



## Foundation for Rabbit-Free Australia

Newsletter Volume 35, February 2022

### AGM

Members enjoyed the opportunity to meet for our November 2021 AGM and to hear an excellent presentation from Katherine Moseby (see [Rabbit Insights](#), below, for more information). Once again **Zoos SA** provided the Santos Conservation Centre as a venue and those present were also treated with a gift from Foundation Sponsor, **Haigh's Chocolates**.

The **Annual Report** is **appended**.

The meeting marked the end of a five year term for committee member Bruce Munday, but thankfully Bruce is continuing to contribute as an Advisor including lending his unique skills to the development of Newsletter articles.

The AGM also marked the retirement of Deane Crabb from the committee as a nominee of Livestock SA. His wise contributions will be missed. **Livestock SA** took the opportunity to re-affirm their commitment and support to Rabbit-Free Australia, maintaining their status as a Foundation Sponsor. Joe Keynes (President of Livestock SA) has been welcomed to the committee, maintaining continuity in their representation.

Anne Burgi, has been assisting the Foundation with sub-editing and design work on numerous publications and has accepted a nomination to be formally recognised as an Advisor

### Greg Mutze

It is with great sadness that we report the passing of Greg Mutze, after battling cancer in recent years. Greg was a long serving supporter of the Foundation, being involved since the early days of its formation, providing expert advice and technical support, and more recently as a committee member.

His research contributions to the control of rabbits have been recognised across Australia, along with his continual willingness to share his knowledge and assist others involved in rabbit research.

A memorial summarising Greg's many contributions is **appended**.

Greg addressing an early Rabbit-Free forum.



## Gene drive technology for rabbit eradication

Rabbit-Free Australia provided catalytic funding to support proof-of-concept investigations into the possibility of using gene drive technology for rabbit control.

That investment enabled Stephen Frankenberg from the **University of Melbourne** to attract further funds and build a team that is now engaged on a large program of related gene drive research.

Covid-19 lock-downs in Victoria have restricted their access to laboratories, but the project is none-the-less making good progress in a highly challenging and technical endeavour.

Being involved with this work helps us understand the technology, while the project is already developing techniques that will have application in any future rabbit gene drive work.

With Stephen's help a summary of the technology and this project is **appended**.



Stephen Frankenberg, Patricia Jusuf & Clancy Lawler

## Ask me anything - I'm an expert

Twelve months ago most of our committee didn't know there was such a thing as an AMA, let alone what it was. Now we all do. It's short for Ask Me Anything - I'm an expert, and is used in online forums where people can ask questions on all sorts of topics.

Thanks to the generosity of **Brian Cooke** and **Amy Iannella** we now have two AMA's in our **Rabbit-Free Forum**, via the Members Lounge on our website. If you have a question about biological controls for rabbits or rabbit genetics, please log-in and ask away.

It's very early days for the Forum and we no doubt have much to learn on how to optimise it, but already there are some interesting discussions taking place. Anyone can see the discussions but only members are able to pose questions and comment.

Ask Brian Cooke or Amy Iannella a question @ [Rabbit-Free Forum](#).



## Rabbit R&D Update

In collaboration with **CISS**, **Rabbit-Free Australia** is planning an online update on the latest rabbit related research. Themes for the Update are rabbit bio-control and awareness raising and we plan to cover several topics:

- Environmental and economic benefits of rabbit control
- How RHDV is working and implications for RHDV-K5 releases
- Raising awareness of rabbit problems and gaining support for control programs.

## Brian Cooke – Personal profile

Foundation Patron, Brian Cooke, will be known to many Foundation members. His work has been fundamental in developing the biological controls that mean there is now a whole generation of land managers who have never seen a rabbit plague, and his understanding of rabbits is matched only by his generosity in sharing it.

Brian tells his story in the latest of our member profiles – which is **appended**. It takes us on a trip around the world including Spain, Britain, Scandinavia, Chile, the Galapagos Islands – and even Wardang Island.

A story about a young boy growing up with a fascination for the natural world, it is also a story of how two of our crucial rabbit bio-controls (myxo spreading rabbit fleas and RHD) were researched and ultimately released in Australia.

## Katherine Moseby – Rabbit Insights

Dr. Katherine Moseby gave a very well received presentation to our November, 2021 AGM.

Katherine is a respected and influential scientist (through roles with **University of NSW** and **University of Adelaide**), and a leader in practical management for conservation (as demonstrated by her co-management of a private, rabbit-free sanctuary, and her position as Principal Scientist with **Arid Recovery** at Roxby Downs).

Katherine drew on her experience and research to provide insights into rabbit management and ecological restoration.

A **summary** of her insights, covering everything from hands-on rabbit control methods to questions of prey-shifting and over-abundant native herbivores, is **appended**.

Katherine was recently interviewed by Richard Fidler on ABC Conversations and is available on-line



*Katherine Moseby was guest speaker at the AGM*

## From the kitchen to the countryside

Former chef, Aris Sertarides, became interested in **Landcare** where he encountered rabbits and learnt of the harm they cause.

Following training in rabbit control by VRAN (**Victorian Rabbit Action Network**), Aris is now venturing out into the commercial world as a contractor, providing advice and control services. Aris is specialising in the control of rabbits in sensitive environments, like peri-urban areas.

It is a great story and, thanks to Bruce Munday, is appended.



*Aris Sertarides installing rabbit-proof netting.*

## Latest News

For information, a few research reports from the Latest News feed in our website's [Member's Lounge](#).

- [Rabbits - Ecosystem engineers](#). How rabbits change entire ecosystems.
- [Rabbits - ecosystem invaders](#). Why rabbit control is a top priority.
- [Feral cats rely on rabbits](#). Why cat control should start with rabbits.
- [Unholy trinity - rabbits, cats and foxes](#). Including, can native prey be taught to be more predator wary?

## Feedback

### **Taking the AGM online?**

It's been suggested that we should video presentations at **next years AGM** and make them available **on-line** for those unable to attend. We'd love to hear your thoughts and whether you'd take up the opportunity to view it or not. Please let us know your thoughts.

### **General**

Any thoughts on this Newsletter, technical difficulties with links, things you'd like to see in future editions, or any matters to do with the Foundation - [please let us know](#).

# Chairman's Annual Report – 2020-21

## Introduction

The Foundation for Rabbit-Free Australia is an environmental charity with three mission objectives:

- Support research and researchers,
- raise awareness and understanding, and
- encourage on-ground control measures.

All three contribute to our ultimate objective - to eradicate wild rabbits from Australia. The European wild rabbit is Australia's worst vertebrate pest, being widespread and destructive to natural environments and primary production. Rabbits adversely affect over 300 threatened native species, change landscapes, and cause losses of over \$200 million a year to agricultural production.

Rabbit-Free Australia is committed to rebuilding productive and regenerating landscapes, free of their most notorious vertebrate pest (the European wild rabbit).

