Final Report on IACRC Project **7.T.8e**

Rabbit Resurgence: Minimizing Future Economic and Biodiversity Losses

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Background

This project was initiated because rabbits are increasing in abundance once again following a decade of more when they were held low by Rabbit Haemorrhagic Disease Virus (RHDV). As the 'mallee' areas of adjoining New South Wales, Victoria and South Australia are among areas most affected by this resurgence it was important to take action in this area to understand and if possible avert the growing problem. Demonstrations of effective ways of combating rabbits would not only enable land managers to be better prepared to handle problems in the mallee but would also provide advance information for managers in adjoining areas where rabbits could increase in the future.

It was assumed that in the short term it will be necessary to rely almost entirely on well-tested rabbit control methods such as poisoning, warren ripping and fumigation to prevent widespread resurgence of rabbits. There is no immediate capacity to improve biological control even though investigations are underway in a project called 'RHD-Boost' to re-invigorate the effective of this disease agent. At best it will be 2 – 3 years before we know if the effectiveness of RHD can be enhanced.

Even so, encouraging the re-implementation of chemical and mechanical rabbit control is no simple task. There are two major problems. On the one hand there had been major skill-loss due to generational change and the lack of continued practical rabbit control experience while rabbits were kept low. On the other hand higher standards of rabbit control are now needed compared with those generally accepted before Rabbit Haemorrhagic Disease (RHD) was introduced. The increased standard of control arises because there is now a greater expectation that rabbit control is not just important for protecting agricultural production but also essential for the conservation of native vegetation. Most regional government authorities have clear policies for retaining and adequately maintaining roadside vegetation for instance.

One of the major outcomes from the release of RHDV in Australia was a massive, though often unrecognized, recruitment of seedlings of native trees and shrubs. This occurred widely in pastoral lands, national parks and even on roadsides. It was also recognized that such recruitment had only been possible because rabbits had been held below a critical density of about 0.5 rabbits/ha for several years. Obviously, it takes very few rabbits to completely inhibit the regeneration of the more palatable species of native trees and shrubs.

In short, this meant that despite growing land-management expectations to maintain sustainable ecosystems, as far as management of rabbits was concerned there was a greatly increased gap between objectives and capabilities. In many instances land

managers had difficulty in recognizing that rabbits were inhibiting plant regeneration let alone take effective action to avert the problem.

To look more closely at these matters, three practical rabbit control projects were planned involving participants from the three adjoining states. By setting up demonstration sites a framework and recommendations for rabbit control could be developed in each chosen situation and detailed information on control costs could also be collated to enable cost-efficiency of treatments to be considered. These same sites were also to be used in assessing newly developing ideas in rabbit control such as NRMB proposals and incentives for involving land holders in rabbit control and an economic decision model being developed for managing rabbits among native roadside vegetation.

Finally, the demonstration sites were to be used for field days where practical rabbit control methods could be demonstrated to local land managers as well as being used in more detail during special training courses in rabbit control for land managers.

Participants

In the final project key participants included: Peter Sandell, Environment Program Manager (Mallee), Parks Victoria; Steve McPhee, Research Contractor, Department of Primary Industries, Victoria; Peter Michelmore, Operations Manager South Australian Murray Darling Basin Natural Resources Management Board; Paul Gillen, Operations Team Leader - Mallee & Coorong, South Australian Murray-Darling Basin Natural Resources Management Board and John Price, Senior Pest Control Officer, South Australian Murray-Darling Basin Natural Resources Management Board.

Despite considerable investment to set up a demonstration project in south-western NSW, administrative and operational delays meant that work could not be completed in a timely way and was discontinued because it could no longer be seen as demonstrating ‘best practice’ rabbit control.

Demonstration sites and activities

Smithville near Lameroo in South Australia

This site, typical of rabbit problem areas in ‘mallee’ cereal growing regions involved control of a severe road-side rabbit infestation. Rabbits burrowed in steep sand banks covered in dense mallee vegetation but grazed on crops and pasture in adjacent farmlands.

