



CENTRE FOR
INVASIVE SPECIES SOLUTIONS

GLOVEBOX GUIDE FOR MANAGING FOXES



Part of the
pestSMART 
publication series

Website: www.pestsmart.org.au

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About this guide

This glovebox guide is part of the PestSmart Toolkit for Foxes, produced by the **Centre for Invasive Species Solutions**.

It is aimed at land managers, pest animal officers and others involved in fox management. It provides general and current information on the best ways to manage foxes, including:

- identifying fox impacts
- developing a fox management plan
- management strategies and direct fox control techniques
- effectively evaluating your fox management plan

The advice provided in this publication is intended as a general source of information only. Always check current regulations and read the label before using any of the products mentioned. The information should be considered and adapted by you as appropriate for your financial, environmental and social circumstances, within legal and regulatory frameworks.

For further detailed information about foxes and other pest animals in Australia, visit our website: pestsmart.org.au



Image by Gary Tate.

Red foxes were introduced into Australia in the 1850s and have spread across most of the continent.

Taxonomic names:

Vulpes vulpes

Common names:

European red fox

Image by Chris Cox



LEARN-Introduction

Red foxes can injure and kill significant numbers of livestock (sheep, goats and poultry) and pet animals in a short period. They can also introduce diseases such as distemper, parvo virus and mange. Impacts from foxes can be very costly and distressing to both humans and animals affected.

Evidence also suggests that foxes are a primary cause of the decline and extinction of many small- and medium-sized rodent and marsupial species in Australia. They also prey on many bird species.

Controlling foxes is not something you do after the damage starts. Foxes are typically widespread and numerous across Australia. They inhabit both urban and rural landscapes. Foxes are not found in tropical climates.

They are highly mobile and efficient breeders, and can quickly move in and recolonise areas where fox numbers are lower or where prey is abundant (for example, rabbits).

‘One-off’ or reactionary control programs are not recommended.

While they may reduce the number of foxes in the short term they do not reduce the overall fox population nor the level of damage over the long term. This means you will need to invest money over and over to address the same problem.

Despite the resilience of foxes, it is possible to have an impact. You can protect livestock, pets and native animals from foxes in specific areas.

The solution is an integrated fox management plan. It takes a long-term, landscape-wide approach to controlling the impact of foxes.

You will need a plan with clear aims and realistic actions. You will need to monitor along the way and evaluate the outcomes.

Take advantage of the fox biology ‘weak spots’ to make the best use of your resources.

Generally, no single strategy or control technique will completely remove foxes from an area. You will most likely need a combination of management strategies and control techniques to keep on top of the fox problem.

Check the laws and guidance for your state or territory, including those that address the humane treatment of all animals.

We recommend following the six step pest animal adaptive management framework

PLAN

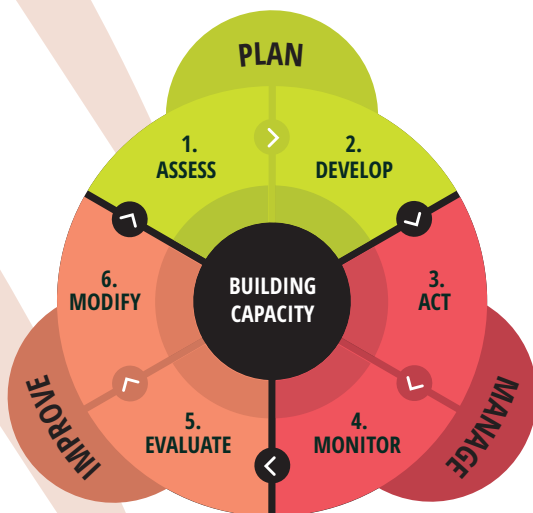
1. Assess and understand the problem
2. Develop a plan and set clear objectives

MANAGE

3. Choose control techniques and strategies and implement
4. Monitor the outcomes of your plan

IMPROVE

5. Evaluate the plan – did you meet your objectives?
6. Modify as required and repeat as necessary



Working with others in your community will be beneficial. And participating in [FoxScan](#), part of the [FeralScan](#) surveillance program can provide you with local information. It will also help others in your region manage foxes and other pests.