## Research

Any success at controlling wild rabbits in Australia has resulted from focussed and persistent research. The need for continuing, directed research comes from the reality that none of the current controls will, on their own, eliminate wild rabbits. Biological controls (myxo, RHDV) can significantly reduce the rabbit population, but in time, these controls become less effective. The search for variations in existing viruses or the discovery of new bio-controls remains vital to buy time until more innovative techniques prove successful.

A possible new technique is the deliberate introduction of limiting genes into an animal population, commonly called Gene-Drive technology. The Foundation has provided support for Dr Stephen Frankenberg of the University of Melbourne, to see if it is possible to modify a specific gene (e.g. one related to fertility) in a way that is self-propagating, thus becoming predominant throughout the population. If successful, this method could drive the population to extinction. As you would appreciate such a challenging technique will have many ethical and social questions to work through before it is applied. While the Foundation's financial contribution is modest, Dr Frankenberg has assured us that it was catalytic in winning more substantive funding from the Federal Government.

The Centre for Invasive Species Solutions (CISS) in Canberra also has an active program on Gene Drive technology, aiming to demonstrate the technical feasibility of genetic bio-control technology for rabbits.

During the last year the Foundation has become an Associate Member of CISS. We are now actively involved in the interesting and complex discussions on shaping the "Integrated Rabbit Biocontrol Program" of the Centre. The program for the next five years aims the following key outputs:

1. Optimised use of existing biocontrol tools.
2. Development of complementary rabbit control techniques, including more effective bio-control application techniques.
3. National Coordination of on-ground management action at the regional level across Australia – mainly through a "National Feral Rabbit Management Coordinator".
4. New diagnostic and monitoring tools and their application.

It is an ambitious agenda that needs to satisfy numerous diverse funders. In discussions about their strategy we have reinforced the need to strengthen national coordination of rabbit control and for suitable control measures for sensitive areas (e.g. natural vegetation and urban settings).

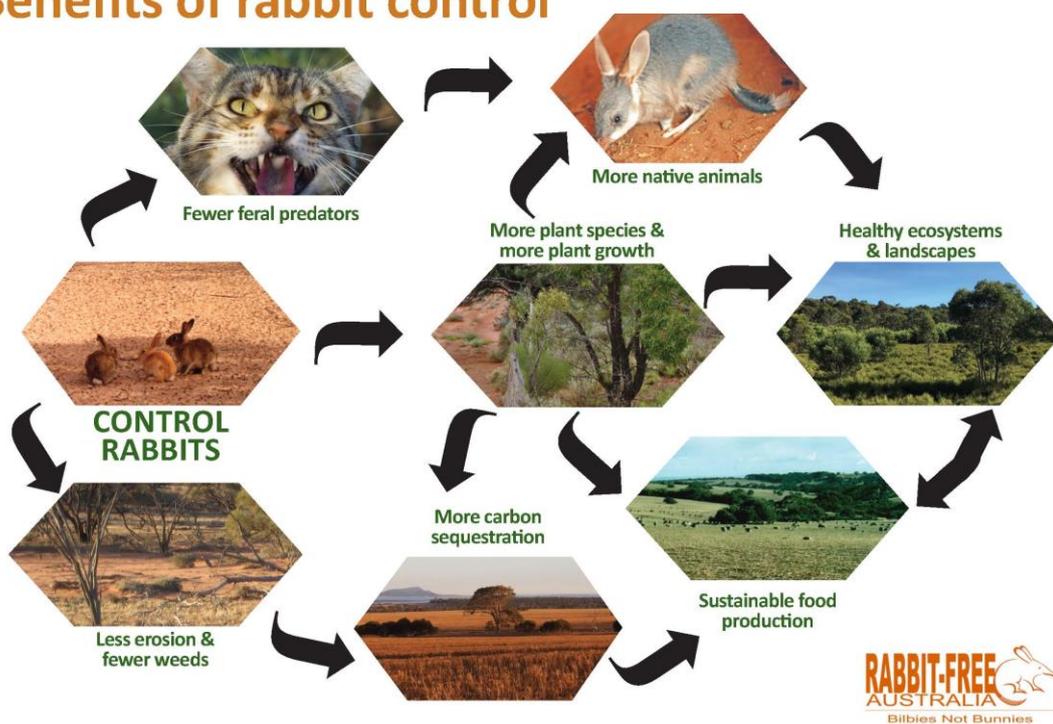
We have also promoted the need for more effective training and deployment of existing controls, and for an integrated approach to pest control; and we are pleased to now be jointly sponsoring a project with CISS to embed 'integration' into their Glovebox Guides for pest control.

Following a call for project proposals in early 2021 we have provided support to.

- Neil Ross (UNSW) for travel expenses (\$12,225) for field work to investigate rabbit impacts on ground layer vegetation. It was noted that field work is imperative but is getting more difficult in universities - this funding would be a catalyst for it.
- Katherine Moseby (UNSW), \$19,000 to compare the impacts of heatwaves on rabbits and other burrowing animals. The study at the Arid Recovery Reserve north of Roxby Downs has an enclosed area where rabbits and bilbies co-habit. Animals will be fitted with tracking collars to follow their behaviour during heat-waves in the study period, potentially giving us more insight into how climate change may affect rabbits and bilbies.

The Foundation committee, with assistance from Patron Brian Cooke and Amy Iannella, have reviewed and updated our Prospectus to encourage a wider range of potential projects to be submitted for funding in 2022. It is my pleasure to launch the 2022 Prospectus and call for project proposals. Specific suggestions for targeting particular researchers and or projects are welcome.

## Benefits of rabbit control



## Awareness

The need to continuously raise awareness and increase understanding is twofold.

First is the critical need to ensure that all land stewards (governments, owners and land users) appreciate that wild rabbits are still present and as destructive as ever. At best, we have partial control of this insidious invader and, thanks to the fantastic success of myxo, rabbit fleas and RHDV, numbers are massively less than they threatened to be.

However this success has spawned complacency – “yes, there are a few, but they’re not a problem!” Well actually they are. A few can very rapidly become a lot, especially as the effectiveness of the current bio-controls inevitably declines, and 1 rabbit per 2 hectares is enough to stop the recruitment of palatable vegetation.

Second, we need to promote Rabbit-Free Australia as a focussed organisation that can encourage and catalyse research and its applications to eliminate wild rabbits. To that end we are engaging in a ‘national conversation’ about rabbits with a wide range of organisations and individuals. Early in the ‘conversation’ it became apparent that organisations appreciate input to their conferences. Carolyn Ireland subsequently presented to the NRM in the Rangelands conference and more are planned. Unfortunately, Carol’s had to be a virtual presentation and she must be commended for mastering the skills to produce a video presentation for that purpose.

