

Herbicide suggestions:

A range of different herbicides have been trialled using basal bark or injection methods, these include glyphosate, garlon, picloram and triclopyr based products. Success has been variable and results conflicting.

Herbicide	Roundup Biactive (minor use registration)
Active Ingredient	360 g/L glyphosate
Dilution rate for injection	50%
Amount of product per 1 litre of water	500 mL
Time of application	summer
Additional information	Used with apparent success in riverine conditions, ie total tree defoliation with no resprouts after 6 months

NOTE: A minor off-label-use permit (No. PER4984) covers the control of Brazilian pepper in non-crop areas in WA. Herbicide application must comply with all conditions of the permit.

Management actions:

- Map tree locations and count number of trees in small stands for a simple and efficient way of monitoring control effectiveness.
- Carefully handweed any seedlings found - plants are harder to remove once established.
- Target moist areas, where Brazilian pepper is most likely to spread, and treat isolated trees in good bushland first.
- Do not treat when waterlogged - inject trees growing in wet areas during summer months.
- For rapid herbicide application work in pairs, one drilling, one injecting.
- Avoid root disturbance until trees are definitely dead (limits unwanted suckering).
- Remain vigilant - check area each year for seedlings.
- Follow up control in following years - map periodically to check progress of control efforts and/or spread.

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Getting involved - The Environmental Weeds Action Network:

The Environmental Weeds Action Network (EWAN) is a community initiative to tackle the problem of environmental weeds in bushland and waterways. It brings together community members in both urban and rural areas, bush regenerators, local government, weed scientists and ecologists to save our indigenous flora from the threat of weeds.

The aims of EWAN include:

- promoting an understanding of the threat of environmental weeds to our precious bushland
- providing useful information about weed control in native vegetation and elsewhere convincing governments at all levels of the need for appropriate legislation and funding for weed control
- researching methods of weed control
- encouraging community participation

Visit our web site at <http://members.iinet.net.au/~ewan/>

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Written by Kris Brooks (EWAN) for the Environmental Weeds Action Network, September 2001.



MANAGING WEEDS IN BUSHLAND

WOODY WEED CONTROL

Schinus terebinthifolius
Brazilian pepper-tree

Illustration provided by
IAS, Center for Aquatic Plant
University of Florida, Gainesville, 1990



BRAZILIAN (JAPANESE) PEPPER AND OTHER WEEDS



What is Japanese pepper?

Japanese pepper refers to the species *Schinus terebinthifolius*. Native to Brazil, Paraguay and Argentina, 'Japanese pepper' is somewhat of a misnomer and the more descriptive common names are **Brazilian pepper** or **broad leaved pepper tree**.

Brazilian pepper is a large shrub to small evergreen tree, 3-7 m high. The trees are mostly dioecious, that is there are separate male and female plants. Both male and female plants produce small cream coloured flowers, but only the female tree produces the distinctive clusters of small red berries. The dark green leathery leaves emit a strong turpentine or peppery smell when crushed.

The weed can form dense thickets which shade out and smother native plants. In addition to displacing native vegetation: Brazilian pepper can block access to creeks, the unripe fruit can be fatal to horses, the crushed ripe fruit is known to cause respiratory difficulties in humans and contact with the sap and leaf resin can cause skin irritation.

Distribution – where does it grow?

Widely planted as an ornamental, Brazilian pepper has successfully naturalised in more than 20 countries in two circum-global belts roughly 15° - 30° North and South. In Australia it is considered to be in the early stages of spread. **It has the potential to become more widespread in the wetlands, rivers, creeks and coastal swamps of sub-tropical Australia.** The weed has been recorded between Geraldton and Perth in Western Australia. Brazilian pepper is most invasive in moist situations but tolerates dry conditions and has been found growing and spreading on cliffs, roadsides and in bushland.

Some interesting biology:

- In favourable conditions Brazilian pepper can reach reproductive potential within 3 years after germination.
- A short synchronous flowering period occurs in late summer/ early autumn, which is consistent between years.
- Seed is held on the tree from April until October - providing an extensive period for seed dispersal.
- Brazilian pepper has a near obligate dependency on frugivores, especially birds, for recruitment (exocarp decomposition relies on seed passing through the animal digestive tract).
- Seed is viable for approximately 5 months once dispersed.
- Seedling survival is largely dependent on water availability.
- Seedlings can grow, albeit slowly, in dense shade.
- Established trees are not usually killed by fire.
- Stems sprout prolifically after canopy damage.
- Trees have a shallow root system in wet areas.
- Suckering is stimulated by root or canopy damage (known to sucker without obvious damage to parent plant).