As the SAMDB NRM already had well-established policies and methods for dealing with this situation, the exercise was used to evaluate the effectiveness of rabbit control treatments, gather data on up-to-date on costs of control and finally to validate an economic decision model (Cooke, Jones and Gong submitted) as a tool for improving future rabbit control.

Local farmers poisoned rabbits using recommended procedures including adequate free-feeding with un-poisoned oats before 1080 oats were laid. A local contractor with a small Bob-cat tracked back-hoe then ripped warrens, minimizing damage to live trees before any missed or reopened warrens were fumigated using Phostoxin® fumigation tablets.

SAMDBNRM officers were directly involved in warren mapping, collecting in assessing effectiveness of treatments (reduction in active warren entrances, spotlight counts) and collecting and compilation of information on operational costs. They also organized and ran a successful field day on the site (see later) as well as attending and contributing to the field day, workshop and training school held as part of the Victorian demonstration project.

Hattah-Kulkyne National Park

The project in Hattah-Kulkyne National Park essentially involved rabbit control methods of poisoning, warren ripping and fumigation as might be carried out to control rabbits on pastoral land and open farmland. However, these were applied more carefully to minimize risk to other park wildlife (e.g. oats for poison trails is laid late in the day to reduce the amount eaten by birds) and more time was spent in tidying up poison trails and ripped warrens so that aesthetic values of the park were maintained.

Apart from gathering up-to-date information on control costs, the demonstration site was set out in a series of 12 replicated experimental plots to ask a specific question: To cost-effectively reduce rabbits below the critical level of 0.5 rabbits/hectare is poisoning a necessary first step? Ripping and fumigation had previously been widely used in the Park but their inability to keep resurgent rabbits down clearly meant it was time to explore additional options. Money allocated for rabbit control in the Park had risen from $26,000 in 2002 to over $250,000 by 2008 yet rabbits continued to increase.

The visitor centre in the Park was also the venue for a field day to demonstrate rabbit control benefits to local land-holders and other land managers and subsequently for a training school over two days for regional Parks Victoria, DPI and DSE staff. This involved lectures, practical demonstrations of poisoning and fumigation equipment and a practical session to evaluate the effectiveness of fumigation.

Other activities

When the demonstration site in NSW was discontinued, agreement was obtained from the APAMP Project Coordinator, Dr Jeanine Baker, to divert remaining funds into gathering additional information of immediate relevance to rabbit control. A workshop on rabbit warren ripping was convened in Mildura given the central importance of ripping in both on-going demonstration projects. It was held just prior to the training school at Hattah-Kulkyne with the advantage that some workshop participants were also able to give talks at the training school and in turn were able to view practical demonstrations prepared for school participants.

Interactions with project participants and people attending field days and the training school also provided ample opportunity for discussing other issues associated with rabbit control projects. These discussions often highlighted the lack of perception of rabbit problems, the need for extra training and barriers to implementation of effective control because of apparently conflicting government policies.

Outcomes from the Smithville demonstration project

Rabbit control costs

The Smithville project was used to up-date current costs of rabbit control and to verify that rabbit control costs used in the economic decision model were valid. Understandably, when parameters to be used in the model were first considered it was hard to obtain recent estimates because few attempts had been made to collate control costs over the previous decade.

Poisoning of rabbits at Smithville was cheaper than estimated for our economic model, $36/ha compared with $52/ha, largely because poison was laid only in paddocks adjacent to the roadside and not alongside the road as normally recommended. This was done to meet the request of a land-holder who wanted to move sheep along the roadside during the time poisoning was to be carried out. This almost certainly reduced the effectiveness of poisoning which, according to warren activity assessment, lowered rabbit numbers by only 80%. Even spotlight counts, normally more reliable indicators of the impact of poisoning, indicated a reduction of only 90% rather than the 95% usually achieved.

Warren ripping costs during the project averaged $69.64/ha (range $35.17 – $117.36/ha on selected sites). This is higher than the estimate used in the economic model ($40/ha) but the cost reflects the degree of difficulty where steep sand drifts on roadside made accessibility difficult even for a back-hoe (Figure 1). Nonetheless, the cost initially used in our economic decision model falls within the range recorded and can be retained as a general value for ripping amongst trees on flat or level ground.

