

UC Agriculture & Natural Resources

Proceedings of the Vertebrate Pest Conference

Title

The use of deer, pigs, and ferrets as indicator species for detecting Tb

Permalink

<https://escholarship.org/uc/item/7dq5r6w0>

Journal

Proceedings of the Vertebrate Pest Conference, 20(20)

ISSN

0507-6773

Author

Lorigan, Roger D. A.

Publication Date

2002

DOI

10.5070/V420110083

The Use of Deer, Pigs, and Ferrets as Indicator Species for Detecting Tb

Roger D. A. Lorigan

Epro Limited, Taupo, New Zealand

Abstract: The pest management strategy for bovine tuberculosis (Tb) in New Zealand aims to achieve official freedom from Tb before 2012 and to eradicate the disease from livestock and wildlife. On farmland, regularly tested cattle and deer usually provide adequate surveillance of Tb presence in sympatric wildlife, but there are many other areas where livestock are absent or their densities too low to be useful. For these areas, Tb prevalence in the wildlife hosts must be surveyed directly but brushtail possums (*Trichosurus vulpecula*), the main host, make poor sentinels (indicators) for identifying Tb presence or absence. Consequently, persistent Tb can go undetected for long periods. The trials reported here assess the feasibility and practicality of alternative techniques for Tb surveillance in wildlife – the use of ‘spillover’ hosts as sentinels for detecting Tb presence or helping quantify its likely absence. Spillover hosts become infected mainly through interaction with other species. This paper will discuss the use of these species to detect both the presence and the spread of bovine Tb in wildlife in the central North Island of New Zealand.

Key Words: deer, ferret, pig, possum, bovine tuberculosis, disease, vector control, indicators, sentinels, eradication

Proc. 20th Vertebr. Pest Conf. (R. M. Timm and R. H. Schmidt, Eds.)
Published at Univ. of Calif., Davis. 2002. Pp. 249-252.

INTRODUCTION

New Zealand is a group of islands in the South Pacific, covering some 269,000 km² (or 104,000 mi²). There are two main islands, with a number of smaller islands surrounding them. It is the closest country to the South Pole, but with its long narrow shape contains many different climates.

In the 18th Century, Europeans began settling in the country, which had previously been the domain of the native tribes – the Maori. This colonization brought with it dramatic changes to the landscape. The good climate and fertile soils meant the land was well suited to intensive livestock farming techniques.

Most of the early settlers were English and they set about creating a “piece of England” in New Zealand. As part of this settling in process, they introduced a large number of exotic plant and animals species – principally sheep and cattle. However, a proportion of these cattle were carrying *Mycobacterium bovis*, the causative agent of bovine tuberculosis (Tb).

INTRODUCED SPECIES

Before human settlement, New Zealand had no mammals. The ecosystem had evolved to be an avian empire. Some bird species, for example the kiwi, had become flightless. Native plants had evolved into highly palatable food sources that attracted birds. These plants had no developed defences against the newly introduced mammals – no thorns or built-in toxins.

In the late 1800s, with the approval of the New Zealand government, a number of species were introduced. Deer were released into the wild to provide recreational hunting. Rabbits, goats, and pigs were brought in as food sources. The brushtail possum

(*Trichosurus vulpecula*) was introduced from Australia for its fur.

Rabbits quickly became a pest to the farmers and as a result shortly afterwards mustelids (ferrets, stoats and weasels) were introduced to help reduce the rabbit population. Without any natural predators, the introduced species thrived, and by the 1930s they had become major conservation pests. The toll on New Zealand’s native flora and fauna was immense with a number of species becoming extinct and others becoming highly endangered. It was identified that the brushtail possum was the biggest culprit in this environmental damage and while attempts were made to reverse the effects, they were not successful.

In the 1940s, people started to question why there was an ongoing level of tuberculosis in the human population. While the proportion of people contracting the disease had not changed particularly, the level of interest in reducing it had. They identified that unpasteurised milk was a leading agent in humans developing tuberculosis. This was because the cattle herds in New Zealand were now carrying a high level of bovine Tb, developed over the years from the infected stock originally introduced. Pasteurisation of milk became standard and the levels of tuberculosis in humans declined dramatically.

