



PESTSMART



Glovebox Guide for Managing Foxes

Lynette McLeod

An Invasive Animals Cooperative Research Centre Project



Website: www.pestsmart.org.au

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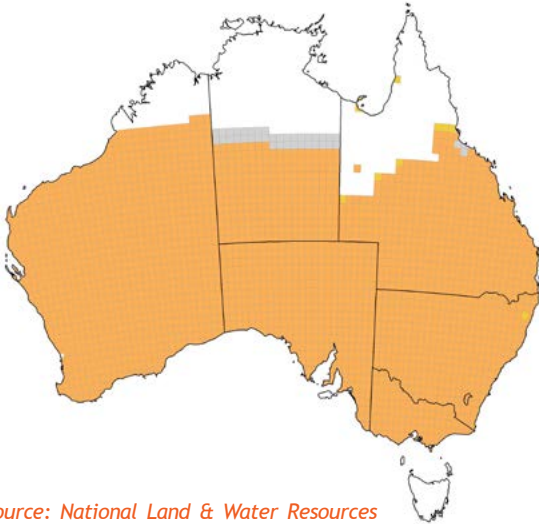
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About this guide

This glovebox guide is part of the PestSmart Toolkit for Foxes, produced by the The Centre for Invasive Species Solutions. It is designed to provide current information on best practice fox management for land managers, pest animal officers and others involved in the management of foxes. This includes general information on:

- developing a fox management plan
- integrated approaches
- identifying fox impacts
- management strategies & techniques



Source: National Land & Water Resources Audit and Invasive Animals CRC (2008). Assessing Invasive Animals in Australia 2008. NLWRA, Canberra.

The advice provided in this publication is intended as a source of information only. Always read the label before using any of the products mentioned. It is important that the information provided is adapted by each individual in accordance with their own environmental, financial and social circumstances.

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

Red foxes were introduced into Australia in the 1850s and have spread across 76% of the

Fox (*Vulpes vulpes*) Distribution

- Localised
- Widespread
- Absent
- Unknown



Introduction

Taxonomic name:

Vulpes vulpes

Common name:

European red fox



*European red fox
Image: Chris Cox*

There are many reasons to control foxes; for example, to protect native wildlife in your area, improve lamb survival on your property, help your neighbour out, reduce the risk of fox-borne diseases such as mange or tapeworm, or prevent the killing of your backyard chooks.

However, fox control is not something you do after the damage starts. Foxes are widespread and numerous across the landscape. They are highly mobile and efficient breeders, and can quickly move in and recolonise areas where fox numbers have been reduced.

‘One-off’ or reactionary control programs may kill a few foxes in the short term but there is little change in fox population numbers and the level of fox damage over the long term. Similar or even more funds are required in following years to address the same problem.

The solution is an integrated fox management plan which takes a long term, landscape approach to controlling the impact of foxes. Integrated fox management is a planned approach, with clear aims, realistic levels of management, and the ability to monitor and evaluate the outcomes. You take advantage of the fox biology ‘weak spots’, and use your resources more efficiently and effectively, resulting in a long term impact on foxes and the damage they cause and maximising the outcomes for the prey species.

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



Step 1: Understand your fox problem

This first step is most important in developing an effective fox management program. You need to identify what the problem is, where it is, where it comes from, who has the problem, when it occurs, will it change over time, how severe it is and what needs to be achieved to solve it.

It is also important to identify and include all the people and agencies that should be involved. This means the problem can be defined from different perspectives, which will assist your group to set agreed goals and help develop a truly community-driven action plan.

Identifying fox impacts

To determine the extent of fox predation, it is necessary to establish that the fox is

the major cause of loss. Other predators, such as feral cats, wild dogs / dingoes or feral pigs may also be present, so it's important to rule out their involvement. As the fox hunts mostly at night, direct observations of them killing is difficult, so you need to rely on other signs of fox involvement.

Fox paw prints can be used to identify their presence, and are easily distinguished from those of dogs or other predators (see Figure 1).