Figure 1. Demonstration of back-hoe at Smithville road field day. Steep sand-ridges and low vegetation make access to warrens difficult. A smaller Bobcat back-hoe was used in the main demonstration trial.

Fumigation costs as calculated for the roadside were $56/ha of which about $40/ha were spent in searching for reopened warrens. This figure is very similar to the estimate used in the economic model which included $40/ha in annual search (inspection) costs and $18/ha spent in materials and fumigation time.

Effectiveness of control

Poisoning, warren ripping and fumigation were effective in combination leading to a 96% reduction in total warren entrances/ha. The current costs of doing so amount to about $120/ha of roadside although in this instance a more thorough poisoning would have achieved a higher initial level of rabbit control, enhanced the results from warren ripping and required less reliance on follow up fumigation to reduce rabbits to very low numbers.

This level of control is adequate to protect crops sown in adjacent paddocks, nonetheless, if actively used warren entrances are considered, this initial treatment only took rabbits from an estimated 10 rabbits/ha to about 1 rabbit/ha which is a reasonable result but still not completely successful in terms of the 0.5 rabbits/ha limit needed for regeneration of palatable native plant species.

Economic decision model verification

The results obtained at Smithville were at the higher end of expectations based on our modelling of the combined treatment of poisoning, ripping and fumigation. However, because of the high number of rabbits initially present on the site, we did not reduce rabbits below the critical level (1 rabbit/ha) where it becomes more economical to switch to a cheaper strategy of ‘rip and fumigate’. Importantly, field practitioners also felt that further work would be required to get rabbits down to levels where there could be some

confidence of maintaining them low with minimum effort. This also subtly strengthens the view that the economic decision model produces meaningful practical outcomes.

The Smithville project also provided important information for future up-grading and further developing the economic decision model. Details of ripping costs show that there is not a simple linear relationship between treatment cost and size of warren (Figure 2). In practical terms this implies that even if rabbit warrens are reduced in size by treatment in one year, the costs of re-ripping in a subsequent year may not fall rapidly until warrens are very small or most warrens are completely closed down. It again points to the value of using highly efficient techniques to remove rabbits completely where possible to avoid repeated treatments.

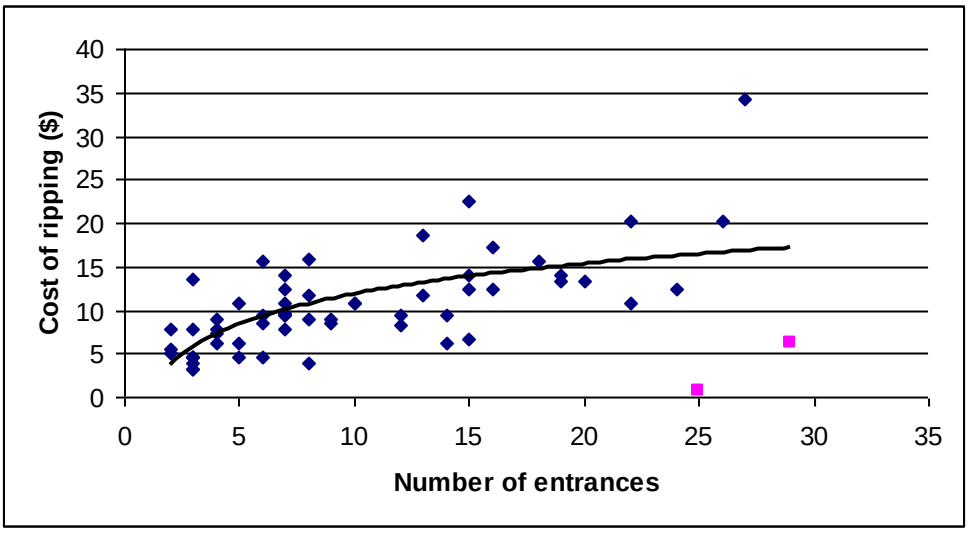

Figure 2. Ripping costs are not directly proportional to warren size so costs of re-ripping small reopened warrens may not be much less than initial ripping. Two large warrens (pink) could not be ripped or were only partly ripped because they were inaccessible to machinery.