At the same time, they set about reducing the levels of bovine Tb in livestock. A compulsory Tb livestock-testing programme was developed. This cleared up most of the problem, by identifying Tb infection in livestock and requiring a compulsory slaughter of any cattle that had a reactor. However, in some parts of the country the testing kept showing more and more cattle with positive Tb reactors – chronic levels of infection.

During this period international trade standards were developed. The standard defined 'Tb freedom' as less than 0.2% of herds in any country carrying bovine Tb. Any country that did not meet this standard was required to demonstrate a commitment to reducing the incidence of Tb or risk trade barriers being imposed.

New Zealand's agricultural base— meat and dairy exports— were (and still are) the backbone of the economy. Despite everything, the levels of bovine Tb continued to climb and this was causing a high level of concern.

POSSUMS AS VECTORS

In 1967, a Tb infected possum was discovered on the west coast of the South Island. This was the first indicator that feral animals were acting a vector in transmitting disease to cattle. This was followed by further Tb-infected possum discoveries.

By 1972, it had been formally confirmed that brushtail possums were vectors in the transmission of bovine Tb. While other feral animals had been discovered with Tb, there was a strong correlation between areas with Tb-infected possums and high levels of cattle reactors. The possum became public pest number one.

A National Bovine Tb Control Scheme was created to control possums, and consequently there was a significant reduction in the number of infected livestock herds. By this time, deer were being farmed commercially and had been included in the compulsory livestock-testing regime, after a number of Tb outbreaks in deer herds.

After five years of intensive control it was thought that Tb problem had been beaten, and government and stakeholder funding was reduced significantly. However, by the early 1990s, the number of infected herds and the number of reactors began to rise rapidly, with new outbreaks showing the disease had spread into areas outside the traditional Tb infection zones.

This rise in infection rates had suddenly put our agricultural exports at risk. While previously, the OIE ("Office International des Epizooties," or World Organisation for Animal Health, responsible for the international standard on Tb) had been happy that New Zealand was actively trying to overcome its bovine Tb problems, the sudden rise in rates meant the risk of trade tariffs being imposed was very real.

A National Bovine Tb Strategy was implemented and a new organisation – the Animal Health Board – was created to oversee its implementation. Possum control began in earnest. The aim of the National Bovine Tb Strategy is to eradicate bovine Tb from New Zealand by 2012.

In 1993, a million ha of land had possum control undertaken on it. This involved aerial baiting with 1080 poison (sodium monofluoroacetate), along with trapping and shooting regimes. By 2000, the total area under Tb

control had risen to 5.3 million ha at an annual cost of NZ\$80 million (US\$35 million).

Currently, New Zealand's bovine Tb rates are at 1.3% on all cattle and deer herds— above the international standard (0.2%). While New Zealand has had success in some areas, there has been a continual spread of the disease into previously clear areas. Much of the 5.3 million ha of land that is being intentionally controlled has had no further Tb outbreaks. However, the risk of stopping control and having the disease show up again as it did in the 1980s is unacceptable.

The need to identify methods that could be used to build on gains made over recent years was critical. New Zealand needed to find more innovative and targeted methods of vector control. The monitoring of wildlife to detect the presence or absence of Tb was identified as a potential tool— that is, using feral animals as indicators or sentinels.

BENEFITS FROM USING INDICATORS

A number of benefits from using indicators in the diagnosing, management and eradication of bovine Tb were identified:

1. Indicators can be used to track progress within a vector area.
2. They determine where 'hot spots' of infection exist. Hot spots are small pockets where environmental conditions are favourable to the maintenance of the Tb bacteria. This is very useful where there is persistent infection in livestock.
3. Indicators allow you to target control more effectively. By having good information on where Tb is located, you are able to determine the most appropriate mix of control techniques to apply.
4. Indicators can be used to set physical boundaries for new control operations. These new operations are often created after outbreaks of positive Tb reactors during the herd testing of deer and cattle. They can help you determine the level of Tb infection in areas where there are no livestock herds— say large tracts of bush. By having information on the spread of the disease, you are able to identify the optimal operational boundaries to prevent further expansion of the vector risk area.
5. By surveying using indicators, you can seek some assurance that it is acceptable to cease vector control in an area. This is undertaken by using historical livestock testing data to identify where Tb has been present. These areas are then surveyed as a final check before vector control ceases.