FERALSCAN
.ORG.AU

PLAN

Assess and understand your fox problem

This first step is the most important to develop an effective fox management program.

You need to identify:

- whether or not foxes are causing harm
- how severe the problem is
- where foxes are a problem
- what is enabling the foxes to thrive
- who else in your area has a fox problem
- when it occurs, for example seasonally or continual
- what needs to be achieved to solve it.

Identify and include all the people and agencies that should be involved. This will help define the problem from different perspectives. This will assist you or your group to agree on goals and develop a truly community-driven action plan.

Recommendation: Contact your neighbours, local council and/or Natural Resource Management agency.

Identifying fox impacts

First you need to establish whether or not the fox is the major cause of loss. Other predators, such as feral cats, wild dogs and dingoes, or feral pigs may also be present. Rule out their involvement.

As the fox hunts mostly at night and is an elusive creature, directly observing them killing animals can be difficult. You will probably need to rely on other signs of foxes.

Here are two approaches we recommend:

1. Look for fox paw prints. They are easy to tell apart from prints of dogs or other predators (see Figure 1).

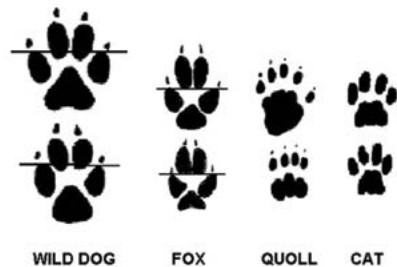


Figure 1: Dog, fox, quoll and cat paw prints. Foxes prints can be distinguished from dog prints - a foxes' pads can be separated by a straight line as shown. Diagram taken from 'Tracks, scats and other traces' by Barbara Triggs. 1996. Oxford University Press, Melbourne. Not to scale

2. Examine dead animal carcasses (if present) to determine the cause of death, and if foxes were involved. Start with the decision tree in Figure It covers sheep specifically but can be used as a general guide for other animals. Refer to the “More hints” section on page 11.

From “any signs of bleeding” – is it possible that the animal bled if it was born dead? The statements around lack of bleeding are confusing. Would suggest that the ‘has lamb breathed?’ question come after the Box: Probably dead when attacked ie. confirm by performing autopsy and examine the lungs.

