

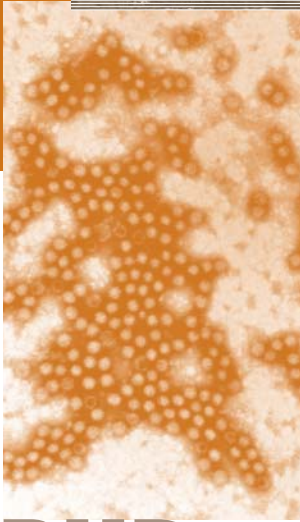
# Making the most of RABBIT HAEMORRHAGIC DISEASE



*Brian Cooke,  
CSIRO Sustainable Ecosystems*

## THE ISSUE

Rabbit Haemorrhagic Disease (RHD, but also known as Rabbit Calicivirus Disease – RCD) has been spectacular in reducing rabbit populations in the Australian rangelands and is still working well in many areas. But, as the RHD virus (RHDV) has been less effective in cooler, higher rainfall regions, rabbits continue to cause problems in these areas. They are damaging farmland, public amenities, home gardens, property and our native plants. It is likely that, as with myxomatosis, both the RHD virus and rabbits may evolve until the virus becomes less effective. This possible evolution is likely to happen first in Australia's arid zone where RHDV is causing the most deaths, and natural selection for resistant individuals may be higher.



# RHD



Therefore we must consider and promote the following options:

- Combining traditional control methods (e.g. baiting and warren ripping) with RHDV and myxomatosis activity to reduce rabbit numbers – particularly in higher rainfall areas where RHDV alone cannot be relied upon to reduce the impacts of rabbits.
- Warren ripping in the rangelands to capitalise on low rabbit numbers and therefore low reopening rates of ripped warrens. This should begin in areas such as drought refuges and other areas where ripping will give the most benefit.
- Using traditional methods to reduce rabbit numbers and increase the RHD susceptibility of the remaining population (this is explained later).

## RHD – how does it work?

Most caliciviruses infect the lining of the throat, lungs or gut. RHDV also infects the rabbit's liver causing acute hepatitis that can kill within 48 hours. Products from diseased liver cells accumulate in the rabbit's blood causing circulatory problems and the bleeding or haemorrhages that gives the virus its name.

Curiously, the age of rabbits at the time of infection with RHDV determines how badly they will be affected. Very young rabbits less than 3 weeks old show little sign of infection and are immunised against infection later in life. About 60% of rabbits 3–6 weeks old die if they become infected and by the time rabbits are 9 weeks old mortality is almost 90%, similar to that in adult rabbits. In addition, young rabbits whose mothers have recovered from RHD often carry maternal antibodies in their blood. These antibodies are passed from mother to embryos before birth and provide temporary protection in young rabbits up

to 12 weeks old. These antibodies do not stop the young rabbits from becoming infected with the virus but may prevent acute disease and death. These rabbits with maternal antibodies have a good chance of surviving RHD and becoming immune for life.

## How has RHD operated in Australia?

When RHD first spread into inland Australia, rabbits of all ages were susceptible to infection. As a result, most adult rabbits died, and most survivors were simply those lucky enough to be between 3–6 weeks old when the virus spread. Very young rabbits in the nest died of starvation if their mothers died.

In the following year, the rabbit population consisted mainly of those young survivors, now grown to adults. RHD now could not spread easily, because nearly all survivors were immune, and it was not until these rabbits had bred and produced a new crop of susceptible young that a second outbreak could occur.

***‘The pattern of RHD outbreaks has varied, and this has important practical consequences.’***

Annual outbreaks of RHD have become common across much of Australia, particularly the arid and semi-arid rangelands. Somehow the virus survives from year to year, revisiting rabbit populations whenever there are enough susceptible rabbits to support infection and transmission. The pattern of outbreaks has varied, and this has some important consequences. Generally, in cooler and wetter parts of Australia, rabbits produce young between autumn and late spring. By about October, many young, early-born rabbits have lost their age-specific and maternal antibody protection against RHD. They are old enough to begin mixing with rabbits living in adjacent territories. RHD then spreads very readily and kills many of the early-born young that have lost all protection - but it can immunise some of the later-born young.

In inland areas, RHD often breaks out in spring but disappears as the hot, dry summer weather begins. This is probably because the virus cannot survive high temperatures or because the activity of insects that carry RHDV declines. As a result, many young rabbits live through their first summer untroubled by RHD. But as they grow into adults they lose the last traces of maternal antibody protection. With the return of cooler weather, and the rains that bring pasture growth, most succumb to a fresh outbreak of RHD.

Climate clearly influences how well RHD works. If an outbreak is finished by spring, many young rabbits are immunised, and not killed. Where outbreaks are delayed by a hot, dry summer until autumn or the following winter they will often kill many of the young adults.