Possums, the primary host or vector, make poor sentinels for identifying Tb disease or absence. They have small home ranges (typically averaging 1 to 5 ha but occasionally up to approximately 30 ha), and this means that almost all the animals in an area would need to be surveyed to be 95% confident that Tb is not present. This

is impractical and unaffordable on the scale that would be required in New Zealand.

Other species that have been identified as infected with bovine Tb are ferrets, feral pigs, and deer. Although these species had been identified with bovine Tb, it was acknowledged that the possum was still the primary infection point for these feral animals as well as farmed livestock.

Research began on the suitability of these species as effective indicators or sentinels to further reduce or eradicate Tb in livestock herds.

FERRETS AS INDICATORS

Findings

- Home ranges of 100 to 250 ha.
- Need high population densities to maintain Tb without Tb infected possums (multiple denning).
- High percentages of infected ferrets in areas where Tb infected possums are present.
- Tb contracted via scavenging and ferret-to-ferret contact.
- Main habitat is farmland and forest / farmland margins.
- Tb not obvious without culture.

Use as an Indicator

- Ferrets are suitable as an indicator species on farmland and waterways.
- Good indicator for finding Tb ‘hot spots.’
- Small home range makes them an ineffective indicator for large operations or for determining spread of disease.
- More a management than a diagnostic tool.

Implementation

Trapping is carried out using specially designed ferret traps. Ferret trapping is often done in conjunction with possum control.

FERAL DEER AS INDICATORS

Findings

- Female deer have a home range of approximately 200 ha. Males may have a large home range—up to 5,000 ha.
- High prevalence of Tb in deer when infected possum density is high.
- Physical contact with infected live possums is the main source of transmission.
- Deer-to-deer transmission is rare in the wild, but not in farmed deer.
- Principally confined to large blocks of forest.
- Tb detected via autopsy and culture—tonsils and head nodes most commonly infected.

Use as an Indicator

- Males are good for finding Tb over a large area. Excellent for determining spread and defining operation boundaries.

- Size of home ranges make females more suitable indicators for determining Tb in a localised area—to target control more effectively in existing operations.
- It has not been clearly determined how good deer are as indicators when there is a low density of Tb infected possums.
- More a diagnostics than a management tool.
- Highly specialised recovery and survey techniques needed.

Implementation

Usually a specialist operation carried out in isolation from any other control. It involves aerial helicopter hunting and carcass recovery, a relatively high-risk activity.

FERAL PIGS AS INDICATORS

Findings

- Home ranges from 350 to 2,600 ha.
- Will see a high prevalence of Tb even when low numbers of possums infected.
- Most infection is contracted through scavenging.
- Pig-to-pig transmission is rare—Tb disappeared from pigs in Australia without any control.
- Tb is easily detected—universal mandibular node infection.

Use as an Indicator

- Only suitable for bush areas.
- Excellent for finding Tb over a large area.
- Large home ranges make them ineffective for finding ‘hot spots.’
- A good technique for determining if vector control can cease in an area.
- Pigs are very susceptible to contracting Tb if it is present in the environment.
- Characteristics offer potential for new techniques.

Implementation

Currently surveys are carried out using trapping and ground hunting. New radio collaring techniques are currently being developed, which will offer more information on the incidence of Tb within areas.

SUMMARY

While we still have some way to go, New Zealand has made gains over recent years. Indicators have played an integral role in helping us understand the spread of Tb. In parts of New Zealand, the disease has been contained and the size of the vector risk area is reducing. Numbers of infected deer and cattle herds are showing a strong downward trend.

Early, accurate identification of problems has allowed us to focus on the correct issues. The decisions being made on vector control are more robust and informed and there is more ability to plan and develop cost effective strategies.

While indicators are only part of the answer, they are a critical element in achieving Tb freedom– especially as levels of Tb infection decrease. Without indicators, our progress towards Tb freedom would have been significantly slower.

ACKNOWLEDGEMENTS

I would like to express my sincere thanks to Environment Waikato for permitting the use of images they own within the conference presentation. In addition, I wish to thank the following people for their assistance and input: John H. Simmons, Group Manager – Biosecurity, Environment Waikato, Hamilton, New Zealand; Paul G. Livingstone, Technical Services Manager, Animal Health Board, Wellington, New Zealand; Graham Nugent, Landcare Research, Lincoln, New Zealand.