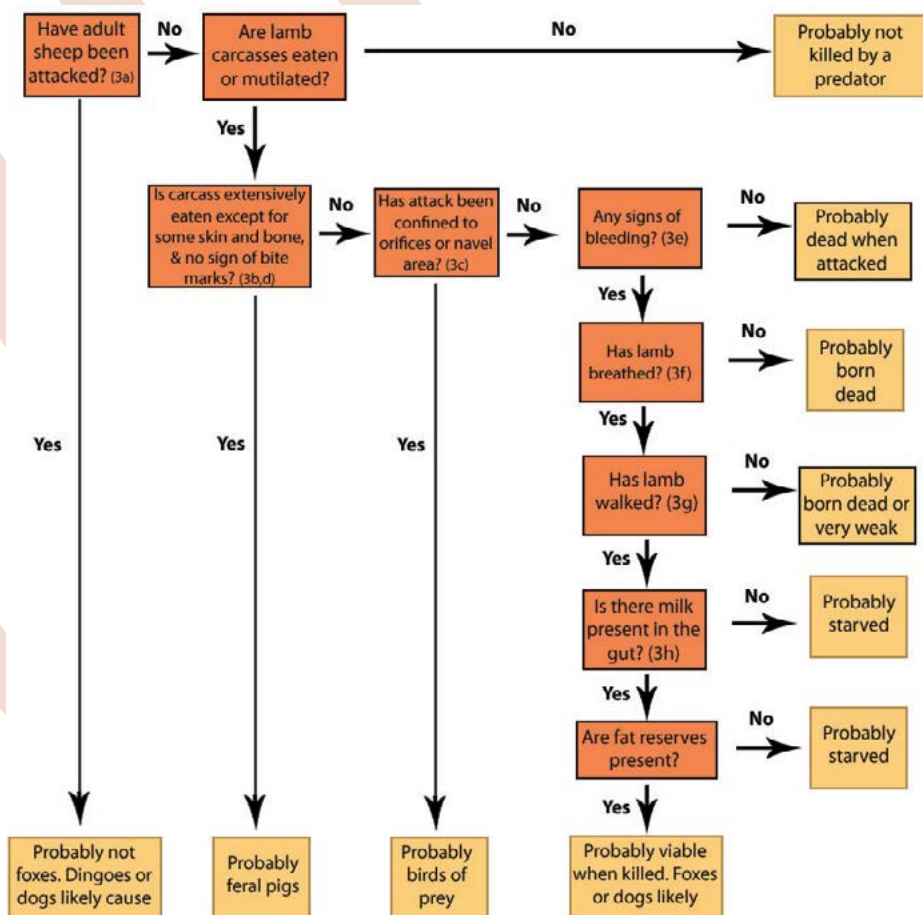


Figure 2: Decision tree for determining the cause of lamb death. Notes in brackets refer to photos on page 11. (after Agriculture Protection Board, Western Australia 1990. Foxes. Infonote 3/85, Edn 1.4, March 1990.)

More hints for determining cause of death

Was the lamb alive when attacked?

If the animal was attacked while alive this will confirm predators (eg. foxes, cats, dogs) are involved.

Examine the lamb closely and look at the wounds. An attack on a live animal results in bleeding at the wound site, with subsequent clotting, forming dark haemorrhagic areas (Figure 3e).

Dead animals do not bleed. If the animal, once dead, has been damaged, this means a bird of prey or other scavenger was involved.

What species of animal was responsible for the predation?

Examine where the wounds are on the body. Birds of prey usually feed on the upper side of the body only, concentrating on the eyes, nose, mouth, navel and anus (Figure 3c). Birds do not leave obvious bite marks.

Mammals, however will bite with teeth and dogs and foxes will often leave matching canine teeth puncture marks on both sides of the limbs or trunk. Foxes and dogs typically attack around the neck and muzzle area. The neck may be crushed, or the muzzle mutilated or bitten off. Look at the puncture marks closely. Foxes have very slender jaws, with the canine teeth closer together. Bite marks are best observed by skinning the carcass (Figure 3d).

Has the body been extensively mutilated or mostly consumed, including bones? This indicates feral pigs (Figure 3b). This can also be confirmed by the lack of canine puncture marks.

Even though dogs and foxes are capable of consuming most of a carcass, foxes especially tend to eat the tongue and organs first.

Attacks by foxes and dogs are often characterised by a large number of lambs killed (surplus killing) in one night. Note that foxes generally do not attack and mutilate adult sheep (Figure 3a).

Still not sure if the animal was killed by a predator? It can be useful to investigate cause of death further

When a body is found partially-eaten, try to determine if the animal was dead before being fed upon or if it was killed but unhealthy. Predators may scavenge on animals that have died from other causes (such as being stillborn), appearing to be the cause of death, when they are not.

To determine if the lamb was born healthy enough to walk, examine the hooves. Lambs are born with protective, soft membranes covering the soles of their hooves. These membranes are quickly worn away when they begin to walk (Figure 3g). An intact sole membrane indicates they did not successfully walk.

If they didn't walk, examine the lungs to determine if they were born dead. If the lungs are a light pink colour, this shows that they successfully breathed. If the lungs are a dark colour, they did not breathe (Figure 3f).

If the lungs are pink and the hoofs have no membrane, the animal may have starved to death. When a lamb fails to feed properly the fat reserves around the heart and kidneys become soft, gelatinous and dark plum red in colour. In healthy lambs this fat is firm, white and lacking obvious blood vessels. Successful feeding is also indicated by milk in the stomach and gut (Figure 3h).



