Eyre Peninsula Landscape Board

PEST SPECIES REGIONAL MANAGEMENT PLAN

Oryctolagus cuniculus

European rabbit

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

INTRODUCTION

Synonyms

Lepus cuniculus Linnaeus, 1758

Rabbit

Biology

European rabbits (*Oryctolagus cuniculus* Linnaeus, 1758) are gregarious, warren living, herbivorous mammals **[1]** in the order Lagomorpha and family Leporidae.

Rabbits are diurnal if undisturbed, but generally nocturnal and crepuscular **[1]**. They do not readily dig new warrens, except on sandy soils **[2, 3]**. In newly colonised areas without warrens, a rabbit will generally live in a 'squat' — a shallow depression in long vegetation or under fallen timber **[4]**. They graze on the most nutritious foliage available, especially green growing tips, but in drought they can survive on dry grass, tubers and bark **[1]**.

Breeding is generally seasonal, but season varies across the their range **[5]**. Territorial, hierarchical, social groups of one to three males and one to seven females are formed during the breeding season, with each group led by an aggressive male and female **[6]**. Each adult female usually produces between 11 young / year in dry areas and 25 or more in productive habitats **[6]**, although a range of 15-53 is recorded for Australasia **[5]**. Most do not survive to breed, and more than 80% of animals die before they reach three months **[6]**. Gestation takes 30 days and both sexes are sexually mature at the age of three to four months **[6]**. Annual survival rate of adults is 40–60%, with survival past six years of age rare in the wild **[4]**.

Home range size depends on rabbit density, food availability, sex, age and surface cover. Average home range size in Canberra is 0.22 ha for adult males and 0.16 ha for females; in western NSW 0.67 ha for males and 0.39 ha for females **[7]**; and in arid SA, home ranges are circular or elliptical and varied from 0.77 ha to 9.18 ha, with a mean of 2.1 ha in summer and 4.2 ha in winter **[8]**.

In Australia, very young rabbits (1–2 months old) are the most common dispersers, with males and females dispersing with equal frequency.**[4]**. A second peak of dispersal occurs mainly among sub adult males (greater than 60 days of age) during the period of social reorganisation at the commencement of the breeding season in autumn or early winter. Rabbits older than eight months rarely disperse **[4]**. Most rabbits disperse to adjacent social groups. Movements in excess of 20 kilometres have been recorded, and even newly emerged kittens may move 1.5 kilometres **[4]**. Between 36–72% of males and 8–30% of females breed in warrens in which they were not born **[4]**.

Rabbit populations vary from one season to the next. Populations are lowest at the beginning of the breeding season (usually winter / spring) then increase by a factor of 2–5 to peak near the end of the breeding season **[9]**. Survivors of a population crash tend to be adult rabbits **[4]**. After the breaking of a drought, rabbit populations are held at low densities for several years by a combination of native predators, red foxes and feral cats **[4]**. It is not until red fox and feral cat numbers decline (sometime after the crash of the rabbit population) and good seasons return, that rabbit numbers build up again. The most significant predators of the rabbit in Australia are: the cat (*Felis catus*); red fox (*Vulpes vulpes*); dingo (*Canis dingo*); wedgetail eagle (*Aquila audax*); little eagle (*Hieraaetus morphnoides*); brown goshawk (*Accipiter fasciatus*); brown falcon (*Falco berigora*); and goanna (*Varanus* spp.) **[4]**.

In general, in South Australia, the highest rabbit populations occur in agricultural areas where management is difficult or neglected, or in rangeland areas where control is not obligatory or legislation is not enforced because control is perceived to be uneconomic **[9]**. Rabbit numbers are low throughout most of the higher rainfall areas in SA (> 300 mm / annum) because of the ongoing influence of myxomatosis and rabbit haemorrhagic disease (RHD). Flat, largely cleared and often cultivated terrain in these regions makes warrens accessible and easily ripped, so that conventional rabbit control is economically viable. Even within these areas rabbit numbers remain high in patches where steep slopes, rocks or remnant vegetation provide harbour for rabbits and hamper effective control.

In areas where rainfall is less than 300 mm, rabbit numbers build up after consecutive good seasons and then collapse during drought due to poor nutrition following depletion of available pasture by rabbits and stock. Numbers may then remain low for some years. The rate of recolonisation depends on rainfall, predator numbers, and outbreaks of RHD, myxomatosis and warren availability **[9]**.

In recent years, subdivision of peri-urban areas into large residential blocks and hobby farms has contributed to increased rabbit populations **[9]**. Rabbits are favoured in these areas by the provision of cover from the re-establishment of trees and shrubs, by year-round grazing from irrigated lawns and pastures, and by limitations on the use of toxins for rabbit control.