Examination of dead animal carcasses (if present) can also help in determining the cause of death, and if predation was involved. Figure 2 illustrates a decision tree for determining the cause of lamb deaths. The following observable signs are also useful.

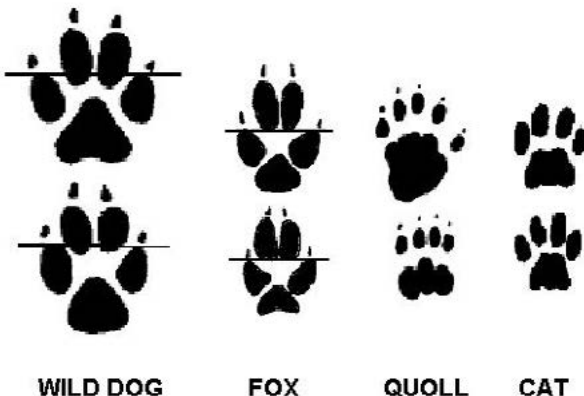


Figure 1: Dog, fox, quoll and cat paw prints. Foxes prints can be distinguished from dog prints - a foxes' pads can be separated by a straight line as shown. Diagram taken from 'Tracks, scats and other traces' by Barbara Triggs, 1996. Oxford University Press, Melbourne. Not to scale