Training and Smithville field day

The program introduced SAMDBNRM staff to new ways of approaching old problems and, through participation in an interstate field day, workshop and training school, provided opportunities for interaction with others who could share expertise and experiences.

On a local level, the Smithville field day was highly successful with a wide attendance including people from south-western Victoria, Adelaide, Upper North and pastoral areas north of the Murray River. Attendees included local farmers and horticultural producers, staff from other NRM Boards, SA National Parks, Landcare and NGOs with conservation interests.

The field day presentation was varied and well appreciated by those attending. Peter Michelmore, explained Board policies for developing community participation in rabbit control. This included the expectation that farmers should carry out rabbit poisoning but in return the Board would subsidize the costs of warren ripping on vegetated roadsides where possible, often contracting out the work to enable specialized equipment to be used. John Price described the significance of the demonstration project and results obtained while guest speakers Brian Cooke and Steve McPhee provided current information on related rabbit control work and developing projects (e.g. RHD Boost) and long-term benefits of post-RHD warren ripping in Victoria. Current costs of control as estimated during the project were presented and attendees were able to discuss practical field techniques while viewing bait-laying equipment and a practical demonstration of a back-hoe ripping warrens among mallee vegetation.

Outcomes from the Hattah-Kulkyne demonstration project

Field day and training school

A field day was held at Hattah-Kulkyne on July 9th 2009 to demonstrate the effectiveness poisoning techniques and warren ripping. Organized by Peter Sandell from Parks Victoria, it was well attended with over 50 participants including local farmers, and representatives from Parks Victoria, DPI Victoria, Catchment Management Authorities, Landcare and interstate NRM Boards. After a general outline of the work there was a visit to the field site so that the outcomes of the work could be seen. The local contractors who carried out the work, Jack Pryce and Daryl Walters, were present for further discussion on laying bait trails and warren ripping. Importantly, these contractors demonstrated a high level of personal commitment to the project and were keen to demonstrate the results achieved. Cleaning-up of poisoned and ripped areas had been so effective that, with new seasonal pasture growth, it was difficult to see where warrens had previously been present.

A training school was held at Hattah-Kulkyne National Park on 18th-19th November 2009 involving 45 participants including local farmers, representatives from the horticultural industry (e.g. almond producers), staff from Parks Victoria, DPI Victoria, Catchment Management Authorities and Landcare.

The training program included background biological information on rabbits to underscore the benefits of fitting in with seasonal rabbit population trends rather than trying to deal with rabbits during the breeding season when the population peaks. An opportunity was also provided for Steve McPhee to highlight the great benefits from warren ripping that had been applied soon after RHDV spread in various regions of Victoria and had lasted over the last decade or more. Of major importance was the opportunity for local rabbit control contractors, Daryl Walters and Les Liddens, to participate and share their knowledge. Interstate participants from the warren ripping workshop, Dr David Berman (Queensland) and Mr Paul Gillen (South Australia), also gave short summaries of their present projects to broaden awareness of approaches to rabbit control in other jurisdictions.

Practical demonstrations of fumigation and direct involvement in assessing warren fumigation results were considered important steps in encouraging training school participants to assess the effectiveness of the methods they currently use to control rabbits. One interesting result was that 4/10 warrens that were 'sham-treated' (i.e. no fumigants used but warren entrances filled with soil) did not reopen. When results from fumigated warrens were corrected against this standard it showed that fumigation was not particularly effective under dry summer conditions and re-emphasized advice normally given that fumigation when soil is dry is not highly effective.

One interesting innovation, initially proposed by Steve McPhee (DPI Victoria) was the cutting of a trench through the middle of a large rabbit warren to demonstrate the need for ripping as deep as possible and more widely than indicated by burrow entrances on the warren surface (see Figure 3).

Figure 3. Peter Sandell explains the features of an excavated rabbit warren to illustrate the need for deep ripping and ripping well beyond the apparent warren perimeter.