Image by Daryl Panther



a. Severe wounds on adult sheep indicate dingo or wild dog attack. Image: G. Ballard



b. Feral pigs tend to extensively mutilate and eat lamb carcasses. Image: P. Pavlov



c. Wounds confined to upper side of carcass, in orifices and navel (entrails) area indicate attack by a bird of prey. Image: NSW DPI



d. Fine puncture marks in lamb skin indicate fox attack. Image: D. Croft



e. Signs of haemorrhaging around teeth, marks on the back of the neck indicate lamb was alive when attacked. Image: NSW DPI



f. Pink lungs indicating successful breathing (top) compared to non-aerated dark coloured lung of stillborn lamb (bottom). Image: NSW DPI



g. Bottom of hoof showing intact white protective membrane (bottom) compared to one worn away by walking (top). Image: NSW DPI



h. Milk in stomach and intestines indicate that lamb has suckled. Image: NSW DPI

Figure 3: Visible signs to assist in determining the cause of lamb death

Set objectives

Once you have established that you have a fox problem, you need to think about what you want to achieve. Set objectives so you can effectively plan and then measure the success (or otherwise) of your program.

A good objective includes:

- what you want to achieve,
- where,
- by when and
- who will help achieve it.

The main objective of any fox management program should be to reduce fox damage. Measure fox damage by the response of the prey species, and not by the number of dead foxes or baits taken.

Structure objectives related to reduced damage within a given timeframe. An example of this might be: "I want to improve the number of lambs surviving to lamb marking by 10% within two years".

Other objectives may be related to operational or socio-economic factors. For example: "Our group wants to increase the participation of landholders to 90% in two years".

Developing a plan

Once you understand the extent of the problem and have set objectives you need to design a plan of action.

Include in your plan: what will be done (in terms of available techniques, approvals required and legal constraints) and who does what, where, when and how.

You need to consider how to integrate fox management with other activities including farm and ecological management.



Image by Daniel Schembri

The main objective of any fox management program should be to reduce fox damage

What will be done and who does what, where, when and how?

The two most notable groups are rabbits and other predators, such as cats.

Rabbits

Consider if rabbits are a problem in your area. Controlling rabbits can help you control foxes.

Rabbits are a major food source for foxes. When rabbit numbers are low, fox numbers are also generally low. Controlling foxes without also controlling rabbits can lead to an increase in rabbit numbers. This may then allow the fox population to recover quickly as it has an abundant food source.

Feral cats and other small predators

Foxes compete with other small predators such as feral cats, goannas and quolls. When foxes are removed through control programs, these other predators can increase in numbers, so it is important to consider this as part of your integrated management plan and in turn have a greater impact on the prey species in that particular environment.

A word of warning: these relationships are complex and not fully understood.

You must consider the whole system when managing foxes. Keep up to date with the latest research via PestSmart and state/territory government agencies. Keep good records to update your plan regularly.

Fox issues are complicated and cannot be considered in isolation from other property management activities and local and regional situations.

Foxes share complex relationships with other animals (both predators and prey species).

Integrate fox control with the management of both farming and natural resource systems

MANAGE

Choose your strategies and controls

Once you have developed your fox management action plan, you need to decide on management strategies and control techniques. Choose what will best suit your situation and achieve your objectives.

Some strategies do not involve controlling foxes directly. You could change your current farm management/business practices, for example:

- the type of enterprise (consider alternates such as moving to cattle production)
- current herd practices, for example the timing and location of lambing, sheep breed and genetics
- other pest management activities (including rabbits, weed management) which may reduce the areas for foxes to reproduce.
- Fox control strategies can incorporate lethal and non-lethal techniques. If you decide on fox control consider:
 - what the prey species or enterprise that is to be protected requires
 - cost and effectiveness of the control technique
 - timing (fox biology vs other farm management activities)
 - your resources (financial and human)
 - potential risk for non-target damage (for example native wildlife, farm dogs)
 - neighbours (their enterprises, level of fox and rabbit control, and likelihood of cooperating in group activities)
 - ethical and welfare ('humaneness') concerns.