Origin

The rabbit originated in Spain and southern France, and was introduced to England from France in the 11th century **[4]**. It was subsequently introduced to Australia from England. Two European subspecies have been distinguished, *O. cuniculus cuniculus* from southern France (average adult weight 1500 g) and *O. c. huxleyi* from Spain (average adult weight 1000 g) **[4]**. The Australian population is referable to *O. c. cuniculus* **[6]**.

Domestic rabbits arrived in Australia with the First Fleet in 1788, and were also imported to various parts of Australia on numerous occasions after that date **[10]**. The first feral populations were in south-eastern Tasmania where they numbered in the thousands on some estates by 1827 **[4]**. The first person to introduce wild rabbits to the Australian mainland was Thomas Austin, an enthusiastic sportsman and member of an acclimatisation society, who released 24 animals at Barwon Park near Geelong on Christmas day in 1859 **[4]**. Rabbits subsequently spread from Barwon Park and a second release point at Kapunda in South Australia.

Distribution

Rabbits presently inhabit an estimated 70% (i.e. 5.33 million square kilometres) of Australia **[11]**. They are abundant across SA and WA, and parts of NSW, Qld, Vic, NT and Tas. Within SA they are generally common and widespread, particularly around and to the south of Adelaide, there is a transition to more localised distributions. Rabbits in Australia are believed to be at their geographical limit under current climatic conditions **[11]**.

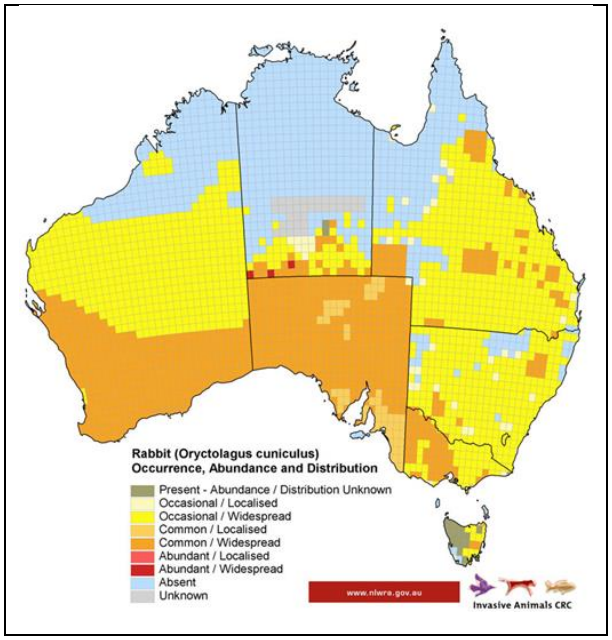

Figure 1: Rabbit occurrence, abundance and distribution in Australia in 2007 [11].

Soils are a major factor influencing local and regional distribution **[4]**. Warrens are larger and more abundant in the deeper soils on lower slopes and flats. These areas are also the most productive areas for domestic stock and are important for drought fodder. Rabbits prefer well-drained soils. Warrens are rarely found on cracking clay soils that become waterlogged and the few rabbits living on this soil type breed in hollow logs. Warren density is higher on deep sands than on shallow sands. This may be due to fox predation or to temperature effects. Rabbits are absent from some areas due to shallow soils or nutritionally deficient pastures.

In general, the highest rabbit populations occur in agricultural areas where management is difficult or neglected, or in rangeland areas where control is not obligatory or legislation is not enforced because control is perceived to be uneconomic **[9]**.

RISK ASSESSMENT

Pest risk

Since their introduction to Australia, rabbits have severely affected native flora and fauna by inhibiting the regeneration of native vegetation, competing with native fauna for food and shelter **[12]**, and by supporting survival of introduced predators such as the red fox and feral cat by providing prey **[13, 14]**. Before the introduction of myxomatosis, rabbits greatly reduced stock productivity and caused profound direct and indirect damage to soils and to native plants and animals **[4]**.

Even at low densities, rabbits impact on native vegetation. At a density of 3/ha in the Coorong National Park, rabbits prevented regeneration of *Acacia longifolia* and the sheoak, *Allocasuarina verticilliata* **[15, 16]**. There may be no safe rabbit density for some tree and shrub seedlings, particularly within 200 metres of rabbit warrens **[4]**. Follow-on effects of rabbit grazing are likely to include impacts on bird communities and increased soil erosion **[4]**.

By providing prey for red foxes and cats, rabbits maintain populations of these feral predators, which then also prey on native fauna. Predation on native fauna is most intense when rabbit abundances rapidly decline, for example during drought or following myxomatosis outbreaks **[4]**. Rabbits also compete with native herbivores **[4]**. Rabbits select the more nutritious components in grass swards and dig below the crowns of grasses to eat seeds and roots. Under dry conditions it also feeds on bark and ringbarking plants thus causing qualitative changes in the composition of plant communities **[6]**.

