

Eyre Peninsula Landscape Board

PEST SPECIES REGIONAL MANAGEMENT PLAN

Vulpes vulpes

Red Fox

This plan has a five year life period and will be reviewed in 2027.



INTRODUCTION

Synonyms

Fox, European red fox.

Biology

After dogs and dingos, the red fox *Vulpes vulpes* is the largest mammalian predator in Australia.

Red foxes are generally nocturnal [1, 2], but can be active during the day when undisturbed [3]. During denning females are more active and their activity can become almost completely diurnal [2].

Red foxes are opportunistic predators and scavengers. Classed as omnivorous they have a wide dietary range but are predominantly carnivorous [4-12], preying on vertebrates ranging in size from small skinks (<2 g) to wallabies (15 Kg) [13]. They also feed on carrion and other scavenged materials [13]. Invertebrates, berries and other vegetative material may be predominantly taken during summer [13], or autumn [14]. Foxes typically consume less than ten percent of their body mass in a day i.e. 380 to 450 g [15].

Red foxes generally have well defined home ranges within spatially stable borders [16]. Home ranges vary with habitat type, food availability, terrain, and habitat complexity. In central Victorian pasture/woodland habitat home ranges have been estimated at between five and seven km², and in semi-urban areas from 0.6 to 1.3 km² [1]. Ranges are mutually exclusive territories, except for breeding pairs, which share a common home range [2].

Red fox densities vary with season. In rural agricultural areas densities have been shown to peak in summer (3.0 foxes/km²), with minimum winter densities (1.2 foxes / km²) [1]. Densities as high as 12 foxes / km² have been recorded in suburban Melbourne [16].

Foxes breed only once a year, but not all females breed every year [1]. Mating occurs in winter, with a single average litter of 4-5 cubs born in late winter or spring after a gestation of 51 to 53 days [16]. Cubs reach independence in late summer [3]. Natal dens are usually extensive burrows dug by the breeding pair. Alternatively, existing rabbit or wombat burrows, or hollow logs may be used. A post weaning litter size of 3.3 cubs per den (range 2-5) has been reported in central Victoria [1].

Juvenile foxes, particularly males [16], disperse in autumn [17]. Young fox dispersal distances in central Victoria are less than two kilometres for 70% of animals, but distances of up to 30 km have been recorded [1]. The 30% of animals moving more than two kilometres from point of capture (i.e. beyond home range dimensions), dispersed an average 11 km [1]. The longest being a straight-line distance of 300 kilometres [18]. The rate of dispersal over small areas can be rapid: when foxes were eradicated from a control zone of two km², migration occurred as quickly as the animals were eliminated [19].

A suite of native mammal species that weigh between 35 g and 5,500 g have been shown to be at particular risk of extinction as a result of red fox predation [20]. Collectively, these mammal prey species are known as Critical Weight Range (CWR) mammals. Mammals generally constitute the major food items of red foxes in Australia, but the key prey species taken may vary with locality, season, fox sex, age, moon phase, and prey species availability [5-7, 9, 11, 14]. In all studies small mammals such as rabbits and house mice were taken as live prey, but larger prey such as sheep and kangaroos appear to be predominantly taken as carrion. Invertebrates appear to be an important supplementary prey [5, 7-10], whereas birds, reptiles and vegetation were generally a minor diet component. Red foxes appear to actively select for rabbits despite the abundance of suitably sized native mammals [11], but where rabbit numbers are low, and in natural landscapes, foxes can sustain their populations on indigenous prey alone [2, 4, 6].

Origin

The red fox has a natural distribution across the continents of Europe, Asia and North America [21]. The subspecies in Australia is believed to be the European Red fox *Vulpes vulpes* [22]. They were first successfully released in southern Victoria, at Point Cook and Ballarat, sometime around 1871 [23]. The subsequent spread across Australia was rapid, reaching South Australia by 1888 and Kalgoorlie in Western Australia by 1917 [22]. This spread and establishment of red foxes followed the spread of rabbits, but after a lag of several years [16].

