesquite control has not been followed up, it has rapidly returned.

These control efforts may be more or less effective with the four different species and hybrids that are naturalised in Australia. Consult your local council or state or territory weed management agency for the best approach for your species of mesquite.

How to identify the prickle bushes

Mesquite is one of four prickle bushes that are yellow-flowering, seed pod forming, woody weeds of northern Australia. For further information on identification, distribution, ecology, management and control of mesquite, and additional case studies, see the 'Mesquite Best Practice Manual', compiled by Qld DNRM and the National Prickle Bush Management Group.

Feature	Mesquite *Prosopis* spp.	Mimosa bush *Acacia farnesiana*	*Parkinsonia *Parkinsonia aculeata*	*Prickly acacia *Acacia nilotica*
Pod size and shape	Up to 200 mm, very slight constrictions between seeds	Up to 60 mm, cigar shaped, slightly curved	Up to 100 mm, straight, long thin constrictions between seeds	Up to 230 mm, large constrictions between seeds
Pod colour, hairiness	Straw coloured, sometimes purple; no hairs	Brown to black; no hairs	Straw coloured; no hairs	Grey-green; fine hairs
Flowers	Greenish cream – yellow 'lambs tail' cylindrical flower spike, 50–80 mm	Golden yellow, ball shaped, 10 mm across	Four all yellow petals and one erect petal either orange or yellow with an orange spot	Golden yellow, ball shaped, 10 mm across
Leaves	Fern-like, paired (1–3 pairs, often with a gap between leaves)	Fern-like, paired (2–4 pairs with a gap between leaves)	Narrow, flat, paired (1–3 pairs) green leaf stalks with small green oblong leaflets	Fern-like, paired (3–10 pairs at each point along the stem)
Bark	Young: smooth dark red – green Mature: rough grey	Grey with prominent white spots	Smooth and green, straw coloured at base of older trees	Young: a tinge of orange and/or green Mature: dark, rough
Tree shape and size	Untidy spreading tree, up to 15 m, single or multi-stemmed	Rounded shrub to 3 m, usually multi-stemmed	Shrub or small tree to 8 m, single or multi-stemmed	Spreading tree to 10 m, usually single-stemmed

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CRC Weed management

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