How does it spread?

- In Florida birds are the primary seed dispersal agent, although mammals, gravity and water also play a part.
- In Australia silvereyes are known to eat the berries but their influence on spread is unknown.
- Root suckers contribute greatly to local spread especially after crown or root damage.
- Physical damage to roots increases root suckering.
- In moist conditions branch cuttings will also take root.

Control and management:

Understanding the distribution: Accurate distribution maps allow targeted control of infestations and provide evidence of where the program has been effective and where it has failed. It is important to keep uninfected areas clear and remove isolated trees or small clumps within intact bushland before they spread. Working from intact bushland out towards the disturbed areas also limits spread – especially where the infestation cannot be removed in one concentrated effort. Updating maps regularly provides good feedback to workers on the effectiveness of their efforts.

Physical Control: Brazilian pepper seedlings can be carefully handweeded being sure to remove all the root. (Seedlings have a distinct tap root, suckers snap off leaving a hockey stick shaped end). Simply cutting the tree at the base and grinding the stump is **not** effective and can increase density of the weed. Damage to the root system or canopy stimulates root suckering.

Chemical control: Currently the most effective means of control for mature Brazilian pepper trees is chemical. Site conditions and seasonal timing influence effectiveness of control. Trees should be treated over the summer months when actively growing and roots are not waterlogged.

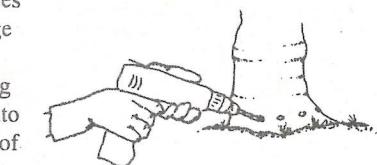
Care must be taken to avoid off target damage when using herbicides in bushland. It is important that training in the correct use of herbicides is undertaken. Always read the label and follow instructions.

Cut and paint:

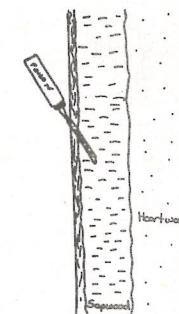
Cutting and painting the stump of Brazilian pepper with herbicide **only offers temporary control** and the resultant resprouting (as much as 26 months later) and root suckering forms denser thickets. The tangled stems make further treatment more difficult. **Both basal bark and stem injection techniques are preferable to the cut and paint method**, resulting in a relatively high proportion of tree death and minimal suckering in the survivors.

Stem injection:

Stem injection techniques reduce herbicide damage to the surrounding environment. By placing the herbicide directly into the tree, contamination of soil, water and damage to off target plants is minimised.



Drill holes around base of tree



Using a cordless drill or brace and bit, holes 4-5 cm long and 8-10 mm in diameter are drilled around the base of the tree at 5-10 cm intervals. The holes are angled at 45° down into the sapwood of each stem. Using a squirt bottle **immediately inject 5mL** of herbicide solution into the holes. In wet areas **Brazilian pepper** should be treated during summer, when conditions are dry.

Filling drilled hole with herbicide

Herbicide can also be injected into the sapwood by means of **frilling**. Use an axe to make cuts into the sapwood around the base of the tree. The cuts should be 3-5 cm wide by 2-3 cm deep. Herbicide should be injected immediately into the cuts.

Using the injection methods can be difficult in dense much-branched stands of Brazilian pepper and basal bark treatment may be more appropriate.

Basal bark treatment:

Basal bark treatments have also been used with some success. This involves painting the bark around the tree about 30-60 cm above the ground with a herbicide/oil solution. Garlon 600 is registered for use in this manner for a number of woody weeds. This method may be easier to apply to trunks with small diameters than the injection method.

Foliar treatment:

Applying a systemic herbicide (at label rates) to foliage of resprouting plants can be used as a follow up measure if required. Take due care not to damage surrounding native species.