### New South Wales

Rangers from Rural Lands Protection Boards across southern NSW have noted that RHD outbreaks occur between autumn and spring. By contrast, rangers from north-eastern NSW observed spring or summer outbreaks. There is a broad area between these extremes where outbreaks can occur in any season. Rabbit numbers are generally higher in areas where RHD outbreaks occur in spring-summer compared with areas where mainly autumn or winter outbreaks occur.

### Victoria

Victoria experiences spring and summer outbreaks of RHD in central and southern areas. In the north-west, RHD outbreaks commonly occur in spring and occasionally in autumn. RHD has been more effective in reducing rabbit populations in the northern and mallee regions than in the central and southern areas.

## South Australia

In South Australia, near Mount Gambier, the disease appears mostly in autumn but moving north through the upper south-east, outbreaks occur mostly in spring. Even further north, in the Adelaide region, outbreaks occur in spring and summer. Links between outbreaks of RHD and rainfall are not as strong as for New South Wales and Victoria. There is probably more of a link between climate and the number of insect vectors that determines exactly when RHD spreads best.

## Western Australia

In Western Australia, RHDV has been particularly effective in the arid and semi-arid rangelands (<350 mm annual rainfall), where epizootics have occurred frequently. However, the effects of RHDV in other areas of the State have been patchy, and there appears to be a number of years between epizootics. This is despite the number of susceptible rabbits appearing to be high in some areas.

Outbreaks most commonly occur in late spring and autumn, with the occasional outbreak in early winter. The effects of RHD show the greatest variability/patchiness in the coastal area. Nevertheless, along with myxomatosis and conventional control techniques, RHDV has been effective in helping to keep rabbit numbers low throughout much of the agricultural region, and the rangelands, of Western Australia.

## Queensland

Rabbit populations are being suppressed by about 70% by RHD in the southern part of Queensland. The virus is less likely to be active in summer but RHD can occur at any time of the year where there is a high density of susceptible rabbits. These conditions usually occur in spring or autumn. In the west, RHD appears inactive in the summer. RHD, myxomatosis, drought and warren ripping have combined to push rabbit numbers to very low levels in south-west Queensland. In the south-east however, there appears to be signs

of reduced effectiveness of RHD with rabbit populations recovering somewhat. Where warren ripping has been conducted rabbit numbers remain low. Further north, isolated pockets of rabbits appear less likely to be exposed to natural spread of RHDV and obvious outbreaks are infrequent even when there are high densities of susceptible rabbits. Introduction of RHDV into these populations can be a useful method for reducing rabbit numbers.

### Tasmania

RHD occurs throughout the State and can cause mortality at all times of the year, although late summer – autumn outbreaks are generally the most effective.

### An existing rabbit calicivirus

There is another reason why RHD affects rabbits differently from place to place. Even when RHD first spread as a new disease among Australia's rabbits, it did not cause many deaths in some areas. It is now clear that, before the spread of RHDV, there was another rabbit calicivirus already present in Australia. This virus, which is most common in

cooler, wetter areas, causes no harm to rabbits but antibodies produced against it seem to help protect rabbits from the more lethal RHDV.

### Myxomatosis

It is interesting that, although outbreaks of RHD occur at different times in different parts of south-eastern Australia, myxomatosis occurs much more consistently in spring and summer. This is related to the spread of myxomatosis among young rabbits at the end of each breeding season. The regular pattern of these outbreaks is in sharp contrast to the regional differences in the timing of RHD outbreaks.

## How do we improve the impact of RHD on rabbit populations?

### Warren ripping and surface harbour removal programs

Since RHD spread, many landholders have been ripping rabbit warrens and removing surface rabbit harbour to further reduce their rabbit problems.



## Improving the economics of warren ripping in the rangelands

*(based on information provided by David Berman, Qld Dept of Natural Resources and Mines)*

It may seem sensible for landholders not to use other control methods while RHD is keeping rabbit numbers low for free. Unfortunately, this is likely to mean that they won't receive the full long-term benefits from RHD.

Many landholders in the rangelands do not rip their warrens because they either can't afford the up-front costs or believe ripping to be uneconomic. However, at Bulloo Downs in south-west Queensland, they are showing that the cost:benefit of warren ripping can be greatly improved by focussing on key rabbit refuge areas rather than treating the whole property. Over 30,000 warrens were ripped in an area of about 95 square kilometres over 18 months at a cost of \$1,462 per square kilometre. The aim is to knock out the rabbits' drought refuge warrens

by ripping all areas within one kilometre of permanent water. If all drought refuge areas can be ripped, rabbit numbers may be pushed low enough that they will not recover well after drought, with dingoes, myxomatosis and RHD potentially keeping numbers low. If this proves to be the case, \$240,000 in ripping costs will have removed the impact of rabbits from 2,500 square kilometres with an estimated cattle production benefit of over \$500,000 per year. In marked contrast, the cost of ripping all warrens on Bulloo Downs would be over \$6 million!