In Australia poison baiting using sodium monofluoroacetate (1080) is considered to be the most effective broad-scale method of fox control

FOX CONTROL OPTIONS

The next section of the guide summarises key information about the following controls and management strategies:

- Toxicants
 - o delivered as bait
 - o delivered through Canid Pest Ejectors
- Shooting
- Trapping
- Fumigating dens
- Guard animals
- Fencing
- Managing habitat, weeds and waste.

Contact your local or state/territory government to check if there are any widescale control programs underway or planned. This may save you money and deliver better results from any actions you take alone to control or deter foxes.

Toxicants

Any toxicants (human-made chemicals) used against foxes must be registered with the Australian Pesticides and Veterinary Medicines Authority (APVMA, www.apvma.gov.au/). Refer to your state/territory legislation and use the relevant standard operating procedures available from PestSmart.

Sodium monofluoroacetate (1080)

The most common toxicant used to control foxes is 1080, a restricted chemical product and a schedule 7 poison. Foxes very sensitive to this toxin, which occurs naturally in some Australian plant species. Many of Australia's native wildlife have a natural tolerance to 1080, unlike introduced species. In foxes this toxin affects the central nervous and respiratory systems. Foxes usually die within 2 to 3 hours.

Para-aminopropiophenone (PAPP)

PAPP is the active ingredient used in recently manufactured toxic baits. This product has been developed for strategic and targeted control of wild dogs and foxes. It is considered more humane than 1080. It is also a schedule 7 poison.

Once a fox eats a bait, the PAPP is absorbed into the bloodstream. It converts normal haemoglobin in red blood cells to methaemoglobin, which cannot carry oxygen to the heart muscles and brain. Foxes will generally lose consciousness within 60 minutes of eating the bait. They will usually die within an hour after that.

Other toxins

Strychnine cannot be used as a bait toxin in all Australian jurisdiction. It is recommended to contact your relevant authority if you wish to use this toxin.

Cyanide is not a registered vertebrate pesticide in any state in Australia, but limited-use permits may be obtained for research purposes.

Delivery of Toxicants

Baits

Check the current rules with your state/territory government agency. Obtain baits through licensed officers or designated government agencies. There are strict guidelines on how to use and place baits. You may be required to complete specific chemical training.

Toxicants are mainly incorporated in some form of meat bait (either fresh, dried or processed) for delivery to foxes. Baits can be distributed either from the air or by hand on the ground. Ground baiting is most common and involves regularly monitoring the buried baits. Aerial baiting is used in remote, sparsely populated areas and requires a special permit.



Image by NSWDPPI

Timing

Baiting programs are most effective when done twice a year. This is because they disrupt both the breeding (late winter/spring) and migration (autumn) stages of the fox life cycle.

For maximum success, make baits available to foxes for at least ten days. Check the baits at least every two days, and replace until no more are taken.

Placement

Place baits at strategic points along tracks and fence lines where foxes regularly travel, or near carcasses. Be mindful of distance restrictions from residences and boundaries. Bury baits in the ground 5–10cm deep at 200–500m intervals, with a total of about five baits laid for each square kilometre. (Burying reduces risks to non-target species, including birds.)

Mark the positions of baits with tape or pegs so you can easily check them later. You can use lures and scents to attract the foxes but do not use them continuously as scent trails.

Remove all uneaten baits at the end of the program to reduce the risk of bait aversion and avoid poisoning non-target species.

Always follow best practice baiting methods for best results and minimal risks to non-target animals. For more detailed information on baiting for fox control visit the [PestSmart website](#).



Image: Chris Cox



Baits should be buried to avoid been taken by non-target animals. Image: NSW DPI

Canid Pest Ejectors

The Canid Pest Ejector (CPE) is a spring-loaded mechanical device that ejects 1080 toxin into the mouth of the fox or dog when it is activated.