Another outcome from early consultation is to engage with CISS to plan a joint Rabbit R&D Update. We hope this occurs early next year as an on-line event.

Raising the awareness of the need for rabbit control is ongoing. It is reassuring to see that CISS has maintained a specific program of research and its application of rabbit control. This engagement at Federal Government level should not be taken for granted since this is a very crowded and competitive space. Invasive species and biosecurity threats are numerous, hence having a consistent and credible presence is important to maintaining political and hence organisational support.

It has also been extremely rewarding to see a collaboration between three Foundation members - Graeme Finlayson (Bush Heritage Australia), Pat Taggart (NSW DPI and CISS) and our Patron Brian Cooke (Uni of Canberra) - bear fruit in a very substantive way. Their paper “Recovering Australia’s arid-zone ecosystems: learning from continental-scale rabbit control experiments” published in Restoration Ecology has triggered an article in The Conversation, publicity by CISS and ourselves including social and on-line media, and traditional media interviews. Their readable and authoritative material is just what is needed to promote our case, and the Foundation was pleased to help ensure it is readily available to all.

I remain keen to improve our engagement with national conservation groups. Having Graeme Finlayson from Bush Heritage Australia on our committee has strengthened our awareness of the practical issues of rabbit control in properties managed for conservation. We have also had ongoing interaction with other private land conservation Trusts and NRM Regions Australia. Part of these interactions has been to explore the possibility of expanding the influence of our Easter Bilby trademark to increase awareness that rabbit control is critical for success in native revegetation and the re-introduction of native animals.

## On-ground Action

As noted in my report last year the Foundation is neither constituted nor equipped to do research or provide on-ground rabbit control advice or service. However, I am keen to see that the Foundation becomes a go-to organisation for quality information on rabbit control. As foreshadowed last year, a primary method to achieve this will be revamping of our web presence.

This has already involved engaging a new site provider, updating software, and reforming the content and its presentation. Executive Officer Peter, along with Committee Member Amy Iannella, and contract programmer Amy Cotton, with help from associates (including Brian Cooke, Graeme Finlayson, Kaye Kessing, Emilie Roy-Dufresne, Kat Ng and Miles Knightly) have done a mountain of work to update ‘About Rabbits’ and the ‘Members Lounge’; including a couple of informative blogs from Brian and a Forum for discussion. It is helping position the Foundation as a primary resource, and a review of the ‘Control’ pages will enhance that next year.

## Operations

### Members

The modernisation of our membership renewal and recording processes required considerable work by our Executive and Administrative Officers (Peter and Vicki) with technical leadership from Amy Iannella. Having membership administration automated lets us improve our interactions with members and reduces the administrative load. If we can grow our membership from the current base of 66 it will not add significantly to administration costs. We hope our new logo helps promote the ideals of the Foundation and make it more recognisable to potential members.

### Committee

The Foundation committee has met four times during the past year, all by electronic conferencing. While this has been efficient and necessary it does limit the personal interactions that comes with face-to-face meetings. I suspect that we will continue with the conferencing, especially if we are able to attract interstate committee members. However, we will endeavour to have at least one face-to-face meeting each year.

The upcoming AGM marks the final meeting as Committee members for Deane Crabb and Bruce Munday, both of whom have given outstanding service for many years. I thank them both and wish them well. They will be hard to replace but we are exploring some options for the future.

The Committee has also enjoyed the contributions from volunteers such as Anne Burgi who has helped with sub-editing publications and design advice, Chris Bourke for her weekly 'post-mistress' duties, and our valued, long-serving Auditor Neil Wallace of 'Wallace Vroulis Bond'. Zoos SA have also once again been very generous in making Santos Conservation Centre available for our AGM.

With assistance from Nicholas Newland, we have catalogued many archived photos this year.



Alister Haigh & Ed McAlister



Numerous associates



William Morgan

### Administration

The Foundation's administrators i.e. Peter and Vicki Day, have been very active during the year. I want to acknowledge the fabulous work that they have contributed. The updated web site, the greatly improved membership contact and renewal system, and rationalising banking and financial arrangements has made the Foundation a more professional organisation. We sincerely thank Peter and Vicki for their enormous contribution. It is also important to acknowledge the input and guidance from our Treasurer, William Morgan. I have come to admire and appreciate William's involvement with the Foundation – he continues to provide financial guidance plus detail on the origins and history of the Foundation.

### Conclusion

It is my happy duty to report that the Foundation for Rabbit-Free Australia is in a financially and administratively sound position. The Foundation is now poised to significantly raise its profile and to exert its influence to fulfil its purpose - to control and ultimately eliminate destructive wild rabbits from Australian landscapes.

## Vale Greg Mutze – a very practical ecologist

(16/02/1957 – 13/01/2022)

Gregory Mutze, born February 1957, spent his early years in country South Australia, where his father was the local doctor for the community of Saddleworth. His secondary education was completed at Immanuel Lutheran College in Adelaide and from there he went to Adelaide University.

In some ways Greg was an accidental ecologist, finding that he did well in studies on botany and ecology after he began university. At the time he was also heavily involved in sport, playing Australian Rules football for Central Districts in Adelaide. Eventually, however, he opted for a career in science rather than football. He nonetheless maintained his great fitness, cycling whenever possible and later with swimming and occasional tennis. He was a keen fisherman.

When Greg first joined the South Australian Vertebrate Pests Control Commission (subsequently the Animal and Plant Control Commission and later part of Biosecurity SA) as a fresh graduate in 1979, he was appointed as an Advisory Officer and participated in rabbit control experiments at Manunda sheep station in north-eastern South Australia. He then managed dingo control efforts along the 'dog fence' before being appointed as a Research Officer specializing in mouse control in croplands.

His work was used to design baiting trials to protect crops so that when south-eastern Australia was confronted with another huge mouse plague in 1993, Greg's recommendations saved \$20m in South Australia alone. Later, Greg was instrumental in developing zinc phosphide as the broadacre rodenticide further saving Australian farmers many hundreds of millions of dollars. Greg was deservedly recognised as the mouse expert in Australia.

Greg's listed areas of expertise on 'ResearchGate' were demography, ecology, vegetation ecology, biodiversity conservation, biological pest control and epidemiology. He had over 110 scientific publications of which 60 are refereed papers and book chapters. He published in many scientific journals and regularly gave lectures and designed practical field activities for training schools attended by local government pest control officers. These schools also formed parts of university natural resource courses.

Greg never completed his MSc at University of Adelaide due to the pressure of fieldwork in his full-time employment. This surprised many of his contemporaries who simply assumed that he had post-graduate degrees. He could ably argue a logical solution to an ecological problem as an equal with highly esteemed international ecologists such as Professor Charley Krebs, who was among Greg's many colleagues and co-authors.

Greg was a cohesive force in the Animal and Plant Control Commission research group and its subsequent iterations, and maintained lasting friendships with international scientists in his field.