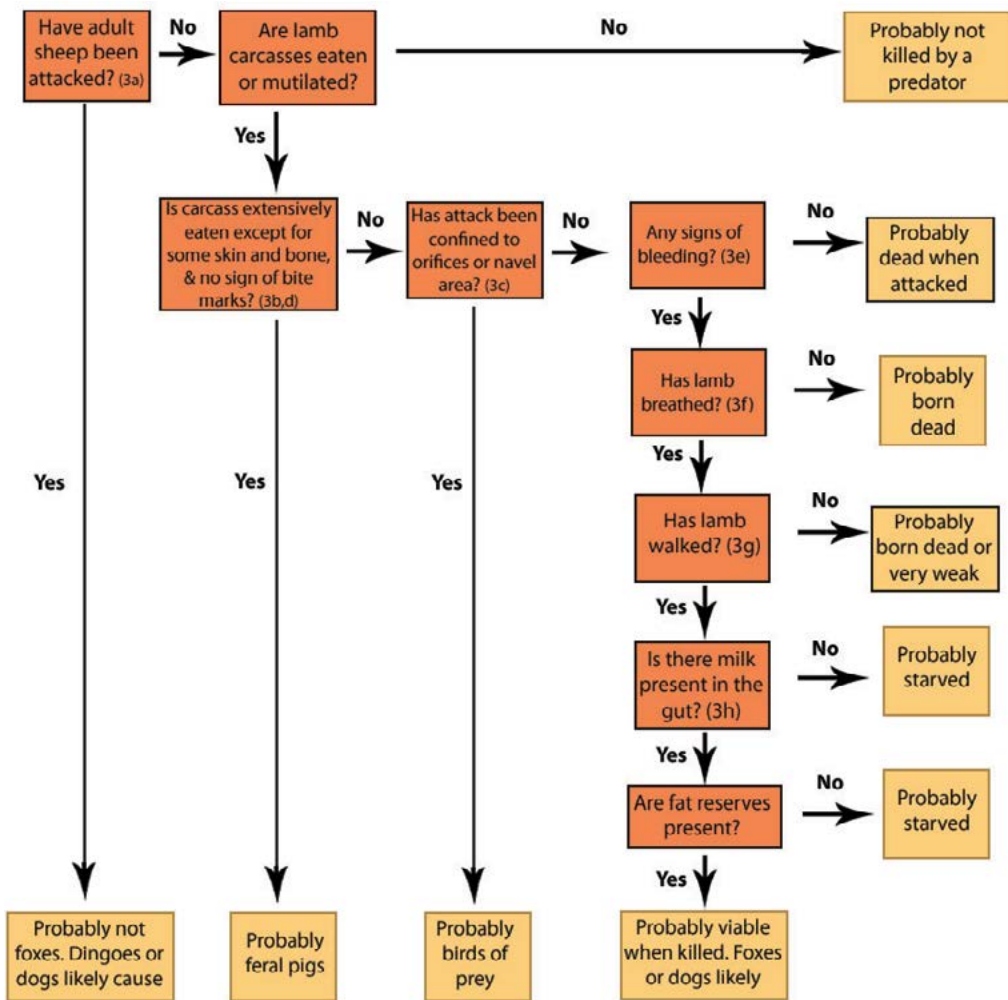


Figure 2: Decision tree for determining the cause of lamb death (after Agriculture Protection Board, Western Australia 1990. Foxes. Infonote 3/85, Edn 1.4, March 1990.



Was the lamb alive when attacked?

Attacks on live animals result in bleeding at the wound site, with subsequent clotting forming dark haemorrhagic areas (Figure 3e). Dead animals do not bleed. This can be helpful to identify if predation occurred, or merely scavenging on animals which had died from other causes.

What species of animal was responsible for the predation? Birds of prey usually feed on the upper side of the lamb body only, concentrating on the eyes, nose, mouth, navel and anus (Figure 3c).

Attacks by mammals involve biting, often with matching punctures on opposite 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. Puncture marks can be used to differentiate dog attacks from foxes as the latter has a very slender jaw, with the canine teeth closer together. Bite marks are best observed by skinning the carcass (Figure 3d). Extensive mutilation and consumption of the lamb carcass, including bones may indicate feral pig predation (Figure 3b). This can be confirmed by the lack of canine puncture marks.

Even though dogs and foxes are capable of consuming most of the 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. Foxes generally do not attack and mutilate adult sheep (Figure 3a).

If alive, was the lamb sick or healthy?

Lambs are born with protective, soft membranes covering the sole of their hooves which is quickly worn when they begin to walk (Figure 3g). An intact sole membrane indicates they did not successfully walk. Examination of the lungs will show a clear difference between successful breathing (light pink) compared to lungs which have not been properly aerated (dark and liverish in colour) (Figure 3f). When a lamb fails to feed properly the fat reserves around the heart and kidneys becomes 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).

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



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

Step 2: Setting the objectives

Once you have established that you have a fox problem, you need to think about what you want your fox management program to achieve. By setting objective(s), you can measure the success of your program. Good objectives should state what will be achieved where, by when and by whom.

The main objective of any fox management program should be to reduce fox damage. This is best measured by the response of the prey species, and not by the number of dead foxes or baits taken. Structure this objective in terms of reduced damage within a given timeframe, eg I want to improve lamb marking by 10% after 2 years.

Other objectives can include operational factors such as the number of participants, or area covered by a group program. For example: our group wants to increase the participation of landholders to 90% in 2 years.

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



Image: Daryl Panther



Step 3: Develop a plan of action

Plans should contain what is to be done and who does what, where, when and how

Once the problem has been defined, and objectives set, a plan of action is required. Plans should contain what is to be done (in terms of available techniques, approvals required and legal constraints) and who does what, where, when and how often.

Foxes can have significant environmental, economic and social impacts, so when considering your fox management plan you must have an understanding of the farming and/or ecological system you are working in.

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

Foxes share complex relationships with other animals (both predators and prey species) so their control should be just one aspect of an integrated approach to the management of both farming and natural resource systems.

Integrated approach

Rabbits

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, which can then allow a more speedy recovery for the fox population. By decreasing the amount of alternative food available, rabbit control can also increase the effectiveness of fox control programs.



*Fox with rabbit
Image: Daniel Schembri*



Cats and other predators

Foxes competitively interact with other predators such as feral cats, varanid lizards (eg goannas) and quolls. When foxes are removed through control programs, these other predators can potentially increase in numbers. They could in turn have a greater impact on the prey species in that particular environment.

This is referred to as the mesopredator release hypothesis. Emerging evidence supporting this concept highlights the importance of considering the whole-system when managing foxes, especially for conservation outcomes.

