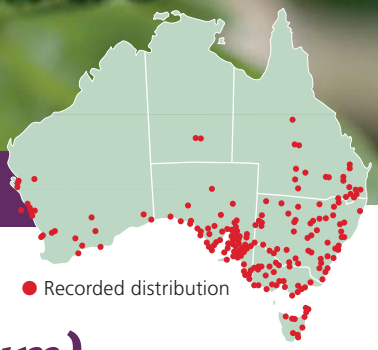
# Weed Management Guide

Managing weeds for biodiversity




# African boxthorn *(Lycium ferocissimum)*



## The problem

African boxthorn (commonly known as boxthorn) is a widespread weed in regional Australia. It is considered a major problem because it invades native vegetation, alters habitat and overruns pastures and other areas. It forms dense, impenetrable thickets that exclude other plants, can provide shelter and food for feral animals such as foxes, rabbits, starlings and sparrows and reduce access for stock, native animals, people and vehicles. Its large thorns can also injure livestock and puncture vehicle tyres and several pest insect species breed in its fruit.

Native fauna requirements should be taken into account during management of boxthorn infestations. For example, boxthorn in coastal regions can interfere with seabird breeding and displace native shrubs such as nitre bush. However, in some situations where much or all of the original native vegetation cover has been removed, boxthorn's dense foliage may be used as habitat by native fauna such as fairy wrens and the fruit may be a food source for native animals.

Many agencies, community groups and individuals expend considerable resources each year on planning and undertaking boxthorn control. While not among the 20 Weeds of National Significance, boxthorn was ranked a close 24th in the assessment of Australia's worst weeds. However, very little research has been done on its ecology.

## The weed

African boxthorn is a much branched, perennial shrub, commonly 2–3 m tall, but may grow up to 6 m tall. Branches are hairless and stiff and end in sturdy thorns. Numerous thorns also occur at right angles along the branches.

The leaves are generally 10–40 mm long, 4–10 mm wide, bright green, smooth and rather fleshy. They are oval in shape with a rounded tip and occur in clusters along branchlets and at the base of thorns.

Boxthorn mainly flowers in spring and summer but flowers may be present any time of year. Flowers hang on stalks, singly or in pairs. They are white to mauve with a tubular base, usually five-lobed and about 12 mm in diameter. Fruit is a smooth round berry, 5–12 mm long, green ripening to bright orange-red, containing more than 20 seeds.

The deep, woody taproot is branched and re-sprouts vigorously if broken or cut.

African boxthorn is an intricately branched shrub with large thorns.
Photo: Jackie Miles and Max Campbell

## Key points

- Boxthorn is spread into natural areas and pasture by birds and foxes.
- Boxthorn re-sprouts readily from roots left in the ground if not poisoned or removed completely.
- Correct weed identification is essential. Australian native species that may resemble boxthorn occur within its current range.
- Prevention is the most cost-effective form of weed control.
- For established infestations in native vegetation, a carefully planned, long-term program is needed to eliminate boxthorn with minimum disturbance.
- Mature boxthorn plants may provide habitat for some native fauna.

## Weed identification and similar native species

One native and three weedy boxthorns (*Lycium* spp.) occur in Australia. All are thorny shrubs which produce berries, with white or purple flowers and petals joined in a tube at the base. The native species, Australian boxthorn *(Lycium australe)* grows across southern mainland Australia, mainly in drier areas west of the Great Dividing Range.