His social ease extended to children. Brian Cooke relates that 'on one visit to our farm, Greg was washing his hands at a rainwater tank, watched by our two daughters, then about 5 and 8. When finished, Greg grinned and flicked his fingers in their direction spraying their faces and clothes with water. They quickly took up on the practical joke and often "did a Mutze" to each other'.

For one of those daughters, Julia, it was a lasting bond. She wrote: 'Greg was so generous to me when I was doing my Honours work on Ward's Weed and I feel lucky to have been able to coincide my trips with his - I learned so much from him, and he gave me lots of opportunities, such as driving while he counted kangaroos and rabbits in the spotlight. He always assumed I'd be competent and was interested in what I was doing - a champion of many no doubt.'

Indeed, all of Greg's work colleagues had similar anecdotes relating to Greg's support and help in carrying out their various projects. Chris Holden, who Greg helped to assess changes in predator diet after RHD heavily reduced rabbit abundance, put it most simply. 'Greg was a humble, beautiful human being; a joy to work with. I will be forever indebted to him.'

Greg's enormous knowledge of rodent biology was readily shared. When it was necessary to test rare native mice for susceptibility to infestation with Spanish rabbit fleas it was Greg's understanding of rodent ecology that provided the necessary specimens.

Greg maintained a broad interest in rabbit control and collaborated in work to reduce rabbit numbers in the Coorong National Park. Following investigations of rabbit haemorrhagic disease Greg took charge of the program to release Spanish rabbit fleas as vectors of myxomatosis and increasingly became involved in assessing the impact of the new disease after it spread from Wardang Island. This led naturally to more research into the benefits of the virus spread for native flora and fauna. Long nights counting rabbits and kangaroos in the Flinders Ranges were followed by hot days processing trapped rabbits as part of epidemiological studies or making assessments of regrowing flora.

Greg continued working on the post-RHD impact of rabbits on native plants and animals and this stands out as one of his greatest legacies because he was the first to demonstrate experimentally that, even at very low densities (less than a rabbit/hectare), rabbits have a large impact on native ecosystems. Greg communicated his findings widely in research reviews and at conferences. When his findings on rabbit damage were not readily acknowledged, and rangelands ecologists continued to look elsewhere to explain the lack of regeneration, Greg, undaunted, published a paper entitled 'Barking up the wrong tree' – a play on words alluding to the rabbits' impact in ringbarking and killing young shrubs and trees.

Just a month short of his 65<sup>th</sup> birthday, a consistent picture of Greg enthusiastically sharing his knowledge shows through in heartfelt comments from many of his contemporaries – from new students to internationally recognized academics and his friends and neighbours. He was an important scientist who made significant contributions to South Australia's rural economy and the preservation of natural flora and fauna, but most importantly he influenced many others to follow his lead.

Prepared by Brian Cooke, Ron Sinclair, David Peacock, Peter Bird and Bruce Munday



*Greg presenting at an early Rabbit-Free function.*

## Gene drive technology and the eradication of invasive rabbits.

### Gene drive technology

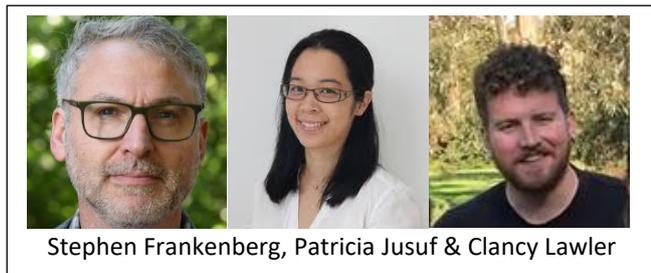
Gene drive technology is the insertion of a gene into the genetic fabric of an organism to promote the transmission of that gene, and the inheritance of a specific trait, to offspring. CRISPR (short for ‘clustered regularly interspaced short palindromic repeats’) is a commonly used technique whereby DNA is cut at a specific location within the genome and a new gene (the ‘driven gene’) is inserted during the process of repairing the DNA at the breakpoint.

CRISPR has several elements. Firstly, it locates the target sequence of DNA (using guide RNA – gRNA – a chemical messenger controlling the production of proteins). Then it cuts the DNA (using a CRISPR assisting enzyme, often Cas9). A DNA template (a string of DNA that partially matches the DNA either side of the cut site, but also includes the new gene to be inserted) is then provided as a patch to repair the cut DNA. The process is modelled on how bacteria respond to infection by a virus. It is referred to as a targeted genetic knock-in.

Zebrafish are commonly used in CRISPR and medical research. They have similar genetics and physiology to mammals, are amenable to genetic manipulation, and reproduce easily with large numbers of progeny and a fast reproduction cycle, making them ideal for laboratory studies.

### Rabbit-Free project update

A team of researchers at the University of Melbourne, led by Dr Stephen Frankenberg and including collaborator Dr Patricia Jusuf and PhD student Mr Clancy Lawler, is exploring the application of gene drive technology for rabbit control, with support from Rabbit-Free Australia.



The project has had a difficult start with restricted access to laboratories due to Covid-19 shutdowns, but it has benefitted from the University attracting other gene drive work, making the rabbit project part of a much bigger program. The Rabbit-Free Australia project was a catalyst for much of that investment.

Working with zebrafish, the researchers have been able to knock-in a DNA template to the gene responsible for production of aromatase – an enzyme necessary for estrogen production.

The first step was to insert a specific DNA fragment into the aromatase gene that will allow additional, much larger fragments to be inserted later with much higher efficiency. This initial fragment included a gene that causes fluorescence, allowing fish with the successful insertion to be readily identified. Since the insertion is heritable, it can be transmitted to subsequent generations.



This will provide both a proof-of-principle for the disruption of estrogen production as a potential strategy for pest control – since all offspring will develop as males – as well as a valuable resource for optimising the design of efficient gene drives.

Further work is now underway to develop another line of gene-edited zebrafish, enabling cross-breeding with the aromatase line in subsequent trials to optimise gene drive design.

Concurrently, working with tissue from a wild-shot rabbit, the team have established a line of fibroblast cells – cells that are important in connective tissue maintenance (e.g. the skin) and the production of collagen (a protein associated with tissue elasticity and structure). That cell line is being used to derive a line of induced pluripotency stem cells (iPSC), which are equivalent to embryonic stem cells. A rabbit iPSC line could, theoretically, then be used to produce gene-edited rabbit embryos. That final step is not part of this project at present, but it may be possible to target a gene responsible for female fertility as a subsequent initiative.

In collaboration with CSIRO, the university will also undertake genetic sequencing of the male wild rabbit cell line. The current publicly available genome sequence for rabbits is female. Being able to access the male genome could lead to the development of rabbits that produce only male progeny.