Woody weeds that sucker and resprout

Species	Common name	Dispersal	Seed bank	Years to maturity
<i>Acacia dealbata</i> *	silver wattle	b,a,wa	soil, long	5+
<i>Acacia melanoxylon</i>	black wood	b,wa	soil, long	5
<i>Allianthus altissima</i> *	tree of heaven	wi,wa,b	?	2+
<i>Casuarina glauca</i>	candle bush	ex,wa,wi,m	?	2+
<i>Casuarina equisetifolia</i>	golden shower	?	?	?
<i>Eriobotrya japonica</i>	loquat	b	? highly viable	2?
<i>Erythrina x sykesii</i> *	flame tree	no viable seed produced?		
<i>Ficus carica</i> *	edible fig	b,ma	short?	4+
<i>Fuchsia magellanica</i> *	fuchsia	b,wa	?	?
<i>Lantana camara</i> *	lantana	b,m,wa	?	2+
<i>Lycium ferocissimum</i> *	African boxthorn	b,m,wa	soil, short?	2
<i>Melia azedarach</i> *	cape lilac	b,wa	soil, short/med	3?
<i>Olea europaea</i>	olive	b,m	soil, long	5+
<i>Populus alba</i> *	white poplar	wi,wa	none	?
<i>Populus nigra</i> *	Lombardy poplar	no viable seed produced?		
<i>Prosopis glandulosa</i> *	honey mesquite	m,wa	soil, long	2+
<i>Prosopis pallida</i> *	mesquite	m,wa	soil, long	2+
<i>Prunus cerasifera</i>	cherry plum	b	low viability?	?
<i>Robinia pseudoacacia</i>	black locust	?	seedlings rare	6+
<i>Rubus fruticosus</i> *	blackberry	b,m,wa	soil, short	2
<i>Salix babylonica</i> *	willow	wi,wa	short	4+
<i>Schinus terebinthifolia</i>	Brazilian pepper	b,wa	short	3
<i>Solanum aviculare</i>	kangaroo apple	b,m	soil, long	2+
<i>Solanum laciniatum</i>	kangaroo apple	?	?	?
<i>Tamarindus indica</i>	tamarind	?	?	?
<i>Tamarix</i> spp	Athel pine, tamarisk	wi,b,m	short	3

Woody weeds that resprout

Species	Common name	Dispersal	Seed bank	Years to maturity
<i>Acacia decurrens</i>	early black wattle	wa,b	soil, long	?
<i>Acacia farnesiana</i>	mimosa bush	ex,m	canopy, short?	8?
<i>Acacia pycnantha</i>	golden wattle	w, b	soil, long	3
<i>Bauhinia populinus</i>	kurrajong	b,m	soil, short	8+?
<i>Callistemon</i> spp	bottlebrush (eastern states spp)		?	?
<i>Chrysanthemoides monilifera</i> *	bitou bush	b,wa,m,a	soil, med/long	1.5
<i>Cotoneaster glaucophyllus</i>	cotoneaster	b	high viability	2
<i>Cotoneaster pannosus</i>	cotoneaster	?	?	?
<i>Eucalyptus botryoides</i>	bangalay	?	?	?
<i>Eucalyptus citriodora</i>	lemon scented gum	?	?	?
<i>Eucalyptus cladocalyx</i>	sugar gum	ex,wi,wa	soil, short	?
<i>Eucalyptus globulus</i>	Tasmanian blue gum	?	?	?
<i>Eucalyptus maculata</i>	spotted gum	?	?	?
<i>Eucalyptus muelleriana</i>	yellow stringybark	?	?	?
<i>Eucalyptus polyanthemos</i>	red box	?	?	?
<i>Eucalyptus saligna</i>	Sydney blue gum	?	?	?
<i>Genista</i> spp	broom	ex,b,wa	soil, long	2
<i>Gleditsia triacanthos</i>	honey locust	m,wa	soil, long	5+
<i>Leucaena leucocephala</i>	lead tree	?	soil, long	2
<i>Melaleuca quinquenervia</i>		wi,wa	canopy	3
<i>Nerium oleander</i>	oleander	wi,wa	soil, ?	?
<i>Nicotiana glauca</i>	tobacco tree	wi,wa	soil, ?	1
<i>Parkinsonia aculeata</i>	parkinsonia	wa	soil, short	2+
<i>Pittosporum undulatum</i>	sweet Pittosporum	b,ma	soil, short/med	5
<i>Rhamnus alaternus</i>	buckthorn	b,m	soil, long	2?
<i>Ricinus communis</i>	castor oil plant	wa,m	soil, medium	1+
<i>Senna surattensis</i>	Singapore shower	wa	soil, medium	2+
<i>Sennaria</i>	Java bean	wa	soil, medium	2+
<i>Ulex europeus</i>	gorse	ex,b,m,a,wa	soil, long	1.5
<i>Ziziphus mauritiana</i>	Chinese date	b,m	short?	?