Meeting conservation objectives in rabbit control

A major outcome of the Hattah-Kulkyne trial was a very clear demonstration of the rigour that needs to be applied to rabbit control to reach conservation objectives. Although the buloke-pine woodlands in the national park are regarded as endangered under the *Victorian Fauna and Flora Guarantee Act 1988* a practical methodology for

meeting the agreed target of fewer than 0.5 rabbits/ha (or 1 active entrance/hectare) had never been properly addressed until that time.

Results from the project clearly show that a combination of poisoning and ripping or even warren ripping alone was adequate to reduce rabbits below the target threshold of required for buloke regeneration. However, longer term results imply that the extra step of poison baiting significantly delays the time taken for rabbits to return to critical levels where they damage seedlings once again. It may well be demonstrated that poisoning rabbits as a first step is highly cost effective if current trends shown in Figure 4 are borne out by continuing work. Where ripping and fumigation alone were used to reduce rabbit numbers it seems that rabbits could return to damaging numbers within 12 – 18 months but where an additional treatment of poisoning was used rabbits will take far longer to become problematic.

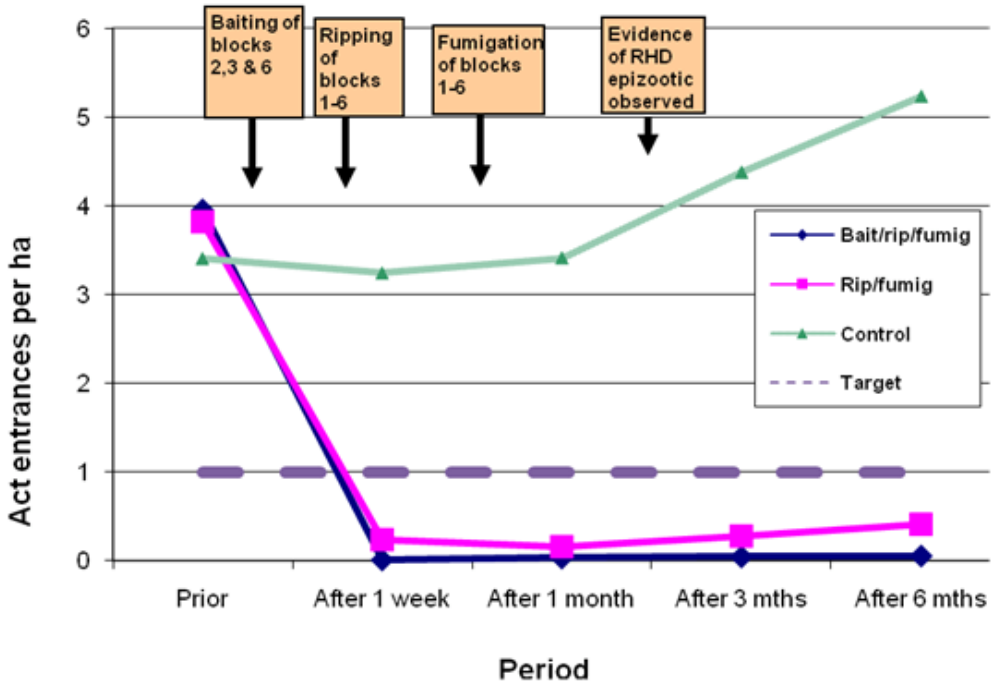

Figure 4. Changes in rabbit abundance (warren entrances/ha) following different treatments at Hattah-Kulkyne National Park. (Figure supplied by P Sandell, unpublished).

Warren ripping workshop

A warren ripping workshop was held in Mildura 17 -18 November 2009. Eleven participants with current involvement in warren ripping programs contributed to the workshop. They came from South Australia, Victoria and Queensland and included landholder and ripping contractor Jack Pryce (aka Jack the Ripper). Outcomes from the warren ripping workshop have been written up elsewhere but major conclusions are as follows.

Warren ripping is the mainstay of rabbit control, particularly arid and semi-arid Australia. Its relatively high cost-efficiency has been maintained by continued up-grading of the range and capacity of machines available and by attention to detail in warren ripping practices. These include ripping at the right time of year, ripping sufficiently deeply and widely enough to destroy warrens completely, adaptations such as 'winged boots' on ripping tines and the use of people on foot or on motor-bikes (spotters) to find warrens and check the completeness of ripping.