Distribution

The red fox is distributed widely across Australia except the far north [24]; occurring in most habitats from wet forests to deserts and urban areas [3]. They are more prolific in patchy landscapes of native bushland and agricultural land. These fragmented environments offer a wide variety of cover, food and den sites. They are not as common in more uniform, open environments or areas that are mountainous or heavily forested. Red foxes are found at higher densities in urban areas than agricultural areas [1, 25].

Severe disturbance such as clearing for grazing or agriculture appears to play a part in the distribution and abundance of red foxes. Phillips and Catling [2] found that foxes favour habitat with a high abundance of either small or medium sized mammals. Dens are generally located in thick cover, burrows or other cavities [3]. In urban areas around Melbourne diurnal red fox habitat use is strongly associated with patches of blackberry or gorse over all habitat types [25], suggesting dense structure for diurnal refuge may be a limiting factor for populations in urban areas.

Red foxes inhabit all mainland areas of South Australia, being abundant and widespread south of the dingo fence (Figure 1) [24].

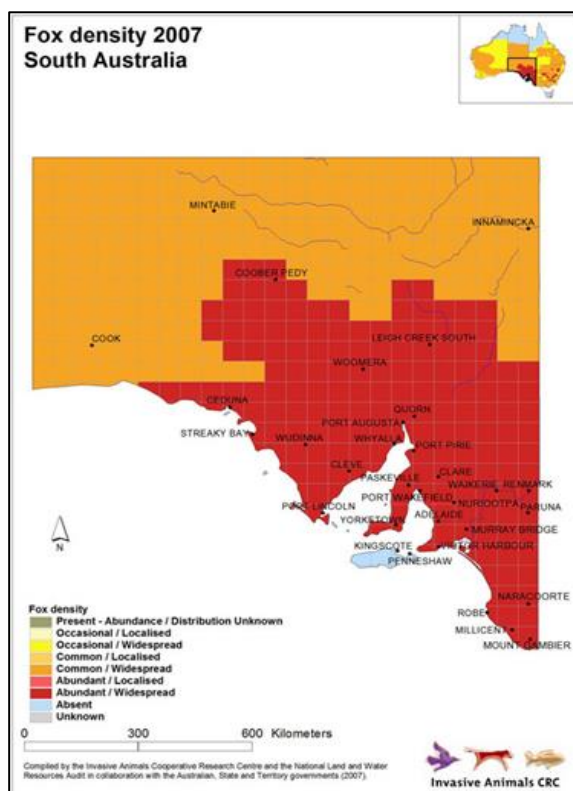


Figure 1: Red fox occurrence, abundance and distribution for South Australia in 2007. Source: [24].

RISK ASSESSMENT

Pest risk

Red foxes have a wide dietary range, and are threatened by few natural enemies and few serious diseases in Australia. They also have high reproductive rates and high rates of cub survival, which allows them to rapidly colonise areas although they only have a short period to breed once a year. These attributes are important in making the fox a significant threat to biodiversity [26, 27].

The role of red foxes as a predator of livestock is not well understood [16]. Red fox predation has been reported on lambs, kids, piglets, calves, cows in birthing difficulties, deer, ostrich and emu chicks, and poultry including chickens, ducks, geese and turkeys [28]. The red fox is acknowledged as a significant predator of free-ranging poultry flocks [29, 30]. Until recently, predation was considered a problem only for small-scale poultry operations, as larger producers housed their birds indoors; however, with the growth of the free-range poultry industry, susceptibility to predation has increased not only bird losses but also stress-related declines in egg-laying and meat quality [31]. Despite this, studies in Australia show that freshly killed livestock, as distinct from carrion, are an infrequent dietary item for the red fox [28, 32-36]. This has been debated with some evidence to suggest that foxes may take from 10 to 30% of lambs in some areas [16]. In some situations red foxes and other predators can cause heavy losses. Predation is likely to be higher in some sheep breeds, for example merinos, which exhibit poor mothering ability. Predation is also higher where optimal red fox habitat occurs nearby [37]. There is some evidence that individual red foxes become habituated to the killing of lambs [34].