### How to identify boxthorns (*Lycium* spp.) in Australia

| | Australian boxthorn *(Lycium australe)* | African boxthorn *(L. ferocissimum)* | Chinese boxthorn or wolfberry *(L. barbarum)* | Kaffir boxthorn *(L. afrum)* |
|---|---|---|---|---|
| **Status** | NATIVE | WEED | WEED | WEED |
| **Plant habit** | Shrub commonly to 1.5 m tall, rarely grows to 2.5 m | Shrub commonly to 3 m tall, may grow to 6 m | Shrub to 2.5 m tall, arching branches, often with few laterals | Shrub to 2 m tall |
| **Lateral branches** | Leafy, often ending in a spine | Leafy, mostly longer than 10 mm, ending in a stout spine | Leafless, mostly 2–10 mm long, may end in a spine | Leafy, ending in a stout spine |
| **Leaves** | Usually less than 5 times as long as broad, thick, mostly 1.5–5 mm wide | Usually less than 5 times as long as broad, 4–10 mm wide | Usually less than 5 times as long as broad, angular tip, single leaves 5–15 mm wide | At least 5 times as long as broad, up to 24 mm long |
| **Flowers** | 8–12 mm long | 10–12 mm long | 10–12 mm long | 15–20 mm long |
| **Fruits** | Orange-red berry, 2–5 mm diameter, 5–20 seeds | Orange-red berry, 5–10 mm diameter, 35–70 seeds | Orange-red berry, 3–4 mm diameter, approx. 20 seeds | Purplish berry, 10 mm diameter, approx. 20 seeds |
| **Current distribution in Australia** | NSW, Vic., SA, WA | All states and territories | All states and territories except WA and NT | Vic. |



### Other spiny native shrubs

Do not confuse African boxthorn with spiny native shrubs that may look similar and occupy similar types of habitat. None have spines as large and rigid as those on mature African boxthorn, which may be up to 15 cm long on main stems.

Key features of native species that may look like boxthorn:

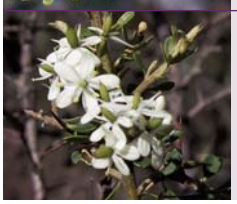
**1. Leaves fleshy, fruit a berry:**

Nitre bush or dillon bush *(Nitraria billardierei)* is a spreading, rounded shrub that grows in drier areas and coastal regions of mainland Australia and on many islands off Western Australia and South Australia. Leaves and flower parts may be felted. Flower petals are hooded. Fruit is a purple, red or golden oblong berry **with only one seed**.
Photo: Peri Coleman

**2. Leaves not fleshy:**

Spiny fanflower or currant bush *(Scaevola spinescens)* is widespread in the drier regions of mainland Australia. **Flowers are fan-shaped**. Fruit is a round, fleshy berry, dark-purplish and 5–7 mm long.
Photo: Peter Tucker

Tree violet *(Hymenanthera dentata* or *Melicytus dentatus)* is found in the ranges of southeastern Australia to the Flinders Ranges. Leaf margins are often slightly toothed. **Fruit is a purple-black berry**.
Photo: Jackie Miles and Max Campbell



Christmas bush or blackthorn *(Bursaria spinosa)* occurs in all states except Western Australia and the Northern Territory and can grow as a tree. Spines are needle-like, flowers in clusters at the end of branches. **Fruit is a dry, brown capsule**.
Photo: Jackie Miles and Max Campbell

Australian boxthorn *(Lycium australe)*, native.
Photo: Dr Tony Robinson (DEH)


African boxthorn *(Lycium ferocissimum)*.
Photo: Colin Wilson

Chinese boxthorn *(Lycium barbarum)*.
Photo: Jackie Miles and Max Campbell

## How it spreads

African boxthorn was originally introduced to Australia from South Africa and planted as hedges for fencing and windbreaks. It spread from the initial plantings and by 1904 was proclaimed noxious in parts of Victoria.

Boxthorn produces large numbers of orange-red berries that are eaten by native and non-native birds and other animals. The seeds pass through the gut and are thus spread into native vegetation. Some of the birds can travel distances of many kilometres. Infestation is common under trees, shrubs, posts, fences or powerlines where birds perch.

## Where it grows

Boxthorn is a hardy, drought-tolerant plant that has been recorded in all states and territories from temperate, sub-tropical and semi-arid regions. Its current distribution includes inland and coastal areas in southern Australia and extends into sub-coastal Queensland. It generally occurs where the average annual rainfall is greater than 200 mm. It is also a major weed in New Zealand.

Boxthorn is mainly a weed of open areas such as woodlands, rangelands, coastal areas including offshore islands, watercourses, roadsides, rail reserves and pastures that are not cultivated. It grows on all soil types but prefers lighter (sandy or loamy) soils.

Fleshy-fruited weeds such as boxthorn often appear first under trees where birds perch but boxthorn is not restricted to such areas.
Photo: Les Tanner

## Potential distribution

Without effective control programs, boxthorn has the potential to become more abundant within its current range and to spread into new areas. Climate matching indicates that it could spread through much of Australia other than forests and the tropics. However, in arid regions it generally grows near watercourses.