Case histories of recent ripping projects confirm that the costs of ripping warrens still remain in the range of $10 – $20/warren and in high rainfall country the costs of warren removal are quickly recouped by added livestock production. In arid-zone pastoral areas warren ripping offers the greatest benefits where it produces long-term control following initial effective investment.

With these efficiency improvements, it is clear that contractors with specialized equipment can remove rabbit warrens very effectively yet this in itself is something of a barrier to community up-take of the new technologies. The perceived cost in hiring a contractor as opposed to the former 'do-it-yourself' approach of many landholders can be daunting. Finding ways of integrating warren ripping effectively into wider community rabbit control programs is an issue that regional rabbit control authorities must tackle, especially when it comes to difficult areas like warren ripping among native vegetation on roadsides. Many landholders do not see themselves as being the custodians of such vegetation but regard it as an asset for which the general community should be responsible. As shown above (Smithville Demonstration Project) subsidizing of costs of roadside warren ripping is one option for resolving these kinds of issues and maximizing benefits from rabbit control in protecting both crops and native vegetation.

Press and Publicity

The field day and training school at Hattah-Kulkyne National Park as well as the linked warren ripping workshop attracted considerable press interest including two live-to-air interviews on Mildura ABC radio. The Sunraysia Daily, 17th July, 2009 published an article by Sam Murdoch, entitled 'Rabbits hit back' and a very detailed article by Peter O'Neil (former science writer for the 'Age' newspaper) entitled 'Bunnies are back' also appeared in the Sunraysia Daily on 21st November 2009.

Extension article

During the development of this project it has become apparent that new approaches to rabbit control are necessary to meet changing circumstances. There is no longer the infra-structure or skill base to resume rabbit control practices that had been in place before RHD was introduced. Furthermore, it is becoming clear that highly skilled contractors with new machinery and close knowledge of all the likely problems and impediments to implementing effective rabbit control offer a better alternative than trying to re-educate large numbers of farmers and other land-managers. Politically speaking, it is also clear that it is regional NRMs or CMAs that have the responsibility for developing and

implementing rabbit control at a regional level and so it seems logical that outcomes from this project should be directed at these regional authorities rather than being aimed at wider groups of individual landholders or land managers.

As a result of these considerations, the final extension article to be produced is entitled "An approach to landscape-scale rabbit control" and brings together rabbit control for agriculture protection and conservation on the basis that they are really related problems in most agricultural landscapes. Rabbits living in relict vegetation on roadsides are not just an environmental threat – they also damage adjacent crops and grazing lands.

Impediments to rabbit control

While rabbits were held low by RHD, changes were made to policies and legislation that directly affected some aspects of rabbit control work, potentially reducing its effectiveness. These changes were not as closely considered at the time as might have been the case had rabbits been much more problematic; a little loss in the efficiency of rabbit control here or there did not seem to matter given the situation. Nevertheless, as rabbits build up again, and every step towards effective control counts, some of these policy and legislation changes need to be carefully reconsidered to better match the objectives of effective rabbit control.

The unification of pesticide product labels is one case in point. In line with the laying of fox baits, the laying of rabbit baits on roadsides is discouraged. While this may seem logical on one hand, it is quite illogical on the other because in mallee farming areas this is exactly where the rabbit problem lies and laying bait trails on roadsides as well as adjacent paddocks significantly improves the ability to bring rabbit numbers down. Likewise, the heavily restricted use of anticoagulants for rabbit control in the proximity of houses or public areas seems excessive when similar anti-coagulant based products to control rodents can be purchased in supermarkets and used within homes. There is room for greater consistency.