In an extensive survey of neonatal lamb mortality, it was demonstrated that neither disease nor predation were responsible for most lamb losses [34]. Most lambs die because they are starving after the relationship between mother and offspring has been broken or failed to establish. Such animals die slowly and become increasingly easy victims for a predator. Nutrition of the ewe during pregnancy and adequate shelter and supervision during parturition were identified as the key to reducing the number of lambs vulnerable to predation.

Red foxes have been linked to major regional declines of medium-sized mammals, birds and reptiles in Australia [13, 38, 39], predominantly through direct predation. The ongoing effect of foxes on the abundance of many fauna is not known [40]. The evidence of impacts is greatest for medium sized ground-dwelling and semi-arboreal mammals, ground-nesting birds and chelid tortoises [40]. Of the threatened species listed under the EPBC Act, foxes are considered a threat to 14 species of birds, 48 mammals, 12 reptiles and two amphibians [27]. These species include the spotted quail thrush, mallee fowl, plains wanderer, two local subspecies of the southern emu-wren, and the southern brown bandicoot. This impact of red foxes on native fauna has probably been exacerbated by habitat fragmentation and modification since European settlement [40, 41].

In 2004, foxes were estimated to cost the Australian economy, environment and agricultural industries more than \$227 million, of which \$190 million was environmental impact [42]. Importantly, increased densities of rabbits and cats may be a substantial environmental cost of fox control [40].

Given the information presented above, defining an effective protection zone around key assets is only appropriate where a baiting program has adequate frequency and spatial extent to address the dispersal ability of red foxes.

Red foxes can be a vector for disease, with potentially significant economic and social costs where disease is introduced.

Feasibility of control

Complete removal of foxes from Eyre Peninsula is well beyond the capacity of available techniques and resources [26]. Red fox populations must therefore be suppressed and managed to mitigate impacts on affected native species. Progress in control programs must be monitored to ensure that objectives are met and to allow management options to be adapted to changing circumstances [26]. There are insufficient resources to control red foxes effectively in all areas where they co-exist with native fauna, thus control programs need to focus on prey species for which the population level impacts of red fox predation are likely to be greatest [40]. Synergy between conservation authorities and the agricultural community over large areas is required for effective management of red fox populations [16].

Urban and peri-urban areas, with their relatively high fox densities, are a source for fox dispersal in the Landscape region. Increased food availability from human waste can have a profound effect on the reproductive success and densities of red foxes, and sound waste disposal measures are very effective in rapidly controlling these overabundant populations [43]. Effective red fox control across the region should address this source of fox dispersal.

A variety of red fox control techniques are used in Australia. These include hunting by trapping and shooting, poisoning, den destruction, exclusion by fencing, or changes to farming practices. These methods are described in detail in a number of references [e.g. 16, 28]. However, apart from broad scale baiting, the methods are expensive, labour intensive, long-term and of limited effectiveness [28]. There has been some research into abortifacients [i.e. cabergoline 44] but it has never been registered for use on red foxes.

Wherever red foxes, feral cats and rabbits co-occur, integrated control methods enhance the decline of predator species. The general principals and strategies of integrated control are outlined in Braysher [45]. Williams *et al.* [46] and Saunders *et al.* [16] provide guidelines for the application of these principals and strategies to rabbits and foxes, respectively.

Effective broad-scale fox control, as a conservation or wildlife management tool, requires that the majority of foxes residing within the control area be presented with an opportunity to locate and consume poison baits. An annual kill rate of at least 65% is needed to stop growth in red fox numbers [40]. This is best achieved by ensuring that the majority of bait stations are established within the home ranges of the majority of individuals. Continuous control operations over large areas are more likely to suppress red fox numbers than seasonal or pulsed baiting programs, or short-term operations over small areas [47, 48]. The reliance on a single tactic for red fox control (poison baiting) will always have limited success in reducing populations in the long-term, with evidence indicating that resistance to 1080 can build up over time [49]. Consideration should be given to alternative tactics to control red foxes over large areas and long periods.

Fox control programs are evaluated by measuring the impact of baiting on red fox abundance, and in turn measuring the changes to prey species,

lambling survival and other species within the food web that may be subsequently affected.