## Growth cycle

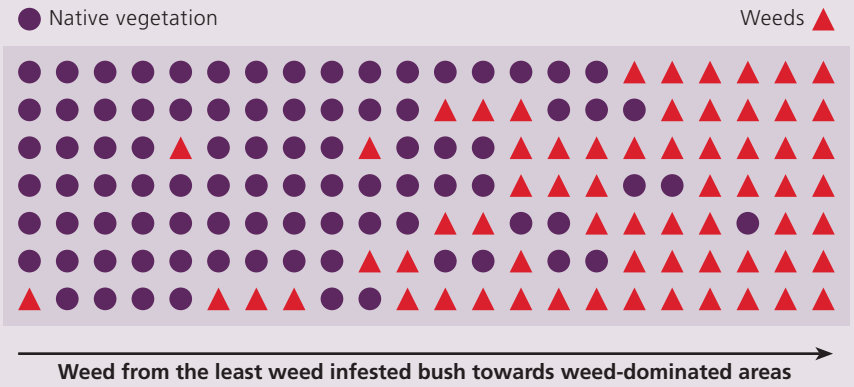
Boxthorn grows in regions having maximum rainfall in summer or winter, or uniform throughout the year. Active growth is mainly in autumn through to spring, but its growth cycle may vary. Plants sometimes lose their leaves temporarily under moisture stress or in winter. Boxthorn generally flowers and seeds in spring to summer but may do so at any time of year depending on local conditions (eg availability of moisture). Seeds may germinate at any time of year and seedlings take two or more years to commence fruiting. There is no evidence that seeds are long-lived in the soil.

## What to do about it

In most regions where boxthorn is widespread, total eradication may not be a realistic goal. However, at the local or property scale a long-term management program can reduce the weed's harmful effects, help to contain its spread and encourage native vegetation to recover.

A planned, strategic approach is essential to ensure that after treatment, boxthorn is replaced by desirable plant cover rather than new boxthorn seedlings, regrowth or other weeds. As well as the information presented in this guide on boxthorn biology and

**Strategic weeding in native vegetation**




Boxthorn sometimes loses its leaves temporarily under moisture stress.
Photo: Colin Wilson

control methods, a plan needs to be based on specific knowledge about the site—including the distribution of other major weeds.

The general strategy and methods described below are useful for native vegetation and introduced pasture. However, a broader range of strategies may be needed for removing boxthorn from pasture or other cleared land.

## Prevent boxthorn spreading

Identify locations where boxthorn occurs as isolated plants or sparse populations. Remove seedlings and treat isolated plants or clumps first and **follow up**. Keep uninfested areas free of boxthorn.

## Reduce established infestations

Develop and implement a **long-term** weed management plan.

### 1. Investigate the site

- **Identify all plant species:** weeds and native plants.
- **Map boxthorn infestations:** indicate weed density throughout the site, identify major sources of fruit from which re-invasion can occur.
- **Map native vegetation condition:** assess its capacity for recovery after boxthorn is removed and identify sites of high biodiversity value, such as rare flora.
- **Values and risks:** identify native fauna habitat values and high risk sites for erosion potential and other factors.

### 2. Develop the site action plan

- Identify goals and priorities based on the site information.
- Define priority areas for control by overlaying maps of boxthorn density, native vegetation, site values and risks.
- Plan to weed strategically:
  - protect the better quality native vegetation first and consider the needs of rare fauna and flora
  - work from isolated boxthorn plants towards core infestations
  - control plants from upstream to downstream.
- The size of the area targeted at each stage should be manageable enough to follow up thoroughly. Boxthorn control that is not followed up is wasteful and can cause a bigger problem.
- Include control of other weeds so that they do not establish where boxthorn has been removed.
- Select the most suitable control method for each weed growth stage in each area to avoid damage to native vegetation. Plan appropriate disposal of weed material.
- Prepare a weed management calendar to maximise the effectiveness of control activities and avoid the breeding seasons of key native species.

### 3. Implement the action plan

- Remove boxthorn from the least infested areas first, then move into the more infested areas. Ensure that activities do not spread the fruit or disturb ground cover. Adapt to local seasonal conditions.
- Follow up weed regrowth each year in areas previously treated before moving to new areas of infestation.
- Coordinate control programs with neighbouring landholders to maximise effectiveness and reduce ongoing spread by animals.