There also seem to be clear environmental benefits from ripping rather than just relying on myxomatosis and RHD. An experimental warren ripping trial showed that native animals were still reduced by the presence of rabbits, even though myxomatosis and RHD were active. Ripping stopped the impact of rabbits almost immediately, with the numbers of some small native mammals doubling within two months.

Warren ripping and other controls (e.g. follow-up baiting), if done properly, can add greatly to the impact of RHD.

Ripping can reduce rabbits to 1-2% of their original numbers. The removal of surface harbour such as boxthorn, gorse and blackberry also assists in maintaining low rabbit populations. Warren ripping and surface harbour removal have been assisted by programs such as the "South-West Rabbit Control Group program", "West 2000" and "West 2000 Plus" in New South Wales, "Rabbit Buster" in Victoria and "Operation Bounce-back" and "Rangelands Action Program" in South Australia.

The economics of warren ripping in the rangelands can be improved by targeting key areas (see Textbox on page 7). Costs are kept down by using bulldozers with enough power to efficiently destroy the rabbit warrens. Winged tines on rippers can help by reducing the need for cross ripping. [See booklet '*Conventional rabbit control: costs and tips*' and/or relevant State Government extension material]

### Additional virus release

It could be argued that if we knew more about when RHD would spread best in different areas and cause the highest mortality, the virus could be released at key times. NSW Agriculture is currently testing carrot and oat baits as a way to introduce the virus into a rabbit population quickly and cheaply. This may be more efficient than injecting captured rabbits with RHDV, and may also be useful in seeding the rabbit population with more virulent forms of RHDV that may be produced in the future. Unfortunately there is currently no quick and simple field test for rabbit RHD antibodies to determine when most might be susceptible to RHDV.



Because RHD outbreaks are influenced by rainfall, either directly or indirectly, it is hard to predict exactly when the virus should be introduced to a population for maximum effect. A recent Victorian study reported a high level of RHDV immunity in some rabbit populations which would limit the potential of virus release programs. Still, if bait-delivered RHDV is registered, the process would become simple and cheap enough to try to manipulate RHD outbreaks.

***‘Virus releases may be effective in areas where the disease usually occurs every second year or even less frequently.’***

Virus releases may be most effective in sites, like parts of the Mount Lofty Ranges in South Australia, or parts of Western Australia, where the disease usually occurs every second year or even less frequently. There are also isolated populations of rabbits (such as those near the margins of the rabbits’ distribution in central Queensland) where the virus doesn’t persist, so RHD outbreaks are fairly rare. Rabbits in these areas are often completely susceptible to RHD and introducing fresh virus gives good kills.

Maintaining rabbit populations at low levels

Although we currently lack an easy method to start fresh outbreaks of RHD, another course of action is possible. The concept is a simple one, based on the idea that RHD will spread more slowly if there are fewer rabbits. If their numbers are kept low, rabbits will generally be older by the time they

become infected with RHDV and age-related resistance or maternal antibodies will protect fewer of them. This is because the RHDV needs a certain number of susceptible rabbits present before it can infect, transmit and persist in a given rabbit population. Additional rabbit control should therefore have two main outcomes: there will be fewer rabbits and their numbers will take longer to recover if RHD (and myxomatosis) becomes more effective.

***‘If rabbit numbers are kept low, rabbits will be older by the time they become infected with RHDV and age-related resistance will protect fewer of them.’***

These ideas are still being tested, but there are some promising results. Although rabbit numbers on some sites remained high following the spread of RHD, follow-up poisoning has seen the populations fall to very low levels and remain low for over eighteen months. Even if reducing rabbit numbers with conventional control techniques does not always enhance the effectiveness of RHDV, it still remains a useful thing to do and certainly does not detract from overall rabbit control.

For information on specific State/Territory Government requirements, visit the following internet sites:

<b>Victoria</b>	<a href="http://www.nre.vic.gov.au">http://www.nre.vic.gov.au</a>
<b>New South Wales</b>	<a href="http://www.agric.nsw.gov.au">http://www.agric.nsw.gov.au</a>
<b>Northern Territory</b>	<a href="http://www.nt.gov.au/ipe/pwcnt/">http://www.nt.gov.au/ipe/pwcnt/</a>
<b>Queensland</b>	Contact your nearest Local Government office
<b>Western Australia</b>	<a href="http://www.agric.wa.gov.au/programs/app/">http://www.agric.wa.gov.au/programs/app/</a>
<b>ACT</b>	<a href="http://www.environment.act.gov.au/ie4/">http://www.environment.act.gov.au/ie4/</a>
<b>South Australia</b>	<a href="http://www.pir.sa.gov.au">http://www.pir.sa.gov.au</a>
<b>Tasmania</b>	<a href="http://www.dpiwe.tas.gov.au">http://www.dpiwe.tas.gov.au</a>



# Natural Heritage Trust

*Helping Communities  
Helping Australia*

A Commonwealth Government Initiative



Department of  
**AGRICULTURE  
FISHERIES &  
FORESTRY –  
AUSTRALIA**



MAY 2003