This is ground-breaking research. The project funded by Rabbit-Free Australia is largely proof-of-concept and the honing of techniques for broader application in rabbit gene drive programs. It is looking very promising and will be an extraordinary contribution to broader assessments of the best ways to apply gene drive technologies for the control of European wild rabbits in Australia.

## **Foundation Patron - Associate Professor Brian Cooke BSc MSc PhD OAM**

### **Myxomatosis**

I first saw a rabbit affected by myxomatosis in 1951 when visiting a local farm as a seven-year-old. That was just a year after the myxoma virus spread from CSIRO field trials in the New South Wales Riverina. Asking my parents what was wrong with the rabbit, they explained that it was a disease deliberately introduced to get rid of them. Living in West Geelong, only 40 kilometres from Barwon Park where Thomas Austin released the first imported wild rabbits, I already knew something about the pests that had proved so disastrous for Australia's pastoral industries, agriculture, and ecological diversity.

As with most Australians at the time, I was probably more familiar with the idea of biological control and its effectiveness than many Australians are today. Rabbit was only occasionally included on the home menu after myxomatosis spread, although my older sister recalls eating rabbit more frequently in the immediate aftermath of World War II.

I was always intrigued by the natural world, and throughout my primary and secondary school years, I was always collecting insects, frogs, and lizards in the bush. This led me naturally to a BSc at Melbourne University, majoring in biology and zoology.

On graduating I applied for post-graduate research at the then new Monash University with Tim Ealy and Professor Jock Marshall as supervisors. Marshall had just published *The Great Extermination. A guide to Anglo-Australian Cupidity, Wickedness and Waste*, one of the first books to discuss the loss of many of Australia's unique native mammals and which made a great impression on his earnest students. Nonetheless, I finally settled for a job in Adelaide with the Vermin Control Branch of the Department of Lands. Things were different in those days and at only 22 years I had a good operating budget, a large laboratory and two field assistants to help me work out the best ways of managing the rabbits that were becoming increasingly resistant to myxomatosis.

The Chief of the Vermin Control Branch, John Bromell, organized for me to spend three months in Canberra at CSIRO's Division of Wildlife Research. There in 1966 I met with many of the researchers who had been involved with the original release and assessment of myxomatosis: Francis Ratcliffe, Ken Myers, Bill Poole and Bernard (Bunny) Fennessy as well as newer members of the 'rabbit group' including Peter Fullagar, Jon Dunsmore, Bruce Parker, and Ian Parer. I visited many of the rabbit study sites Ken Myers had set up, in localities as varied as the Snowy Mountains, Mitchell in sub-tropical Queensland and Calindary in arid western New South Wales. That 'did the trick' and I realized that I could make a significant contribution to both the farming industry and wildlife conservation by finding new ways to control rabbits.

Returning to Adelaide, I not only assessed the effectiveness of the different ways of controlling rabbits (poisoning, warren destruction, fumigation) but also set up study sites in several areas of South Australia ranging from the cool, temperate south-east to the hot, dry inland. Studying the roles of climatic variables gave us insights into the best strategies for controlling rabbits. For example, strategic control during the summer should be more effective because rabbits were fewer in number and short of high-quality food making them more likely to take poisoned baits. Ripping up rabbit warrens in summer made more sense too. Warrens collapsed more readily if the soil was dry, and rabbits deprived of deep cool warrens were less able to survive summer heat and predators.

Some of my experimental sites also became key localities when I took up further academic studies at the Adelaide University. I completed an external MSc in 1970 and subsequently took three years leave to complete a PhD, both degrees centred on rabbit biology.

Pam and I married during my time as a PhD student and after my thesis was submitted we travelled overseas, first to a conference in Moscow (behind the 'iron curtain') and then visiting several pest control laboratories in Britain and Scandinavia.

### Rabbit fleas

Later, my South Australian study sites proved invaluable when I joined forces with CSIRO's Bill Sobey to assess European rabbit fleas, *Spilopsyllus cuniculi*, as vectors of myxomatosis. There we collected data on rabbit breeding and population dynamics over several years before and after fleas were released, showing that the fleas made an enormous difference to the spread of myxomatosis and enhanced its effectiveness. However, a critical result was that European rabbit fleas could not persist in arid inland Australia. This in turn led to the idea that 'arid-adapted' fleas might be found on rabbits in Spain and these might be used as alternative myxoma virus vectors in dry areas.

I spent two years in Spain in the late 1980s, based in Seville, and investigating several species of fleas as potential 'arid-adapted' vectors of myxomatosis. Pam and our two daughters, Natalie and Julia, accompanied me for part of that time. Dr Ramon Soriguer of the Spanish Consejo Superior de Investigaciones Cientificas (CSIC) generously provided laboratory space and field support. I selected an arid-adapted flea (*Xenopsylla cunicularis*) living only on rabbits as the most suitable vector. On importation into Australia, it became known as the 'Spanish rabbit flea' to distinguish it from the European rabbit flea introduced earlier by Bill Sobey.

### RHDV

During my studies on rabbit fleas in arid south-eastern Spain in late 1988, highly lethal rabbit haemorrhagic disease (RHD) suddenly appeared in the wild rabbit population. The causative virus is now thought to have evolved from closely related non-pathogenic viruses in rabbits and it severely disrupted plans for assessing and releasing Spanish rabbit fleas. Nonetheless, as it was specific to rabbits, I quickly realized its potential as a new biological control agent and strongly campaigned for its assessment and eventual release among Australian rabbits.

Further investigations of the epidemiology of RHD in Spain followed. I worked with Dr Luis Leon-Vizcaino of the University of Murcia Veterinary School to understand how this new rabbit disease spread, while also supervising necessary on-going work on the Spanish rabbit fleas, maintained in a quarantine insectary in Adelaide. Apart from the challenge of safely importing disease-free rabbit fleas, we had also to demonstrate that the fleas would parasitize only rabbits. Much of this work was ably carried out by Faerlie Bartholomaeus. After approval the fleas were widely released in the early 1990s enabling me to transfer to CSIRO in Canberra in 1995 to take part in the field assessment of RHD.

During the final stages of the program to introduce Spanish rabbit fleas, the RHD virus was carefully assessed under strict quarantine at the Australian Animal Health Laboratory in Geelong and again shown to cause disease only in rabbits. All other domestic animals and native species remained healthy and uninfected following experimental challenge. Although officially working at CSIRO in Canberra, I spent most of the following year on Wardang Island off the coast of South Australia assessing the ability of the virus to spread in the field. There would be little point in releasing it widely unless it spread naturally from rabbit to rabbit.

Nicholas Newland led the 'Rabbit Calicivirus Program' and resolved many of the critical problems associated with working on an island. For example, he arranged for the local Aboriginal Community at Point Pearce to equip large pontoons so that vehicles and fencing materials could be towed to the island by local fishing boats. William Morgan, the inaugural Executive Officer of RFA, was one of two pilots who regularly ferried food supplies to the team working on the island. There was ready

collaboration and voluntary assistance between State and Federal government employees, funding bodies including Meat and Livestock Australia, the Point Pearce Aboriginal Community, and the then fledgling Anti-Rabbit Research Foundation, later to become Rabbit Free Australia.