### 4. Monitor and evaluate outcomes and adapt the plan accordingly

Include **monitoring of native plant regeneration**. In weed management programs there is often a tendency to focus on the removal of weeds as a goal, but at the site level the ultimate goal is restoration of native vegetation or productive pastures for grazing properties.

# Control methods

Mature boxthorn is difficult to destroy because of its large size, thorns and capacity to regrow vigorously from roots or stumps. All but the smallest plants are difficult to pull out completely without breaking off at the root or disturbing

surrounding vegetation. Cut stems can also take root if left in contact with the soil. No biological control agents have been identified for this species.

In selecting the most suitable control techniques it is essential to minimise adverse impacts on native vegetation and to encourage its subsequent recovery. Different methods may be appropriate for sparse boxthorn plants amongst native vegetation, compared with areas dominated by the weed. Where boxthorn infests a pasture, other methods may be available, so consult weed control contacts and existing fact sheets for more detailed advice.

To prevent injuries from thorns, protective clothing including thick gloves, long pants, boots, long-sleeved shirt and eye protection must be worn.

## Physical weed removal

Seedlings can be hand pulled if the ground is not too hard. For extensive infestations in pastures, mechanical equipment such as a 'Boxthorn Plucker' may be used on individual plants. It is essential that the work be followed up over several years to treat regrowth from root fragments left behind, but less follow-up should be needed after a few years of concerted effort. Regrowth can be treated with herbicide. Preferably pull plants when not in fruit.

As heavy machinery is involved, the plucker method is unsuitable in native vegetation where off-target damage would be unavoidable.

## Chemical control

Herbicide can be highly effective, providing it is carefully chosen and selectively applied to minimise regrowth, off-target damage and disturbance. The main herbicide treatments for boxthorn are foliage spray, cut-stump, stem injection and basal bark application. All of these methods are only effective if the plants are actively growing at the time of application.

## Foliar spray

For spraying to be effective, all boxthorn foliage must be wetted and the equipment suited to the size of the plants. In native vegetation, careful spot spraying using hand held equipment (handgun and hose or knapsack) would be required to avoid off-target damage. In this situation, foliar spraying is generally limited to small plants and regrowth under conditions when spray drift will not occur.

## Cut-stump application

**Suitable for all basal stem sizes**

All stems are cut horizontally with secateurs, bush saw or a chainsaw no higher than 15 cm from the ground and the cut surface painted **immediately** (within 10 seconds) with herbicide, using a hand held spray bottle or a brush. For large plants, the first cut stems may need to be treated before the remainder are cut and a team of two or more people need to work together. Use a dye in the mixture to show that stems have been treated.

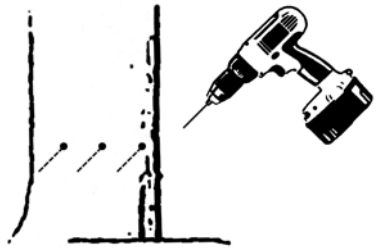
Gaining access to the base of large thorny bushes can be difficult. Several people working together can use a cable to pull the bush out of the way, cut the stems and paint immediately with herbicide. Or the top of the plant can be cut away first, then the stems cut lower and herbicide applied immediately.

Once stems are cut, herbicide must be applied immediately to stumps: North Pasco Island, Tas. Photo: Karen Ziegler

## Stem injection

**For basal stem diameter larger than 5 cm**

Drill holes at approximately 5 cm intervals around the stem, angled downwards and sideways. Use a drill bit of 6 mm or more in diameter. Holes need only be as deep as the living wood just under the bark. Fill **immediately** with herbicide using a squirt bottle or plastic syringe.



Stem injection. Side view of trunk showing 45° -angled holes in wood.

## Basal bark application

**For basal stem diameter up to 5 cm**

Bark of all stems needs to be sprayed or painted with herbicide around the entire circumference to a height of at least 30 cm from ground level. This method may be impractical for large multi-stemmed plants due to the difficulty of applying herbicide to all sides of all stems.