Perhaps the most commonly encountered impediment is the occupational health and safety (OHS) issue associated with the use of warren fumigants. Naturally enough, agency personnel attending chemical handling courses are advised to use appropriate safety equipment such as gloves and face-masks and other protective clothing when fumigating rabbit warrens. Standard operating procedures or SOPs (Sharp and Saunders 2004) list overalls, eye protection (e.g. chemical goggles or safety glasses), elbow length PVC or rubber gloves and full-face respirator with combined dust and gas cartridge (canister) or breathing apparatus with air supply. Nonetheless, these latter two suggestions are quite impractical in the field making work clumsy and uncomfortable particularly on hot days (also recommended as the best time to fumigate in the SOPs). Rabbit control contractors on the other hand dress more comfortably and appropriately for field work and rely on simple routine, precautions to avoid chemical exposure such as working up-wind from the warrens they are fumigating and wetting aluminium phosphide tablets only as they are put into rabbit burrows.

In contrast to the practical approach taken by independent contractors, legal responsibility of ensuring work-place safety within government organizations and other institutions often stops fumigation as a normal rabbit control practice rather than facilitating it. Where rabbit control programs have stalled because of uncertainty over handling of fumigants it would be worth returning to safe operating procedures rather than giving the impression that unwieldy physical protective barriers are essential.

Animal welfare policies are also another example of potential restriction on effective rabbit control. Currently circulating suggestions to improve animal welfare aspects of rabbit control include the idea that rabbit warrens should be fumigated after poisoning and before warren ripping. This would be quite disastrous because it would deliver very questionable improvements to rabbit welfare yet add substantially to the cost of rabbit control work. My reasoning is as follows. 'Ten-eighty' oat baiting at the recommended time (after rabbits are already greatly reduced by the normal summer die-off) is extremely effective; it reduces rabbit numbers by 95% leaving few rabbits. Subsequent ripping destroys largely empty warrens and there is very little reopening if ripping is also done in summer while the soil is dry and powders finely to flow into the deepest warren leads. By contrast, warren fumigation gives relatively poor results in summer because it is difficult to seal off the burrow entrances with dry soil and contain the fumigant gases. At best it kills 30 – 50% of the remaining rabbits (and sub-lethally exposes the rest to the fumigant) while adding at least another $60/ha to already high rabbit control costs. Fumigation is not recommended at this time of the year because of its inefficiency, consequently, advocacy of fumigation as an intermediate step on animal welfare grounds would be in conflict with logic and well-established practices in rabbit control. It should also be stated that the proposal takes no account of ideas such as the stewardship of land or preserving natural biodiversity nor does it consider the benefits of rabbit control to native wildlife. The following example brings this point home.

By 2008 rabbits had reached such numbers within the open woodlands of the Hattah-Kulkyne National Park that they caused extensive damage to native pastures and shrubs and not only rabbits but also Western Grey Kangaroos were quite literally starving (see Figure 5). Under those circumstances, the suggestion that additional steps should be included in present rabbit control programs to marginally improve rabbit welfare (see comments above) seems an absurdity and implies an appalling lack of consistency and coordination in policy development. The perceived welfare of rabbits should not take precedence over the welfare of equally sentient native fauna nor should it push aside land management objectives such as the effective protection of plant communities listed as endangered.

It is well established at both Federal and State levels that rabbits grazing is a threatening process for many native species and that rabbits seriously out-compete even common wildlife species such as kangaroos and wombats (Cooke 1988, Mutze et al 2008). Consequently, there is little excuse for leaving such issues out of the development of rabbit control policies while promoting what essentially amount to simplistic animal welfare considerations.

Figure 5. Starving Western Grey Kangaroo, Hattah-Kulkyne National Park. Note that rabbits have reduced the ground vegetation to dry introduced weeds rather than perennial native grasses and have stripped the bark from the large Hop Bush (*Dodonaea viscosa*) up to 500 mm above the ground. Kangaroos are culled in this area to prevent them from drastically modifying the natural pastures and in this case rabbits were the over-riding cause of food shortage the ecological damage. (Photo: Daryl Walters, January 2009)