First experiments during the winter months to assess the spread of RHD showed mixed results. Sometimes the virus spread among the rabbits but on other occasions it failed to spread beyond those rabbits that were initially inoculated. But in the spring this pattern changed. The virus spread between separate pens where rabbits were held, then appeared outside the main double-fenced quarantine enclosure and finally reached the mainland three kilometres away. In retrospect, it seems clear that the virus was carried by carrion-feeding blow flies that fed on dead rabbits and subsequently spread the virus well beyond the experimental sites. Nonetheless, the escape of the virus was a constant topic on national news for some weeks and had major political consequences, even though the rapid spread of the virus and the high mortality of rabbits showed that it was going to be a highly effective means of controlling rabbits.

Over the following seven years, epidemiological studies continued. For example, Dr Tony Robinson in CSIRO not only quantified important relationships between rabbit age and disease susceptibility but also helped to build a close collaboration with Italian researcher Dr Lorenzo Capucci whose methods of assaying antibodies in rabbit blood samples revolutionized our understanding of RHD. This led to the hypothesis that in some areas of Australia a naturally circulating, non-pathogenic RHD-like virus might be immunizing rabbits against RHD and so reducing the effectiveness of this new biological control agent.

Importantly, Dr Tanja Strive in CSIRO was able to isolate this virus and show that infection with it lessened the chance of rabbits developing acute RHD. Along with Dr June Liu they showed that the distribution of this non-pathogenic virus across the Australian continent corresponded with areas where RHD had reduced potency as a biological control agent.

I had always imagined that, if I found a way to enhance rabbit control in Australia, it would mean that funding would naturally flow for further work on rabbit management. This was far from reality, however. The release of RHDV occurred at a time when Australia's wool industry was in serious trouble. Competition with synthetic fibres and ill-founded attempts to maintain wool prices through a Wool Deficiency Payments Scheme followed by a Minimum Reserve Price Scheme had not worked. Australian Wool Innovation, and later Meat and Livestock Australia, had been the major funders of rabbit control research but now had limited capacity to support research. Without industry funding, CSIRO's Division of Wildlife and Ecology was in financial trouble and unable to support people like me who had been recently recruited for specific programs.

I saw the writing on the wall and resigned from CSIRO. Some of my colleagues who remained were badly hurt when the Division of Wildlife and Ecology was disbanded. Having obtained the status of a full Division in the heady days after myxomatosis was released, and wool prices were high, the Division's demise was just as clearly associated with the collapse of industry support.

Fortunately, my time in Spain had given me language skills that I turned to advantage. I took up a position at the Charles Darwin Research Station in the Galapagos Islands. Pam and I spent two years there. I worked at the Station, again developing ways of eradicating introduced pest species, while Pam volunteered at the local pre-school in Puerto Ayora and as a sonographer at the local hospital. It was an adventurous time, and after we left the islands we travelled extensively in South America for several months, including time in central Chile with local pest controllers working to solve problems caused by introduced European rabbits.

When we returned to Canberra, it was apparent that Australian Wool Innovation were concerned that rabbits were increasing once again, just as they had after the initial highly effective outbreaks of myxomatosis in the late 1950s. I was subsequently employed to rejuvenate interest in rabbit control among state agencies and I became a Research Associate at the University of Canberra within the Institute for Applied Ecology.

This gave me an opportunity for new research and time to write up results from research that had not been published or had taken on a new perspective in the light of later publications. Freed from work at the laboratory bench, I have written or co-authored over 40 scientific papers on different aspects of rabbit control while associated with the University. Some of these resulted from continuing work with colleagues in BiosecuritySA, including epidemiological studies on RHD and our efforts to determine the impact of rabbits on arid-zone vegetation.

I was also able to spend more time with Professor Frank Fenner who had been involved in the original research on myxomatosis. Frank was a former Patron of RFA, and even before my sojourn in the Galapagos Islands we had regularly met at the Australian National University and collaborated in several ways. We had been co-authors on a scientific paper on RHD published in *Wildlife Research* and I provided information on the field trials on RHD for Frank to summarize in a book entitled 'Biological control of vertebrate pests' that he co-authored with Bernadino Fantini a Swiss medical historian.

After Frank Fenner passed away in 2010, aged 95, I was approached by Nicholas Newland who asked if I would become Patron of RFA. It took me a while to decide to accept especially because previous patrons had been the Governor General of Australia, the Honourable Bill Hayden and of course Professor Fenner who I had seen as my mentor and a great role model. In the end, however, I was happy to accept, and it has proved a very productive partnership.



Dr Ramon Soriguer (left) from the Spanish CSIC and game guard Antonio Gil (centre) with author (right) in Almeria, Spain, collecting rabbit fleas from recently shot rabbits. The photo was taken in 1988 when RHDV was first recorded in the province (Photo: Ernesto Garcia Marquez).

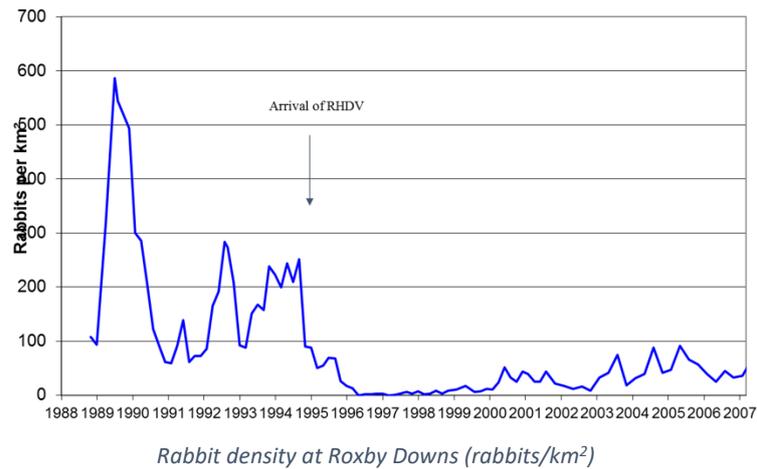
Brian Cooke, 2022  
Edited by Bruce Munday