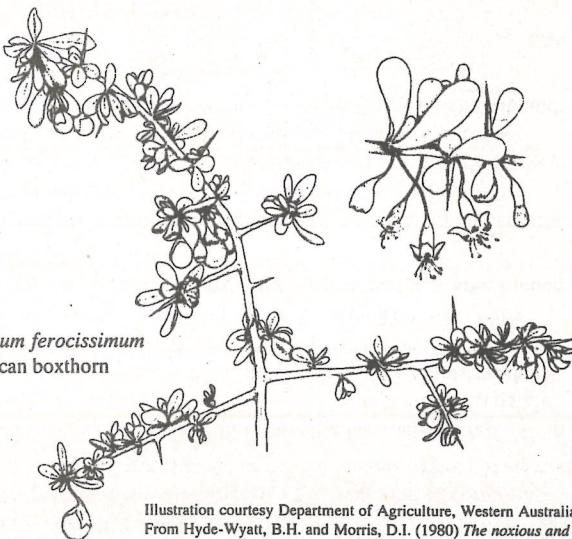
Non-resprouting woody weeds

Species	Common name	Dispersal	Seed bank	Years to maturity
<i>Acacia baileyana</i>	Cootamundra wattle	b,m,a	soil, long	2+
<i>Acacia elata</i>	mountain cedar wattle	?	?	?
<i>Acacia leptoaphylla</i>	Flinders Range wattle	w, b	soil, long	2
<i>Acacia longifolia</i>	Sydney golden wattle	w, b, a	soil, long	2
<i>Acacia podalyriifolia</i>	Qld silver wattle	w, b	soil, long	
<i>Chamaesyces palmensis</i>	tagasaste	ex	soil, long	3
<i>Lagunaria patens</i> onii	Norfolk Is. hibiscus	?	?	?
<i>Leptospermum laevigatum</i> +	Victorian tea-tree	wi	soil, canopy	4
<i>Pinus pinaster</i>	maritime pine	wi	canopy, med	7
<i>Pinus radiata</i>	radiata pine	wi	canopy, med	5+
<i>Polygalma myrtifolia</i>	butterfly bush	b,a,w	soil, short/med	1+
<i>Psoralea pinnata</i>	taylorina	wa,ma	soil, medium	3

WA natives naturalised outside normal range

<i>Calothamnus quadrifidus</i>	?	soil,	?
<i>Calothamnus validus</i>	?	?	?
<i>Chamaeleum uncinatum</i>	Geraldton wax	?	soil,
<i>Melaleuca pentagona</i>	?	?	?
<i>Melaleuca nesophila</i>	?	?	?
<i>Verticordia monadelpha</i>	?	?	?

+ Suckering from root damage and resprouting has been reported on the south coast



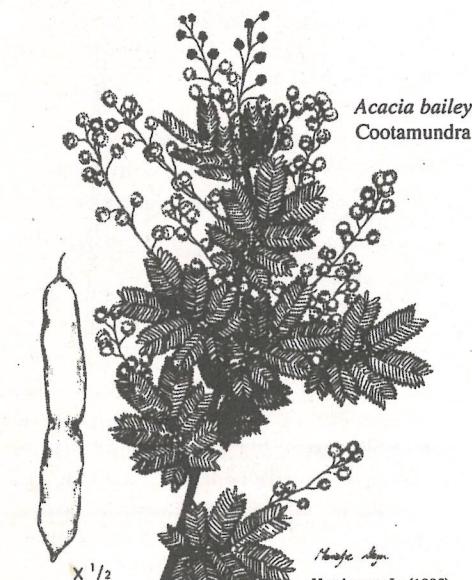
Lycium ferocissimum
African boxthorn

Illustration courtesy Department of Agriculture, Western Australia.
From Hyde-Wyatt, B.H. and Morris, D.I. (1980) *The noxious and secondary weeds of Tasmania*, Dept. Agriculture, Tasmania.



Melaleuca quinquenervia

Illustration courtesy provided by IFAS
Centre for Aquatic PLants, University
of Florida, Gainesville, 1990.



Acacia baileyana
Cootamundra wattle

Henderson, L. (1995).
Plant Invaders of Southern Africa.
Handbook N°5 Plant Protection Research Institute.
Agriculture Research Council South Africa

Dispersal: mode of seed dispersal, a = ants, b = bird, ex = explosive, m = mammal, wa = water, wi = wind. **Seed bank:** main storage of seed (canopy or soil), and length of seed viability, short = days to 1 year, medium = 1-5 years, long = 5 years plus. **Years to maturity:** how many years it takes to produce the first seed crop. * = will grow by vegetative fragments or stem layering. ? = unknown.

Managing woody weeds without herbicide:

Hand removal:

Tree seedlings can be carefully pulled by hand, ensuring removal of the tap root. Seedlings can be distinguished by the presence of a long tap root while suckers have a hockey stick shaped end where they have broken off the parent root.

Grubbing out mature trees is not recommended, disturbance to soil structure and surrounding vegetation is high and for many suckering species small root fragments left in the soil will simply resprout.