Rabbits reduce the carrying capacity for livestock, but the overall extent is not well quantified. On a property at Robe in SA, stock numbers were increased by approximately 40% after rabbit control, and these increased stocking rates were

maintained during the worst drought on record in 1967 **[4]**. Competition between sheep and rabbits is likely to be most significant when pasture biomass falls below about 250 kg/ha, especially during and coming out of drought **[4]**. In 1989 the value of lost production due to rabbits is estimated to be $20 million a year for the pastoral districts of South Australia **[17]**, and $115 million annually for the wool industry over the whole of Australia **[4]**. A 2016 report estimates total economic losses for South Australia due to rabbits at $23.41 million, with 10% of area utilised for wool, sheep meat and beef industries each experiencing high impacts. National impacts were estimated at $216 million per year **[21]**.

Rabbits can significantly reduce crop yields **[4]**. Rabbits inhabiting scrub alongside the boundary of a crop have been shown to take one-third of the crop within 50 metres of the boundary, and in a similar situation in South Australia, a loss of 58% in the first 70 m of a crop paddock **[4]**. Annual crop losses to rabbits in South Australia in 1989 were an estimated $6.5 million **[17]**.

Forestry and tree plantation losses due to rabbits can be high **[4]**. Rabbit control costs in private forests can be as high as $80/ha during the period when trees are vulnerable to rabbit damage. Damage from browsing rabbits can approximate one year's loss of growth, equivalent to $80/ha, at clear-felling.

Based on the information presented above for rabbits an effective protection zone around key assets is set at 500 m. This distance is defined by home range cross sectional length and relates to foraging movements from burrows, rather than dispersal movements.

Feasibility of control

Sustained effective rabbit management is the most potent method available for reducing the impact of introduced predators on native species **[4]**. It is probable that reducing rabbit numbers will reduce numbers of native birds of prey as rabbits are the main food of many raptors during their breeding seasons.

Rabbit management programs aim to affect three main aspects of rabbit biology **[4]**:

- reducing survival by a range of methods including poisoning and gassing, warren ripping, habitat manipulation to reduce shelter from weather and predators, and introducing parasites, disease and disease vectors;
- reducing breeding by destroying warrens, making habitat less favourable, and by introducing parasites, diseases and disease vectors; and
- deterring dispersal of rabbits into treated areas by destroying warrens, controlling rabbits in refuge areas, and erecting and maintaining rabbit-proof fences.

Since 1995, rabbit haemorrhagic disease (RHD) has become endemic in rabbit populations throughout South Australia **[9]**. Disease activity generally begins a month or two after breeding commences in late autumn or winter, and peaks in early spring, before ceasing in summer. Where the disease is most active it suppresses rabbit numbers during the breeding season, with compensatory recruitment increasing abundance in summer but to lower levels than before RHD.

The impact of RHD on rabbit numbers has varied greatly. In the rangelands it has been profound, with most populations held at only 5-20% of previous levels **[9]**. Significant effects have also occurred in the agricultural zone, but in some areas it has had little impact, most notably in high rainfall areas of the Mount Lofty Ranges and South-East, and in some coastal rabbit populations on Eyre Peninsula **[9]**.

The seasonal peak of myxomatosis is now in early summer or autumn instead of late spring. In South Australia the impact of myxomatosis and RHD appears to be synergistic on decreasing rabbit populations.

Where rabbits use warrens, ripping is the most cost effective and enduring of the available single control techniques **[4]**. The effectiveness of ripping is greatest when followed with other control treatments or with repeated ripping **[4]**. Destroying rabbit warrens by ripping in areas used by rabbits to survive drought is a very effective control measure, particularly in arid Australia, with no active warrens found seven years after ripping **[18]**. The cost of ripping only drought refuge warrens was calculated to be less than 4% of the cost of ripping all warrens on the property.

High levels of diurnal surface activity in rabbits suggests that warren fumigation may be ineffective unless rabbits can first be flushed to their warrens for example by use of dogs **[8]**. Activity data suggests that fumigation or ripping should be conducted between 0900 and 1600 hours in winter and 1100 and 1800 hours in summer **[8]**.

Under the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the rabbit is recognised as a threat to native animals and plants. Competition and land degradation by feral rabbits are listed as a key threatening process under the EPBC Act and pose a threat to a large number of native species, and a threat abatement plan has been developed to address these threats **[19, 20]**.