# Insights into rabbit management and ecosystem recovery.

## Rabbits in the rangelands

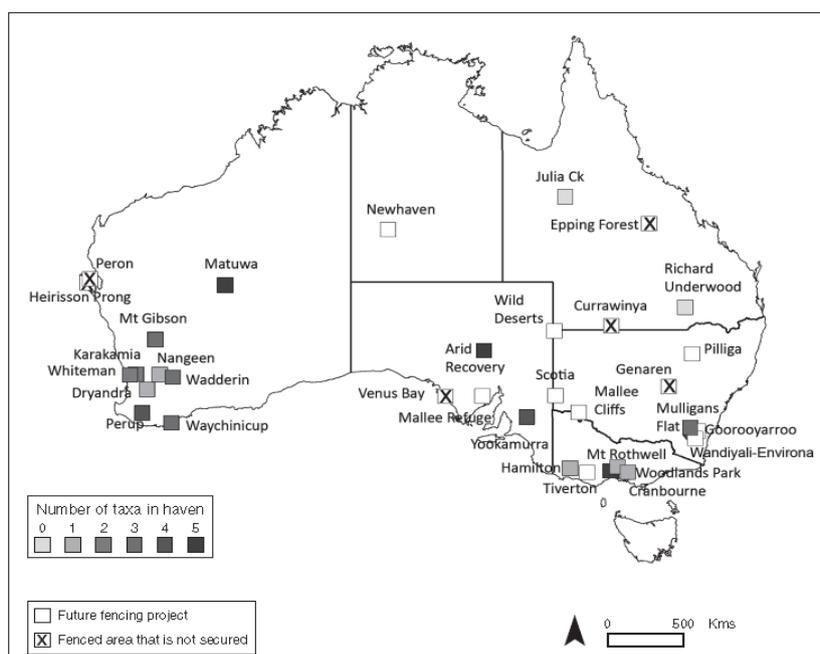
This paper focuses on work conducted in the 70% of Australia classed as arid or semi-arid, where rabbits have a fundamental impact on ecosystems and environmental health. It draws on research and practical management experience from the Arid Recovery reserve.

In the 1990s rabbit densities around the Arid Recovery site at Roxby Downs reached as high as 600 rabbits/sq km, following good rains. The arrival of calicivirus was a spectacular success with rabbit numbers dropping dramatically and staying low for years to follow. That massive reduction in rabbit populations provided a rare opportunity to restore natural environments.



## Rabbit-free recovery

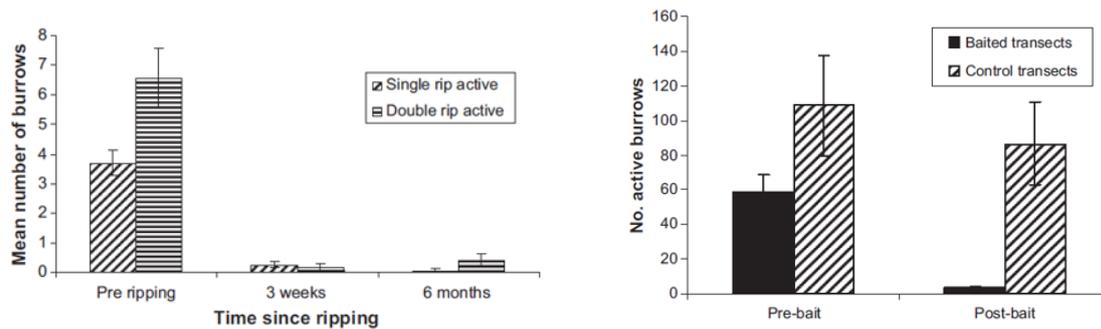
Fenced conservation reserves are now becoming more common around Australia, but many are not rabbit-free – and that is a risk for them. Only Arid Recovery (6,000 ha), Wild Deserts (4,000 ha in Sturt National Park, NSW), Mallee Refuge (900 ha at Secret Rocks) and the Koonamore vegetation reserve are rabbit-free. Rabbit control is part of the solution for ecological restoration. It sets areas for the reintroduction of a wide range of native species that were displaced, at least in part, by rabbits.



Fenced conservation reserves in Australia (after Legge et al. 2018)

Becoming rabbit-free at Arid Recovery took 18-24 months per area and involved a lot of learning, including:

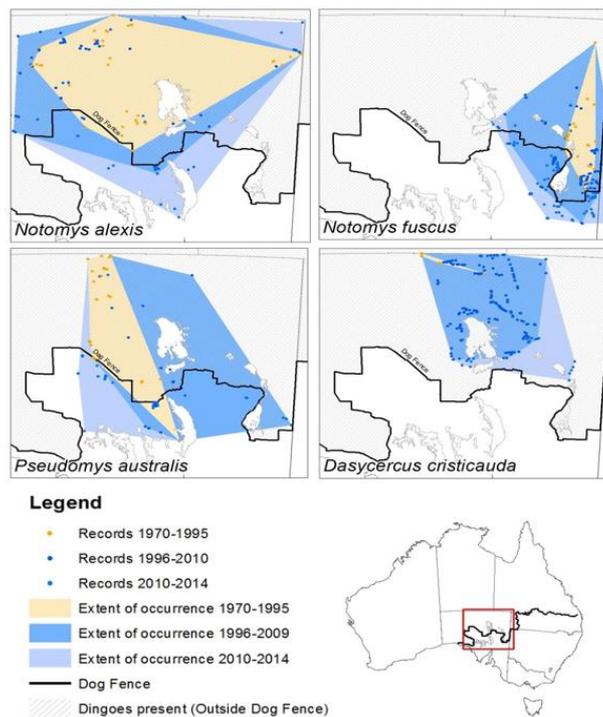
- Monitoring warrens, buck-heaps and animal tracks help to quantify rabbit numbers and distribution.
- 30mm, not 40mm, wire netting is needed to exclude young rabbits, and fence maintenance is an ongoing problem.
- Eradication is easier in sandy habitats and much harder in stony country.
- Ripping was the most effective control option, phosphine tablets proved the most successful fumigant (with dogs herding rabbits into treated burrows), and 1080 poison trails were useful.



The benefits of ripping warrens and 1080 bait trails. (Read et al. 2011)

Vegetation benefited following rabbit control paving the way for ecosystem recovery and the reintroduction of native mammals. Feral predators (cats and foxes) also became less common once their favourite food (rabbits) became scarce.

A similar story unfolded following the advent of calicivirus outside of reserves, evidenced by threatened species of native rodents dramatically increasing their distribution in the following 20 years. Their numbers still surge and fall in line with seasonal conditions but they are continuing to spread (being seen in NSW for the first time in 100yrs), due to there being fewer rabbits, more vegetation, and lower populations of feral cats and foxes.



Expansion of threatened species of native rodents following calicivirus (Pedler et al. 2016)

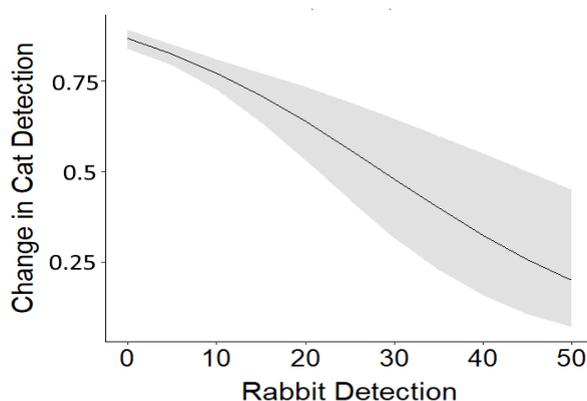
Digging by native herbivores is also better for seedling regeneration than that by rabbits. Bilbies and bettongs produce twice the number of foraging pits and those pits contain 80% more seedlings than rabbit digs.