Cut stump: Suitable for trees that do not resprout

The crown can be cut off 5-15 cm above the ground. It is important that stumps are cut below any branches and close to the ground, as some species may have dormant buds higher up the stem.

If herbicide use is not desirable and the offending tree resprouts, try cutting the stump and then repeatedly cutting any regrowth. This should eventually exhaust the plant's reserves, but be prepared, it may take years!

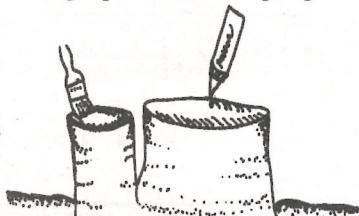
CAUTION: Cutting of suckering species will probably induce prolific root suckering.

Applying herbicides:

Cut and paint: For trees that resprout

Many resprouting species may be controlled by cutting the stump close to the ground (5-15cm) and immediately painting with a systemic herbicide. The entire surface of small stems can be painted using a paintbrush or sponge applicator.

On larger trunks it is possible to apply the herbicide to the cambium only. This is the ring of live cells just inside the bark. The herbicide must be applied within 30 seconds of the stump being cut.



Cutting and painting stems of woody weeds

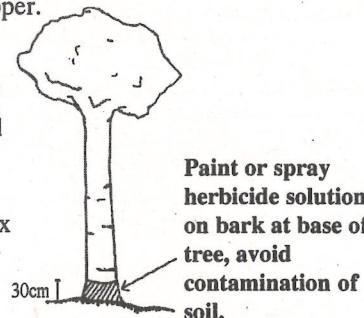
Treating resprouts

No matter how good your technique, follow up may be necessary for some species or under some conditions. Foliar spray of the resprouting coppice or further cut and paint treatment can be carried out (use a systemic herbicide registered for use on the weed and a good penetrant).

Stem injection/basal bark treatment: For trees that sucker

Although many plant species will sucker without provocation, many others sucker primarily in response to canopy or root damage. Species which root sucker may be best treated by the stem injection or basal bark treatment outlined for Brazilian pepper.

Basal bark treatment is useful where stems are of small diameter, in tangled thickets or where the infestation covers huge areas. A Garlon/diesel mix is registered for a number of woody weeds.



Removing the rubbish:

Whether using herbicide or not, there are a few things to keep in mind when cutting out woody weeds.

- Minimise damage to surrounding vegetation by planning your removal route in advance.
- Cut back large or bushy plants sequentially.
- Don't cut down or carry out plants covered in fruit or seed, as this will only help spread the weed!
- Unripe fruit/seed can ripen on cut branches.
- Some plants will grow easily from branch cuttings, so careful removal of all material is essential; alternatively treat these species by stem injection or basal bark treatment.
- Trees that are injected or basal bark treated, make good perches when left standing. They will rot and fall eventually. Depending on the area, and how many weed trees there are, you may decide to leave the dead trees standing.

Things to think about:

Application technique: When treating woody weeds, either by the cut and paint or stem injection method, it is essential to apply the herbicide within 30 seconds of tissue damage. If not, the tree seals the wound preventing the herbicide from being transported around the plant by the sap.

What herbicide when?: A number of systemic herbicides are registered for use on a range of woody weeds. Glyphosate, garlon, picloram and triclopyr based products are often recommended. Wetting or penetrating agents are not required when injecting or painting stumps. It is important to treat weeds during their growing season for maximum herbicide translocation to the roots and growing tips. Plants should not be treated when under stress from drought, waterlogging, cold etc.

Canopy stored seed: Herbicide treatment may induce seed drop in bradysporous (retain seed on plant) species such as *Melaleuca quinquenervia*. The herbicide places the tree under stress causing the canopy stored seed to be released. This may result in prolific seedling recruitment. Consider cutting down and removing the branches immediately from the bushland.

What about fire?: Although fire can often facilitate spread of woody weeds, for non resprouting trees, particularly those with short to medium lived seed, fire provides an opportunity for very effective control. The mature plants are killed by fire and if seedlings are consistently controlled for a few years following fire entire populations of woody weeds can be eradicated.

Follow up: Once mature trees are removed keep an eye on the area and pull out any new seedlings. Some seeds are short lived, others much longer lived; depending on the weed and conditions, you may be pulling out seedlings for a number of years. Nearby populations of the weed may also be a source of reinfestation.

What comes next: When removing weed trees, especially large monocultures, you have to consider what will move back into the area. Is another, harder to control weed, poised to move back in? Will you need to assist regeneration of native plants by seeding or planting?