## Registered herbicides for boxthorn

The table below includes a limited selection of the chemical applications registered for boxthorn. These non-residual, systemic chemicals can be applied to individual boxthorn plants in native vegetation by community groups, landholders and public land managers.

When using herbicides always read the label and follow instructions carefully. At least one member of a group should have formal training in the safe storage, handling, preparation and use of the chosen herbicides. Particular care should be taken when using herbicides near waterways because rainfall runoff can carry herbicides. Use special formulations for such environments where appropriate.

| Active constituent | Off-target risk | Boxthorn target | Mixture | Method of application | Details / timing: see label |
|---|---|---|---|---|---|
| Glyphosate 360 g/L as isopropylamine salt*<br>*Registered label use* | Any type of plant when foliage, green stems or exposed non-woody roots are in contact with the chemical | Foliage# | 7–10 mL / 1 L water<br>Follow label advice on adding surfactant | Handgun or knapsack spray | Lower rate for young bushes, higher rate for mature bushes<br>Do not spray during hot dry periods or windy or wet conditions |
| Triclopyr 600 g/L as butoxyethyl ester<br>*Registered label use* | Any plants other than grasses when exposed parts are in contact with the chemical | 1. Basal bark (stems up to 5 cm diameter)<br>2. Cut-stump (basal stems > 5 cm diameter or difficult to access) | 2 L / 60 L diesel | 1. Spray or paint basal bark—all sides<br>2. Paint all stumps immediately after cutting | When plants actively growing<br>(Tasmania: do not treat during winter) |
| Triclopyr 600 g/L as butoxyethyl ester<br>*Registered label use for Tasmania only* | Any plants other than grasses when exposed parts are in contact with chemical | Foliage of plants less than 2 m tall# | 170 mL / 100 L water | Knapsack spray | Boxthorn plants not stressed by drought |

**Glyphosate-only herbicide products containing other concentrations and forms of the active chemical are also registered for spraying African boxthorn. Follow label advice for rates.*

*#Avoid spray drift—refer to label.*

## Alternative methods of applying glyphosate

Cut-stump application and stem injection of glyphosate for boxthorn are not included on registered labels. A 'Permit to allow minor use of an AGVET chemical product' may be issued to allow registered products to be used for a purpose or in a manner that is not included on the approved label. Permits that include stem treatment of woody weeds with glyphosate in some situations exist in Tas., WA, Qld, SA, NSW and the ACT. Refer to the Australian Pesticides and Veterinary Medicines Authority website to find the relevant permit for your state or territory and obtain advice on local conditions from the permit holder. Refer to the fact sheet 'Off label chemical use in Victoria' for sources of advice in that state. Examples of treatments that may be included in a permit are summarised below.

The herbicides listed in this guide are both systemic and non-residual, defined as follows:

- **Systemic or translocated herbicides** are transported throughout the plant and within the plant to the roots, storage organs, stems and foliage. Through this means they can be effective on perennial plants.
- **Non-residual herbicides** are not herbicide-active in the soil for any length of time. Therefore they do not prevent subsequent regeneration of weeds or other plants.

| Active constituent | Off-target risk | Method and stem size | Mixture | Details / timing |
|---|---|---|---|---|
| Various registered glyphosate-only products | Any type of plant when foliage, green stems or exposed non-woody roots are in contact with the chemical | Cut-stump (basal stems of any size)<br>Stem injection (stems 5 cm or more in diameter) | Undiluted or diluted in water<br>Add dye | See label for advice on safety, weather conditions and timing<br>Refer to permit and seek advice on a suitable dilution rate |

...case study

## Boxthorn on offshore islands

Islands play an important role in conserving seabirds, marine mammals, coastal vegetation and other wildlife. Many also have a colourful and varied human history, during which non-native plants and animals became established. Due to their relative isolation, islands often present opportunities to attempt local eradication of feral animals and weeds, for the benefit of wildlife in the long term.

African boxthorn was planted in harsh island environments to provide windbreaks and fences, and with the assistance of birds has since spread widely. It can displace native vegetation and has a range of impacts on wildlife habitat. Eradication of any established infestation presents an enormous challenge, one that is being met by a sustained effort in some key coastal locations.