Fox control should be just one aspect of an integrated approach to the management of both farming and natural



Step 4: Choosing your strategy

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

Some strategies do not directly involve any fox control at all, and include considering changes to your current farm management practices, for example:

- the type of enterprise (consider alternatives such as moving to cattle production)
- improvements and changes to your current practices (eg the timing and location of lambing, sheep breed and genetics)
- other pest management activities (eg rabbits, weeds)

Fox control strategies can incorporate lethal and non-lethal techniques. If you've decided on fox control you need to consider the:

- requirements of the prey species or enterprise that is to be protected
- 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 (eg native wildlife, farm dogs)
- neighbours (their enterprises, level of fox and rabbit control, and likelihood of cooperating in group activities)
- ethical and welfare concerns.

In Australia poison baiting using sodium monofluoroacetate (1080) is considered to be the most

Fox control techniques

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

Registration of an alternate toxin (PAPP) is currently in progress. Shooting is also popular, but not considered as efficient as baiting over large areas.

Toxicants

Any toxins used against foxes in Australia must be registered with the Australian Pesticides and Veterinary Medicines Authority (APVMA, www.apvma.gov.au/).

Sodium monofluoroacetate (1080)

The most common toxicant used to control foxes is 1080, a restricted chemical product and a schedule 7 poison. Foxes are among the most sensitive species to this toxin, which occurs naturally in some Australian plant species. In foxes this toxin affects the central nervous and respiratory systems, and death occurs within 2 to 3 hours.

Para-aminopropiophenone (PAPP)

PAPP is the active ingredient used in new manufactured toxic baits developed for strategic and targeted control of wild dogs and foxes. Once it is eaten and absorbed into the bloodstream, PAPP works by converting normal haemoglobin in red blood cells to methaemoglobin, which cannot carry oxygen to the heart muscles and brain.

Other toxins

Strychnine cannot be used as a bait toxin in Australia, although it can still be used on traps in Queensland, if they cannot be checked daily.

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

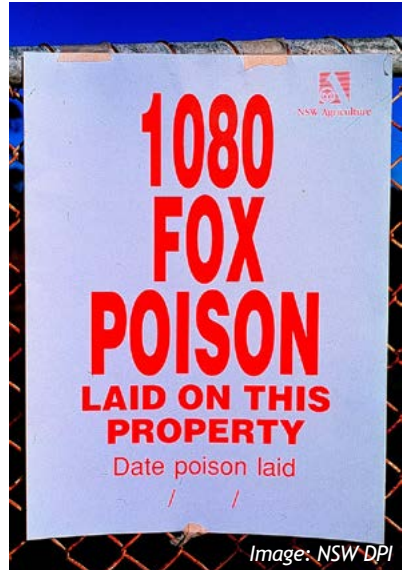


Image: NSW DPI

Delivery of Toxicants

Baits

Baits can only be obtained through licensed officers or designated government agencies in each state and territory, and there are strict guidelines relating to the use and placement of baits. Some states require specific chemical training to have been completed, so it is advisable to check specific requirements with your local agency.

Toxins 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 the main technique used and involves regular monitoring of buried baits. Aerial baiting is used in remote, sparsely populated areas and requires a special permit.

Baiting programs have been shown to be most effective when done twice a year. This causes maximum disruption to both the breeding (late winter/spring) and migration (autumn) stages of the fox's life cycle.

For maximum success, baits should be available to foxes for at least ten days. They should be checked at least every two days, and replaced until no more are being taken. Baits should be placed at strategic points along tracks and fence lines where foxes regularly travel, or near carcasses or other attractants, allowing for distance restrictions from



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

residences and boundaries. Baits should be buried 5-10cm deep or tethered (in Queensland and Western Australia only), at 200-500m intervals, with a total of about five baits laid for each square kilometre. The positions of baits should be marked with tape or pegs so they can be easily checked later. Lures and scents can be used to attract the foxes, although continuous scent trails should be avoided.

Removing all uneaten baits at the end of a program is important to reduce the risk of bait aversion as well as to prevent poisoning of non-target species.