The CPE is registered nationally, however check with your state/territory about the specific regulations and licensing requirements.

Drive or pin down the device in to the ground with the bait head, holding a capsule of 1080 poison, sitting above the soil. Because the poison is sealed in a capsule, it is better for the environment as it cannot break down easily like 1080 in a regular bait.

Ejectors can remain set in the field for extended periods; checked monthly rather than daily or weekly. This saves significant resources.

Foxes cannot move or cache (bury in a hole to be eaten later) the devices, meaning it is easier to track the number of doses consumed. It is unlikely native animals will trigger the ejector because sufficient force in an upward direction is required to activate it.

This also means reduced risks to both domestic and working dogs but the 1080 poison contained in the capsule will still kill a domestic or working dog. Take precautions; disarm and remove CPEs prior to mustering.



Mechanical ejector. Image: Rob Hunt



Mechanical ejector set in place.
Image: Steve Lapidge

Shooting

Shooting is a humane method of destroying foxes, if carried out correctly. For broadscale control it is too labour-intensive but it is useful for targeting small areas or problem animals.

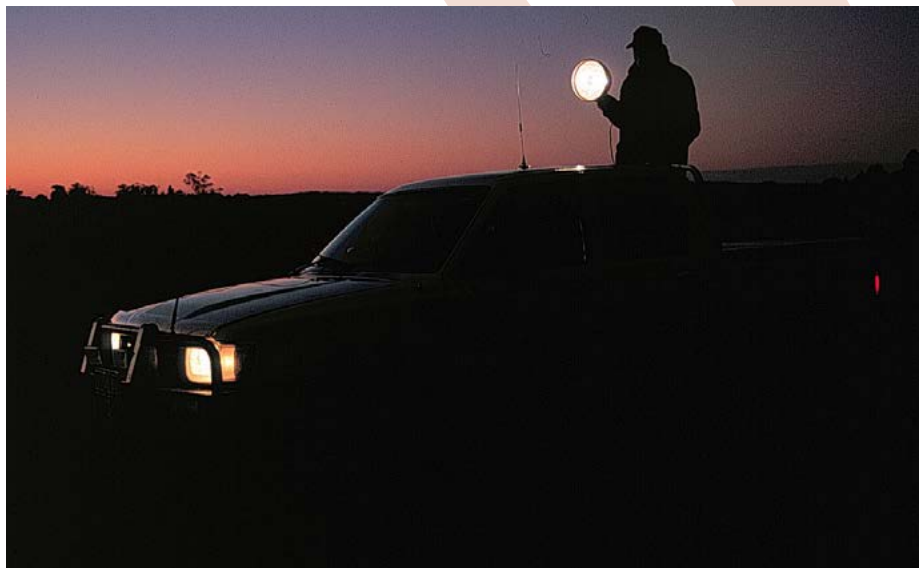
Shoot at night, with the aid of a spotlight, when foxes are most active. Fox drives or battues, which involve scaring foxes towards shooters may be useful in rural areas.

Trapping

Trapping is most useful in urban areas or for targeting problem animals and protecting specific assets such as poultry houses and wildlife refuges. It is not effective for broadscale control as it is too labour-intensive.

Some states/territories allow modified and padded (soft-jaw) leg-hold traps, but the use of steel jaw leg-hold traps (toothed and/or without padding) are prohibited across Australia. Trapping generally causes more suffering prior to death than other control options (refer to the humaneness matrix on the PestSmart website).

In urban areas, use cage traps because they cause fewer injuries and cause less stress than leg-hold traps. You can also easily release non-target animals.



Spotlighting for foxes. Image: NSW DPI



Image by Jason wishart

Fumigating dens

Fumigating breeding, or natal, dens will destroy young fox cubs. The only registered fumigant for foxes in Australia is carbon monoxide (CO). It is a colourless, odourless gas. It depletes oxygen in the immediate area leading to unconsciousness and rapid death without pain or discernible discomfort. Although fumigating dens may reduce the number of foxes or problem animals in the local area, it is not effective as a broad-scale fox control method.