Predation by the red fox is listed as a key threatening process under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act). Under the EPBC Act, the Australian Government in consultation with the states and territories has developed the Threat Abatement Plan [26, 27].

Status

Within the EP Landscape Board region a risk management assessment shows that red foxes merit a Manage Pest Animal Populations status in all the relevant land use types (Table 1) with the aim of reducing the overall impact of the species through targeted management.

Table 1: Regional Assessment

Land Use	Pest Risk	Feasibility of Control	Management Action
Crop/pasture	360 (Very High)	66 (Low)	Manage Pest Animal Populations
Native vegetation	393 (Very High)	176 (Negligible)	Manage Pest Animal Populations
Urban	393 (Very High)	176 (Negligible)	Manage Pest Animal Populations

REGIONAL RESPONSE

Special considerations/Board position

Effective red fox control is a landscape scale issue. On Eyre Peninsula, district-based fox baiting groups composed of agricultural landholders have been effective in implementing baiting programs on the landscape scale.

Many of these programs need to be reinvigorated. Landholders should be encouraged to bait more often throughout the year. Baiting in autumn and spring should be encouraged as a minimum. All actions need to have regard to the consequences of red fox control on other species.

Integrated pest management is integral to the effective control of red foxes. Rabbit control programs in conjunction with fox control should be encouraged through district baiting groups. The potential for cat control programs needs to be investigated and where possible research encouraged and supported.

Outcome

Facilitate a coordinated approach to best practice red fox management across Eyre Peninsula to minimise agricultural, economic, environmental and social impacts of foxes.

Objectives

To:

1. Encourage coordinated red fox control programs that operate at an effective temporal and spatial scale;
2. Implement effective integrated pest management programs as part of best practice;
3. Protect key environmental assets from the impacts of red foxes; and
4. Support the protection of primary production at significant risk from the threat of red foxes.

Area/s to be protected

Identify priority management locations through community consultation and survey.

Control strategies objectives to reduce impacts to key environmental assets (areas containing EPBC listed animal species) and primary production assets (stock).

Actions

Land managers to:

control foxes using best practice methods and supply control information on request to Landscape Board staff;

Landscape Board staff to:

Provide access to 1080 fox baits (Landscape Board is the only supplier) in a timely and effective manner,

Facilitate, encourage and compel control strategies and actions with a focus on protecting key assets,

Support and encourage landholders to adopt best-practice red fox management through practical community engagement activities across the EP landscape;

Develop localised annual action plans to achieve the objectives and actions of this management plan

Undertake systematic data collection of where (ie Hundred and Section) and when baits have been distributed, and store in a central spatial database; and

Raise community awareness about the impact of red foxes and to improve practical skills of management practices (e.g. domestic waste and

food availability) to decrease populations in urban areas.

Evaluation

Evaluation of success will be based on:

1. A five yearly review (literature review) of best practice, e.g. review outcomes of red fox control programs across the nation and globally;
2. Annual analysis in July of control data to evaluate the effectiveness of control actions;
3. Identify any gaps in delivery and action as soon as possible; and
4. Review of this pest management plan every five years.

Declarations

In South Australia the red fox is a declared pest under Schedule 1 (CLASS 5 – Provisions: 186 (1)(3), 187 (1), 188, 189, and 192 (2) for the whole of state), (CLASS 6 – Provisions 186 (1)(3), 187(1), 188, 189 and 192(1) for all offshore islands and any vessel adjacent to any such island) of the *Landscape South Australia Act 2019* (

Table 2). Meaning that you cannot bring red foxes into the region or spread them to areas where they do not already exist. You cannot keep, sell or release red foxes in the region, and must control and keep controlled red foxes on your land.

Table 2: Red foxes – relevant sections of the Landscape South Australia Act 2019.

Section	Description of how the section applies
186 (1) (3)	Cannot bring the animal into the region Cannot spread animals to areas where it doesn't already exist
187 (1)	Cannot keep a declared animal
188	Cannot sell the animal
189	Must not release the animal in the region
192 (1)	Landowner must destroy all red foxes
192 (2)	Landowner must control and keep controlled red foxes.

More information

Contact your local Eyre Peninsula Landscape Board office

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