Following best practice baiting methods is important to maximise the effectiveness of any baiting program and minimise the risk posed to non-target animals, regardless of which type of bait is used. Burying the baits helps eliminate the risk to most non-target species, including birds.

For more detailed information on baiting for fox control see:

- PestSmart Factsheet: Fox baiting (FXFS8). Invasive Animals CRC (2013). www.pestsmart.org.au/pestsmart-fox-baiting/
- PestSmart Factsheet: Frequently asked questions about PAPP (WDFS7). Invasive Animals CRC (2016). www.pestsmart.org.au/papp-for-wild-dog-and-fox-control/
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Mechanical ejector. Image: Rob Hunt



Mechanical ejector set in place. Image: Steve Lapidge

Canid Pest Ejectors

The canid pest ejector is a spring-loaded mechanical device which ejects a toxin into the mouth of a target species when it is activated. The device is driven or pinned in the ground with the bait head sitting above the soil. The bait head holds a capsule containing 1080 poison and when the target animal attempts to remove the bait or attractant, the pulling action triggers the device and a plunger ejects the toxin into the animal's mouth. Canid Pest ejectors have significant advantages over traditional baits as the poison is sealed in a capsule and does not breakdown in the environment like 1080 would in a regular bait. This allows ejectors to remain set in the field for extended periods, resulting in significant resource savings, as ejectors can be checked monthly rather than daily or weekly.

The ejector device cannot be cached or moved by foxes as it is pinned in the ground and an upward pull of sufficient force results in activation of the device. This high level of bait security provides land managers with the confidence to implement fox and wild dog control programs with minimal risk to both domestic and working dogs. The 1080 poison contained in the capsule will still kill a domestic or working dog, so precautions should be taken to avoid exposure of working dogs to ejectors; disarming and removal prior to mustering is strongly advised. Ejectors also provide high target selectivity due to the pull force and head orientation required to activate trigger mechanism, therefore minimising the risk to non-target species. The Canid Pest Ejector is now registered nationally however each state has its own specific regulations for use and licensing requirements.



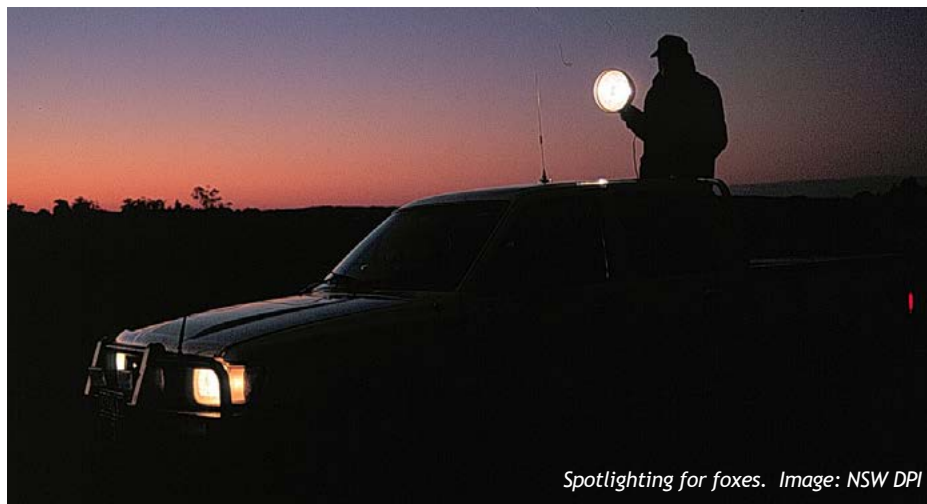
For further information on Canid Pest Ejectors (CPEs) please visit the Animal Control Technologies Pty Ltd website: www.animalcontrol.com.au

Shooting

Shooting is a humane method of destroying foxes if carried out correctly. It is considered too labour intensive for broad-scale fox control but is useful for targeting small areas or problem animals. Shooting is mainly done at night with the aid of a spotlight when foxes are most active. Fox drives or battues which involve scaring foxes towards shooters are occasionally used in rural areas.