Althorpe Islands Conservation Park is located off Yorke Peninsula in South Australia, under the management of the SA Department for Environment and Heritage. The park is important habitat for native species including large numbers of short-tailed shearwaters *(Puffinus tenuirostris)* which breed on the island, digging nesting burrows in the sandy soil. For more than 100 years the island was inhabited and non-native species including boxthorn were introduced. The weed proliferated after feral goat removal was completed in 1990. It is considered a threat to the shearwaters because they are apparently unable to burrow through its dense root mass.

Friends of Althorpe Islands Conservation Park actively assist with management, including research and weed removal and in 1998, a major effort commenced to eradicate boxthorn from the island. Community service volunteers and the Australian Trust for Conservation Volunteers were also involved. About 10 000 mature boxthorn were cut and painted, and over six years thousands of seedlings were removed. Activity within seabird colonies was timed to avoid the critical breeding seasons, but it was also essential to treat boxthorn plants with herbicide when they were actively growing.

Boxthorn emerging through native succulent shrubs: Althorpe Island, SA, 2006.
Photo: Erika Lawley

The Friends group found that the most efficient and effective method for killing mature boxthorn is to cut stems horizontally near ground level and immediately apply glyphosate (diluted in clean water) to the stumps. To follow up, they cut and painted regrowth. Site conditions affected the amount of regrowth after initial treatment, with plants in sheltered, sandy locations being the most persistent. Young plants are often detected when they emerge through native shrubs and follow-up work continues. In 2006, almost 700 boxthorn seedlings were removed. Once the island is free of mature and regrowth boxthorn, regular maintenance will be needed to remove seedlings, as seeds may be dispersed to the island by birds.

Regrowth after primary treatment – cut and paint to avoid damage to native plants: Althorpe Island, SA.
Photo: Erica Lawley

It was important to assess the impact of boxthorn removal on shearwater breeding and on native vegetation. To do this, regeneration of native plants and density of shearwater burrows in the vicinity of dead boxthorn stumps were monitored. Bare ground around boxthorn stumps was initially colonised by weedy annual plants, then generally replaced by native plants. While initial monitoring of burrows was encouraging, further monitoring will show whether shearwaters are benefiting from weed eradication.

case study

## Contacts

| State / Territory | Department | Phone | Email | Website |
|---|---|---|---|---|
| ACT | Environment ACT | (02) 6207 9777 or 132281 | EnvironmentACT@act.gov.au | www.environment.act.gov.au/yourenvironmenthwp/pests |
| NSW | NSW Department of Primary Industries<br>Dept of Environment and Climate Change | 1800 680 244<br>131 555 | weeds@dpi.nsw.gov.au | www.dpi.nsw.gov.au/weeds<br>www.nationalparks.nsw.gov.au/npws.nsf/Content/Weeds |
| NT | Dept of Natural Resources, Environment and the Arts | (08) 8999 2020 | weedinfo.nreta@nt.gov.au | www.nt.gov.au/nreta/naturalresources/weeds/index.html |
| Qld | Dept of Natural Resources and Water | (07) 3405 5537 | enquiries@nrw.qld.gov.au | www.nrw.qld.gov.au/pests/index.html |
| SA | Dept of Water, Land and Biodiversity Conservation | (08) 8303 9620 | N/A | www.dwlbc.sa.gov.au |
| Tas. | Dept of Primary Industries and Water | 1300 368 550 (cost of a local call) | Weeds.Enquiries@dpiw.tas.gov.au | www.dpiw.tas.gov.au |
| Vic. | Dept of Primary Industries / Dept of Sustainability and Environment | 136186 | customer.service@dpi.vic.gov.au | www.dpi.vic.gov.au<br>www.dse.vic.gov.au |
| WA | Dept of Agriculture and Food | (08) 9368 3333 | enquiries@agric.wa.gov.au | www.agric.wa.gov.au |
| Australia-wide | Australian Pesticides and Veterinary Medicines Authority (APVMA) | (02) 6272 5852<br>Fax: (02) 6272 4753 | EnquiryLine@apvma.gov.au | www.apvma.gov.au<br>http://services.apvma.gov.au/PubcrisWebClient<br>(search on 'African boxthorn' to find current registrations) |

Contact details for state and territory agencies with responsibility for weeds are listed above, along with the APVMA. The APVMA website hosts the PUBCRIS database which contains information on all herbicides that are registered for use on weeds in each Australian state and territory, including minor use permits.