As well as general national policies concerning OHS and animal welfare there are often departmental policies or directives which also seem to inhibit pest control. During work on the current project it was frequently stated by Parks Victoria Rangers that 'poisoning of rabbits was not to be done when raptors such as hawks and eagles were breeding'. Superficially this might sound reasonable but in reality it is a reflection of poorly thought out rabbit control practices in the past. Spring-time, when hawks and eagles breed, is also the time when rabbit breeding reaches a peak. This is the worst possible time to be implementing a rabbit poisoning program and the directive should have spelled out that springtime rabbit poisoning was known to be a waste of time and money even before any risk to non-target species was considered. Nevertheless, other policies such as the restriction on poisoning rabbits within a certain distance of habitats likely to be occupied by brush-tailed possums (*Trichosurus vulpecula*) make more sense; possums do at times eat oat baits. Nonetheless, accurate confirmation of the distribution of possums in or near areas to be poisoned seems preferable to simply avoiding poisoning in areas of suitable-looking habitat where possums may or may not be present.

Despite on-going policy conflicts there are nevertheless some good examples where progress has been made. In North-west Victoria rabbit control in the vicinity of Aboriginal burial sites and sites of prior occupation can be difficult and it is recommended that warren ripping in general should not exceed 600 mm depth to avoid inadvertent damage. (Precisely how and why this depth limit was set remains unknown.) Nevertheless, site inspection by Aboriginal elders enables marking out areas that cannot

be ripped and generally allows rabbit control and subsequent land rehabilitation to proceed on adjacent land. Burial sites that are being damaged by rabbit burrowing can in turn be protected by rabbit netting pinned down on the soil surface. Outcomes of a balanced on-site approach are clearly of benefit for both the Aboriginal custodians and the land managers trying to rehabilitate land.

Interestingly, most of these apparent impediments seem to be fairly readily resolved where field operators have a clear understanding of the economic and environmental problems rabbits are causing and a will to sort out apparent impediments to control. This suggests that future progress should involve three approaches: first, training to ensure that practitioners are fully aware of the importance of rabbit problems from both economic and conservation viewpoints; second, active resolution of inconsistencies that work against effective rabbit control and third, providing field operators with support and confidence to use available techniques efficiently to achieve very high levels of control. It is important that these principles are not just applied to field operations but also flow through to other management issues such as ensuring that finances are in place to meet all aspects of planned rabbit control projects. Initiating rabbit control when money is available at the end of a financial year but not being able to complete work until money becomes available in the following year's budget is extremely wasteful; work is not only initiated at the wrong time of the year but is rarely satisfactorily completed in a timely way.

The booklet "Rabbits: a threat to conservation and natural resource management" is a step towards enhancing an appreciation of the environmental problems rabbits cause and the demonstration projects at Smithville and Hattah-Kulkyne show that rabbits can be adequately controlled. What is less clear however is how progress should be made in harmonizing different policies so that these are not seen or used as obstacles to effective rabbit management.

Summary and Conclusions

The project met its basic objectives of establishing demonstration sites to show how rabbit control methods could be very effectively applied and adapted for use in mallee farmlands and open pine-buloke woodland areas commonly used for pastoral enterprises or for conservation purposes. The main extension outcomes were:

- Two demonstration projects were successfully established (a third in NSW was set up but discontinued when it could not be completed on schedule)
- Two field days on rabbit control (Hattah, Victoria and Smithville, SA) were held to outline project results and demonstrate field equipment for poison laying, warren ripping and fumigation
- In place of the discontinued demonstration project in NSW a workshop on rabbit warren ripping was held in Mildura involving 11 delegates representing 4 states and territories
- A successful and well attended 2-day training course for field operations staff was held at Hattah-Kulkyne National Park

- Preparation of a report entitled ‘An approach to landscape-scale rabbit control’ based on information gathered and reviewed during the project which is specifically designed to encourage NRMBs and CMAs to develop a better integrated approach to rabbit control in both agricultural land and areas of conservation importance.

Within this context a great deal of practical information was collected including the up-dating of current rabbit control costs and the evaluation of the usefulness of new rabbit control strategies and tools such as an economic decision model to help plan rabbit control programs. Importantly, it was also shown that previously developed rabbit control methods and strategies, if applied correctly, can hold rabbits sufficiently low to avert economic losses on farmland and reduce rabbits below the level of 0.5 rabbits/ha critical for avoiding environmental damage.

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