### Ecological flow-ons

It wasn't all plain sailing once rabbits and feral predators were controlled, and native species were re-introduced to the Arid Recovery reserve. Over-abundant native macropods - especially bettongs that ate out ruby saltbush (*Enchylena tomentosa*) – were one problem to arise. Quolls were subsequently introduced as a natural predator to restore the balance.

In a separate exercise, western quolls were also reintroduced to the Flinders Ranges as a native predator for rabbits, but a third were lost to predation by feral cats. Controlling rabbits is part of the job when controlling cats, but there are several inter-relationships to be understood and managed. Research has shown that:

- Rabbits are common prey for cats and quolls. While cats eat rabbits all the time (and are dependent on them), quolls only take rabbits when there are lots about. Quolls are not spatially associated with rabbits, but cats are. Aerial baiting for cats works best when there is low rabbit abundance.



*Aerial baiting for cats is most cost effective where rabbits are in low numbers (Moseby et al. 2021)*

- Quolls shelter in rabbit warrens, as do cats, however quolls (being smaller and more agile) have other shelter and feeding options, so warren ripping is still a valid control option. Rabbit control is expected to give a net benefit to quolls and other native wildlife.
- Prey-switching was another early concern from rabbit eradication. However, only one event has been documented in Australia and Arid Recovery trials show that 40% of cats died after rabbits were reduced by 80%. Individual cats may prey-switch (mainly to reptiles, birds and invertebrates) but there was no change in the proportion of cats consuming small mammals and the overall level of predation was much reduced, so net environmental benefits outweighed short term impacts.

### Rebounding rabbits

Rabbit control is rarely fully completed. Monitoring and vigilance are essential to ensure rabbits do not rebound. Their resilience seems linked to two factors:

- Rabbits recover after drought much better than do native animals. They have higher reproductive rates, giving them a head-start from which they dominate early recovery landscapes.
- Rabbits are more wary of cats and foxes compared to native mammals like bettongs, and they are much harder to catch.



Bettong. Maximum 3 litters/yr.  
Ave 1 young/litter.



Bilby. Maximum 4 litters/yr.  
Ave 1.5 young/litter.



Rabbit. Max 8 litters/yr.  
Ave 6 young/litter.

In the future, extreme heat and climate change might work against rabbits. With assistance from Rabbit-Free Australia, research is now underway at Arid Recovery to see if a hotter climate may affect rabbits and native burrowing animals differently. More extreme heat, including night-time (foraging time) temperature, could affect animal survival and breeding success. Observations suggest that rabbits are active on very hot days panting and salivating, possibly due to humidity in warrens. The research will record temperatures and humidity in warrens and on the surface, as well as the activities of rabbits, bilbies and bettongs.

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Katherine Moseby, 2022

## From Kitchen to countryside – the journey of Aris Sertarides

In 1788 the First Fleet arrived at Botany Bay, carrying 5 rabbits in its cargo. Raised in cages, rabbits were an integral part of the domestic food markets in Sydney and Melbourne. These markets were transformed in the mid-nineteenth century when wild rabbits became established – and the rest is history.

For all the damage rabbits have done to this country, they also provided good tucker to many Australians for about ninety years until the successful introduction of myxo. There was of course always a tension between farmers who wanted to be rid of every last rabbit and the trappers who wanted to sustain the breeding population – in other words, to farm the rabbits. Whatever the ambition, over nine decades there was plenty of opportunity to develop and test rabbit recipes.

What has this to do with Aris Sertarides? Well, Aris was 15 years a chef in Geelong with ample opportunities to explore and value *la cuisine délicieuses de lapin*. But fate intruded when Aris took a course in land management to find that his real passion was local flora and fauna. This led him to the [Bellarine Landcare Group](#) with its active interest in revegetation and natural regeneration. Inevitably these ambitions are thwarted by rabbits unless there is a large investment in tree guards or netting fences – the Bellarine is after all just downstream from Winchelsea where Thomas Austin gave Australia it's infamous Christmas gift in 1859.



It was not that long ago that the Bellarine Peninsular was open grazing land behind a scattering of coastal villages. Today it is boutique wineries, craft breweries, B&B, farm gate, and hobby farms often occupied only on weekends. Rabbits are of course a regional problem and control is particularly difficult as so many landholders have to be involved. While the individual properties might be relatively small, there are lots of them.

In 2020 Aris took part in the [Victorian Rabbit Action Network](#) (VRAN) rabbit control boot camp, subsequently joining the Bellarine Rabbit Action Group ('the Rabbiter's'). This is a sub-group of the Bellarine Landcare Group, which takes an active role in organising rabbit control field days, webinars, and other educational events, and supports landholders with advice and some working bees on rabbit control.

Aris now works with the Bellarine rural community using the VRAN principles to 'provide the tools and networks to enable community, industry and government to implement best practice management in the control feral rabbits'. VRAN run training and mentoring programs, deliver workshops on best-practice rabbit control, and support people and organisations to collaborate on rabbit action. A key aim of the course is for participants to become a local 'go to' person on rabbit management'. Aris is one of those.

The nature of the Bellarine, with its large number of small properties, poses its own unique problems. Biological control (e.g. Calicivirus) can impact rabbits on a regional scale, but in most instances a fifty percent 'strike rate' is about as much as one can expect. Netting boundary fences can isolate the problem to individual properties, but this is a costly prospect that also restricts the migration of other small animals. VRAN strongly advocates networking where members get together to exchange ideas, share challenges, seek feedback on programs and provide a deeper understanding of how complex rabbit management can be.

A key to Aris's work is the Bellarine Landcare Group through which he can use an already established network to educate and inform landholders. This can involve individuals or small groups, using successful case studies as role models. To date the main tactics have involved mapping, ripping and fumigating warrens, along with netting fences to protect high value crops.

The Landcare Group has developed an [affordable smoking kit](#) that members can purchase and has subsidised landholders to undertake training for an Agricultural Chemical User Permit (ACUP). Whilst Aris then provides the advice on fumigation, the responsibility still rests with the landholder.

To date there has been limited success with RHDV (calicivirus), but Aris is now providing education on the safe use of Pindone through pamphlets, webinars and workshops as part of an integrated best practice rabbit control program.



*Rabbit-proof fencing can be an option in peri-urban areas.*

Compiled by Bruce Munday, 2022