Consult the natural resource management organisation for your region or local council to find local contacts on managing weeds for biodiversity, including community groups working on boxthorn.

Refer to the CRC for Australian Weed Management website (www.weeds.crc.org.au) for weed management guides in this series, as well as guides for Weeds of National Significance and alert list species. The Introductory Weed Management Manual (also available from this website) may assist in developing a plan tailored to your situation.

## Legislation

African boxthorn is a declared plant in NSW, Qld, SA, Tas., Vic., ACT, NT and at the local level in WA. Declared plants are often prohibited from sale and accidental or deliberate movement, and control by landholders is required (see the contacts table for further details relevant to your location).

In most states where boxthorn is widespread, legislation encourages involvement of all landholders in coordinated, long-term programs to reduce the weed's impacts and minimise spread into uninfested areas. Weed control that could significantly damage native vegetation may be regulated by legislation.

## Acknowledgments

Information and guide revision: Qld, NSW, Vic. and Tas. government factsheets on African boxthorn. John Virtue (SA DWLBC / Weeds CRC), Deb Agnew (Northern & Yorke Natural Resources Management Board). Australian Bureau of Flora and Fauna (1982) Flora of Australia: Volume 29. Australian Government Publishing Service.

Map: Australia's Virtual Herbarium, *(Lycium ferocissimum)*, via Royal Botanic Gardens Melbourne, Council of Heads of Australian Herbaria. www.rbg.vic.gov.au/cgi-bin/avhpublic/avh.cgi.

Case study: Erica Lawley (Friends of Althorpe Islands CP) and Caroline Paterson (Department for Environment and Heritage SA).

African boxthorn flower and leaves.
Photo: Colin Wilson

# Strategic management of African boxthorn

**Quick reference guide**



## Vegetation management or weed control?

The ultimate success of a boxthorn removal program is measured by the type of vegetation that replaces it. Adopt a strategic, integrated, long-term approach to maximise restoration of native vegetation or pasture and minimise reinvasion by boxthorn or other weeds.

Natural regeneration of native plants is the best form of revegetation, but in sites dominated by boxthorn over many years, there may be no native plants or seed remaining. Where this is the case, establish locally collected indigenous plants, including ground covers.

In rural landscapes, where the original native understorey vegetation has been removed and boxthorn provides the only cover for native fauna, plant suitable local native shrubs before removing it.

## Adapt the control method to the situation

Boxthorn occurs in a wide range of environmental conditions and land uses. Mechanical removal may be appropriate in introduced pasture but would result in off-target damage in native vegetation.

## Apply herbicides during periods of active growth

Herbicide should only be applied when plants are leafy and actively growing, preferably before the main fruiting season. Avoid hot or wet conditions, or periods when plants are under stress, as specified on the herbicide labels.

## Consider disposal options

In paddock situations, it is generally recommended that bushes be stacked and burnt to remove harbour for pests such as rabbits. However, if mature boxthorn provide scarce habitat for native fauna, cut bushes (preferably without numerous fruit) may be best left on site as temporary cover. Piles of cut boxthorn should not be left on top of native vegetation. Check that cut stems are not in contact with the soil where they may take root.

## Follow up

It is essential to monitor for regrowth from root fragments and stumps after physical or chemical treatment and follow up thoroughly. Wait until regrowth is 50 cm tall, then cut and paint or spot spray. The amount of regrowth will depend on season and site conditions. Plants that appear dead can sprout new growth three years after treatment.

Bird nest in boxthorn. Dense foliage can provide habitat for native and introduced fauna.
Photo: Peri Coleman

## Prevent boxthorn re-establishment

Once fruiting plants have been killed, the focus is on preventing re-establishment from seeds in the soil or brought in by animals. There is no evidence that boxthorn seeds are long-lived in the soil.

1. Avoid large-scale disturbance that would create extensive areas of bare soil, such as too-frequent fire in native vegetation or overgrazing in pasture.
2. Identify likely boxthorn fruit sources, dispersal agents and patterns of invasion such as bird roosting sites.
3. Monitor boxthorn-free areas every two years to detect and remove seedlings before they fruit.



CRC Weed management