Guard Animals

Guard animals have been used to protect domestic stock from wild predators since ancient Roman times. Guard animals used in Australia include dogs and alpacas, and to a lesser extent llamas and donkeys. Four breeds of guard dogs are available in Australia: Maremma, Great Pyrenean, Anatolian Shepherd/Karabash, and Central Asian Shepherd/Ovcharka.

Overseas research suggests that guard animals have potential, however Australian research is sparse, with supporters mainly relying on testimonial accounts.

Before the use of guard animals can be considered a viable option, more evidence is needed about:

- efficacy and cost effectiveness
- the availability of guard animals
- the costs of training
- industry perceptions (and likely acceptance) of the technique as anything other than a novel measure
- security against theft.

Fencing

Fencing to exclude foxes is a non-lethal method commonly used to protect domestic livestock and threatened wildlife species.

It can be effective, however the barrier is not absolute. Fencing requires regular monitoring. You also need to have a management plan in place to detect and quickly address breaches.

Where possible, control foxes in a buffer zone outside the enclosure as well. This will make the overall fencing approach more effective.

There are a range of fence designs developed to exclude foxes. Choosing the best design is dependent on:

- the species you want to protect
- the area to be covered
- if you also want to exclude other pests (for example, rabbits)
- presence of other non-target animals
- budget
- resources for regular maintenance
- features of the local environment such as topography, substrate, vegetation density, climatic conditions and geographical location.

Managing habitat, weeds and waste

Modifying habitat can work in two ways: either to improve the survival chances of the animal being protected, or to reduce fox abundance. It can only work if habitat is a limiting factor and it is cost-effective to modify it.

Some experts believe that the fragmentation of habitat across Australia has increased the vulnerability of native wildlife to fox predation. One idea to counter this is to make habitats more structurally complex to protect native species. Research has shown, however, that this is not necessarily a simple solution. Other implications need to be considered such as if the cover will help other unwanted animals or increase disease transmission.

Destroying dens, particularly at breeding time, is one action that might reduce fox abundance.

A word of warning: Evidence is sparse that the general fox population is limited by den sites. So if you use this control, monitor its effectiveness.



Image by Sean Passarin.

Can reducing weeds help?

According to research, yes. Urban foxes prefer den sites associated with exotic weed infestations, such as blackberries. Controlling these weeds may influence the fox numbers living in a particular area.

General hygiene and managing waste

- Improve general hygiene practices and remove other food sources from around a farm or suburb. This will deter foxes and reduce their numbers.
- Control wild rabbits and mice.
- Lock up pets such as rabbits, mice and guinea pigs in secure, fox-proof enclosures at night.
- Clean away or place in covered bins: household garbage, pet food, compost heaps, fruit dropped from trees and carrion.



Foxes use log piles as den sites

Image: Jake Relf



Image: Chris Lane

IMPROVE

Monitor and evaluate your plan

Monitor the progress of your fox management plan and evaluate its effectiveness at the end of the program. Did you achieve the objectives you set?

Monitoring can include measuring changes in fox damage (for example, reduced number of lamb deaths, or an increase in wildlife populations).

Record operational details such as who did what, when, where and for how long.

Useful questions to ask when evaluating your plan include:

- how well did the plan work
- what features worked and why
- what features didn't work and why not
- did I save money or spend more than I planned
- could I spend money better next time
- what could I change to make the plan work better next time?

You can now modify your fox management plan if required.

Repeat the process until you are satisfied your fox management planning process is the best it can be. You will likely need to adapt the plan each year as the situation changes on your property and in surrounding areas.

To get help evaluating your plan contact your local biosecurity officer, community landcare coordinator or ranger.

For further information on fox control resources, information and references visit [Pestsmart.org.au/toolkits/European-foxes](https://pestsmart.org.au/toolkits/European-foxes)

7. Notes

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7. Notes

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