Trapping

Trapping is considered too labour intensive for broad-scale fox control but is useful in urban areas or for targeting problem animals and protecting specific assets such as poultry houses and wildlife refuges. Some states 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. Cage traps are preferred in urban areas as they are perceived to cause fewer injuries than leg-hold traps and non-target animals can be easily released.



Spotlighting for foxes. Image: NSW DPI



Fox in soft-jaw trap.
Image: Steve Lapidge

Den Fumigation

Fumigation of breeding, or natal dens is sometimes used to destroy young fox cubs. The only registered fumigant for foxes in Australia is carbon monoxide (CO), which is a colourless, odourless gas that causes oxygen depletion leading to unconsciousness and rapid death without pain or discernible discomfort. The gas is generated by the incomplete combustion of carbon using sodium nitrate within a fumigant cartridge. Although den fumigation may locally reduce the number of foxes or problem animals, 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 to protect from fox predation 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 Ovcharka.

Overseas research suggests that guard animals have potential, however there has been little research conducted in Australia, with supporters mainly relying on testimonial accounts. Factors that need to be addressed before the use of guard animals can be considered a viable technique include the collection of more evidence of their efficacy and cost effectiveness; the availability of guard animals and the costs of training; the change in industry perceptions (and likely acceptance) of the technique as anything other than a novel measure; and security against theft.

Exclusion Fencing

Exclusion fencing is a non-lethal method commonly used to prevent fox predation on domestic livestock and threatened wildlife species. It can be an effective method, however the barrier is not absolute, so there needs to be a monitoring system and a management plan in place to rapidly detect and control breaches. The control of foxes in a buffer zone outside the enclosure can greatly enhance its effectiveness.



There are a range of fence designs developed to exclude foxes. Choosing the best design is dependent on: the species to be protected, the area to be covered, if other pests are also to be excluded (eg rabbits), presence of other non-target animals, budget, resources for regular maintenance, and features of the local environment such as topography, substrate, vegetation density, climatic conditions and geographical location.

Habitat Modification

Habitat modification can work in two ways: either to improve the survival chances of the animal being protected, or to reduce fox abundance. This method can only work if the habitat resource is a limiting factor and can be modified economically.



*Foxes use log piles as den sites
Image: Jake Relf*

The fragmentation of habitat across Australia has been suggested to increase the vulnerability of native wildlife to fox predation. One idea to counter this is to increase the structural complexity of habitat to protect native species. Research has shown, however, that this is not such a simple solution. Other outcomes need to be considered such as the cover provided for other unwanted animals, disease transmission and other complex population interactions that may be occurring.

Den destruction, particularly at breeding time, is one habitat modification that might reduce fox abundance. Even though there is no evidence that the general fox population is limited by den sites, urban foxes have been shown to prefer den sites associated with exotic weed infestations such as blackberries. It has been suggested that controlling these weeds may influence the fox numbers living in a particular area.

Improving general hygiene practices and removing other food sources from around a farm or suburb is another modification that has been suggested to deter foxes and reduce their numbers. Wild rabbits and mice should be controlled. Poultry and pets such as rabbits and guinea pigs should be locked up in a secure, fox-proof enclosure at night. Household garbage, pet food, compost heaps, fruit dropped from trees and carrion should be cleaned away or placed in covered bins.



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Step 5: Monitor and evaluate the plan

Once completed the plan needs to be evaluated, and if objectives were not achieved it is useful to know why not

Once your fox management plan is put into action it needs to be monitored so you can evaluate its effectiveness and whether the objectives were achieved.

Monitoring can include taking measurements to detect and quantify changes in fox damage (eg a reduction in lamb deaths, or an increase in wildlife populations), as well as recording operational details such as what was done, when, for how long, and by whom

Once completed the plan needs to be evaluated, and if objectives were not achieved it is useful to know why not, so appropriate modifications to the strategy can be applied.

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,

there cost overruns or savings, could money be better spent next time, what changes could be made to make the plan work better?