Status

Within the EP Landscape Board region, a risk management assessment shows that rabbits merit a Manage Pest Animal Populations status in land use types of crop/pasture, native vegetation and urban (Table 1). In these areas the aim is to reduce overall impact 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	378 (very high)	364(negligible)	Manage Pest Animal Populations
Urban	378 (very high)	364 (negligible)	Manage Pest Animal Populations

REGIONAL RESPONSE

Special considerations/Board position

All actions need to have regard to the consequences of rabbit control on other species.

Integrated pest management is integral to the effective control of rabbits.

Outcome

To minimise the economic, environmental and social impacts of rabbits.

Objectives

To:

- protect key environmental assets from the impacts of rabbits;
- implement integrated pest management programs as part of best practice;
- support the protection of primary production at significant risk from the threat of rabbits; and
- facilitate and encourage councils to control rabbits in urban problem spots.

Area/s to be protected

Key environmental assets (as outlined below), primary production assets (crops and pasture) and urban public areas.

Key environmental assets are:

- Remnant vegetation (particularly vegetation that is an EPBC listed vegetation community or contains EPBC listed plants or animals).
- Revegetation areas

Actions

Land managers to:

1. Control rabbits using best practice methods and supply control information on request to Landscape Board staff;

Landscape Board staff to:

1. Provide access to 1080 rabbit bait (Landscape Board is the only supplier) in an timely and effective manner,
2. Facilitate, encourage and compel control strategies and actions with a focus on protecting key assets,
3. Support and encourage landholders to adopt best-practice rabbit management through practical community engagement activities across the EP landscape;
4. Develop localised annual action plans to achieve the objectives and actions of this management plan;
5. Undertake systematic data collection of where (ie Hundred and Section) and when baits have been distributed, and store in a central spatial database;
6. Minimise negative impact of rabbit control on fauna species of conservation significance;
7. Coordinate opportunities for rabbit control post fire and during drought;
8. Participate in biological control programs;
9. Raise community awareness to promote rabbit control across the region; and
10. Work with local councils to develop rabbit control programs in urban areas.

Evaluation

Evaluation of success will be based on:

- annual analysis in July of monitoring and control data to evaluate the effectiveness of control actions;
- identify any gaps in delivery and action as soon as possible; and
- review of this pest management plan every five years.

Declarations

In South Australia the rabbit is a declared pest under Schedule 1 (CLASS 8 (wild and domestic rabbits) – Provisions: 186(1)(3), 187(1), 188, 189, 190, 192 (1) all offshore islands; CLASS 9 (wild rabbits) – Provisions: 186(1)(3), 187(1), 188, 189, 192 (2), 194(1) whole of state; and CLASS 10 (domestic breeds) – Provisions: 189 and 191 (1) whole of state) of the *Landscape South Australia Act 2019* (Table 2).

Table 2: Wild Rabbits and CLASS 8 domestic rabbits – relevant sections of the *Landscape South Australia Act 2019*. Provisions for the whole of state excluding all offshore islands

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 (2)	Landowner must control and keep controlled wild rabbits.
194(1)	Boards may recover costs from landholders adjoining road reserves where rabbit control has been carried out by the boards.

Domestic breeds of rabbits are proclaimed within two provisions of Class 11 the Act (Table 3). The keeping and sale of rabbits for meat, fibre and pelts was prohibited in South Australia under the *Animal and Plant Control (Agricultural Protection and Other Purposes) Act 1986A*, until a review of the Animal and Plant Control Commission's policy in 1999 determined that commercial farming of domestic breeds of rabbits for meat, fibre and pelts and the keeping and sale of domestic breeds of pet rabbits did not present a significant risk to the wild rabbit management program **[9]**.

Table 3: Domestic Rabbits – relevant sections of the *Landscape South Australia Act 2019*. Provisions for the whole of state excluding all offshore islands

Section	Description of how the section applies
189	Must not release the animal in the region Any costs associated with controlling or recovering domestic rabbits as a result of a deliberate release can be recovered from the owner of the animals
191 (1)	Must comply with instructions to keep animals confined. An authorized officer can give a person a notice (approved by the Minister) to take any action specified in the notice to keep a domestic rabbit in captivity.

For rabbit farming a Code of Practice for Intensive Rabbit Husbandry has been prepared by the Standing Committee on Agriculture and Resource Management to take consideration of animal welfare concerns **[9]**. This Code has been adopted in South Australia under the provisions of the Prevention of Cruelty to Animals Act 1985, and subordinate legislation. Rabbit farming in South Australia must comply with this Code of Practice, which is administered by the RSPCA. Private individuals and breeders keeping pet rabbits are also required to comply with levels of husbandry required under the Prevention of Cruelty to Animals Act 1985. Rabbit farming is an intensive animal industry and Local Government planning approval is required.

More information

Contact your local Eyre Peninsula Landscape Board office

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