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**Experimental evaluation of  
fox control and  
the impact of foxes on lambs**

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## Abstract

Baiting with sodium monofluoroacetate (1080) to protect lambs (*Ovis aries*) from red foxes (*Vulpes vulpes* L.) has become more frequent in NSW and other parts of Australia during the last 10 years despite the lack of reported evidence evaluating the effects of fox baiting on lamb survival. NSW Agriculture has developed fox control recommendations aimed at minimising impact, but these guidelines have not been tested experimentally. Defining the extent of a pest problem and the effectiveness of pest control are key components of a strategic approach to vertebrate pest management as it is the damage of pests that justifies their control.

This thesis describes an experimental evaluation of the recommended practice of fox control in NSW. The effects of three levels of fox control were tested in the experiment; no treatment, baiting once a year before lambing (the recommended practice) and baiting three times a year (thought to be the maximum farmers would instigate). Each treatment had two replicates. No previous manipulative experiment using synchronous controls and matched replicates has been undertaken to test the effects. The study quantifies the level of fox predation on healthy lambs and the level of predation on lambs that had other causes including illness and mismothering contributing to this fox predation. It also examines the response of the fox population, lamb predation and lambing outcomes to different levels of fox control. The cost effectiveness of fox control is examined in relation to lamb predation and an investigation of the optimum level of fox control is begun. The experiment also provides the first chance to consider the examination of multiple response variables and the scale of field ecology experiments required to recognise a significant response and avoid a Type II error due to between replicate variability even with tightly controlled site selection criteria to standardise experimental sites, and with the synchrony of experimental control and treatment surveys.

The study occurred on five sheep properties near Boorowa (34°28'S, 148°32'E) and Murringo (34°18'S, 148°31'E) in south-eastern Australia. The terrain was undulating to hilly with a maximum elevation of 660 m above sea level. The main agricultural enterprises in the district are Merino wool, fat lamb and beef cattle production and winter cereal cropping. The native vegetation of *Eucalyptus* woodland has been mostly cleared, though remnant patches occur. Most of the area

is now sown with pasture of *Phalaris tuberosa*, *Lolium* spp. and clover *Trifolium* spp.. The experimental properties grazed self-replacing Merino flocks, primarily for wool production, so lamb survival was vital to the economic operation of the farm. Over 50 selection criteria including lamb survival rates, ewe fertility and bloodline, sheep management practices, climate and habitat features that affect lamb survival, past fox control practices and prey species were used to select sites. Sites were representative of most sheep farming properties in the region, but were also extremely similar in factors that affected fox abundance and ewe and lamb survival, thus minimising variation between replicate sites.

The manufactured meat baits used to poison foxes contained 3 mg of sodium monofluoroacetate (compound 1080). A replacement baiting program was carried out in 1995 and 1996. Fox control programs were carried out over the experimental units and adjacent buffer zones covering approximately two fox territories, approximately 6km<sup>2</sup>, around the lambing paddock under study. The recommended fox control practices described by NSW Agriculture also included neighbouring farmers taking part in an extended group baiting program. In all the area baited at varying intensities totalled 3400 km<sup>2</sup>. Synchronised lambing with neighbours was a further recommended practice to reduce fox predation and was carried out on these sites. Lambing occurred during a six to eight week period in late winter on all sites, a practice known as 'spring lambing', and on many surrounding properties so a surplus of lambs was available to foxes over a relatively short time.

The benefits of fox control were measured directly as enhanced lamb survival derived from differences in lamb marking rates between ultrasounded flocks of approximately 1000 ewes and the predation of lambs was measured from over 2000 lamb carcasses post-mortemed in 1994, 1995 and 1996. A mean of 138 lambs were expected at ultrasounding from 100 ewes and 113 lambs per 100 ewes were alive at lamb marking.

There was no significant ( $P>0.05$ ) effect of fox control on lambing performance (the number of lambs per 100 ewes that lambed). Fox predation was inferred as the cause of lamb death in a minimum of 0.8% and a maximum of 5.3% of lamb carcasses during 1995 and 1996. There was a significant ( $P<0.05$ ) effect of fox control on the minimum possible percentage of lamb carcasses classified as healthy lambs killed by foxes, with the percentage declining from 1.50% (no fox control), to

0.90% (fox control once per year) to 0.25% (fox control three times per year). There was also a significant ( $P < 0.005$ ) effect of fox control on the maximum possible percentage of lamb carcasses classified as healthy lambs killed by foxes with the percentage declining from 10.25% (no fox control), to 6.50% (fox control once per year) to 3.75% (fox control three times per year). The observed results were used to estimate the number of treatment replicates needed to be confident of detecting an effect of predator control on lamb marking performance. The estimated numbers were very high if small effects were to be detected. No significant correlation between the fox density and the minimum and maximum possible number of lamb carcasses classified as killed by foxes was found. Bait uptake was monitored as were the costs of fox control.

# EXPERIMENTAL EVALUATION OF FOX CONTROL AND THE IMPACT OF FOXES ON LAMBS

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