You now have the information to modify your fox management plan if required, and once this has been done, your improved plan can be put into action and monitored again. The process can be repeated until you are satisfied your fox management plan is the best it can be.

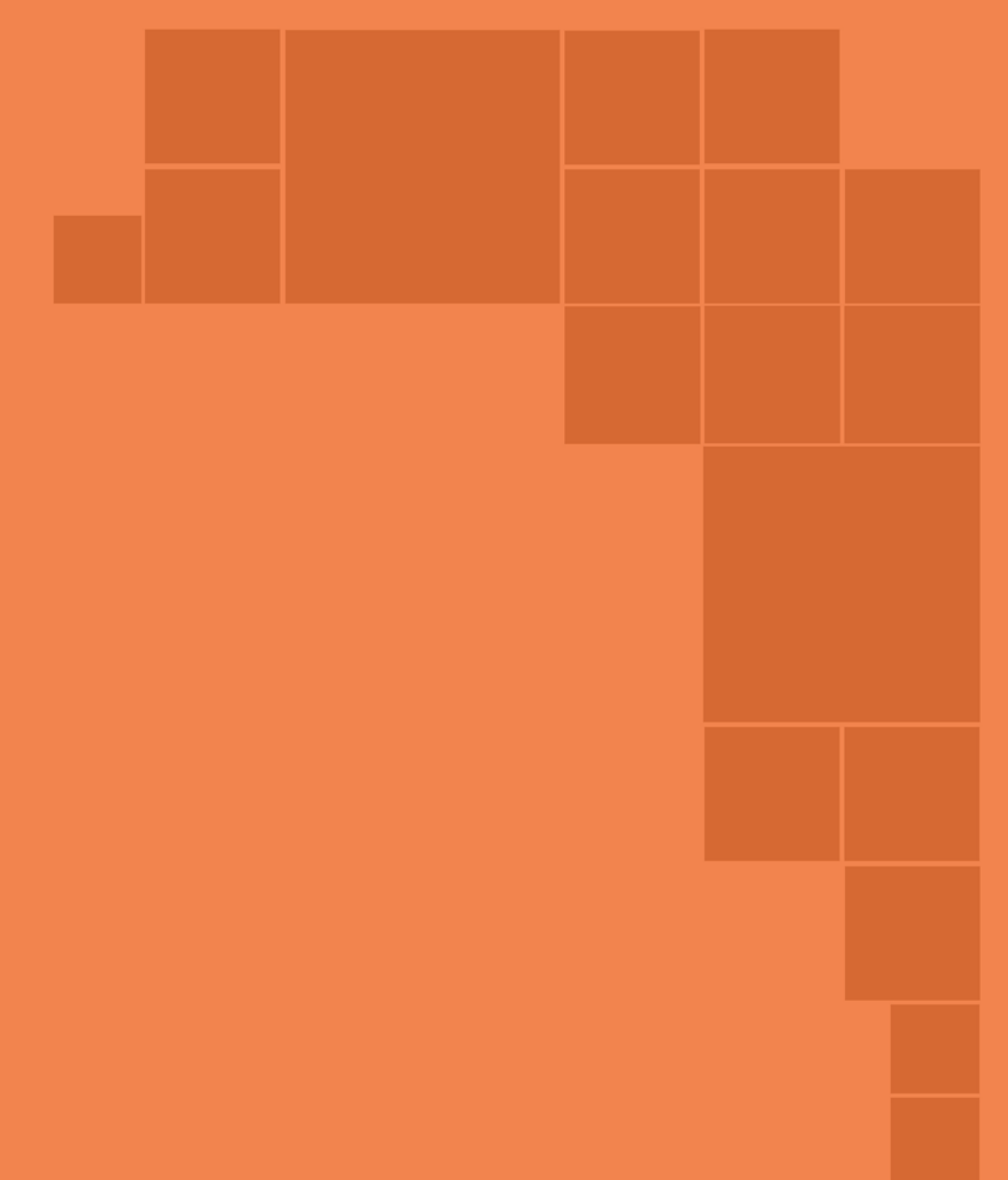


More information on fox management programs



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