

~~Review of wombat
management~~
Managing wombats: A
review of current practice, issues, and
challenges to inform policy in the ACT.
~~in
the ACT~~

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1. Executive Summary

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Summary of legislation findings – ie all jurisdictions with the exception of ACT, have an explicit mechanism to enable control of wombats for the purpose of mitigating damage on agriculture or infrastructure.

1. Introduction

Needs a short introduction about the documents purpose and structure. Include in this section the use of the common name the Bare-nosed Wombat (use capitals) and full scientific name *Vombatus ursinus* and then (hereafter “wombats”). Will save a lot of excess words.

2. Legislation, policy and regulation

2.1. Policy and legislation

2.1. Need a short paragraph in here eg This section reviews legislation and policy from jurisdictions across the species range for the purpose of...

2.1.1. Victoria

Legislative history

The bare nosed wWombats was/were declared vermin throughout the state of Victoria in a 1906 proclamation by the governor-in-council, under provisions of the *Vermin Destruction Act* 1890 (Seebeck 1988) because of: Wombats received vermin status due to the damage they caused to rabbit exclusion fencing. In 1925, a bounty of 10 shillings per scalp was placed on *V. ursinus* under the vermin and noxious weed act 1922 and wombats, with more than 60,000 bounties were paid up until 1955. The bounty on wombat scalps was subsequently suspended in 1966 and officially abolished in 1971. Wombats remained a pest to many and from 1971 to 1986 government officials fumigated wombat burrows on crown land.

In 1977, bare-nosed wombats were declared protected under the *Wildlife Act* 1975 in the region west of the Melbourne to Sydney railway line, where they occurred in low numbers. The vermin status of *V. ursinus* the species was maintained in eastern Victoria until 1984, when wombats were. Once the vermin label was removed *V. ursinus* were protected under the *Wildlife Act* 1975 across all Victoria. Lobbying by farmers led to the species to, though it was be declared ‘unprotected wildlife’ in 193 parishes in eastern Victoria, due to lobbying by farmers. Within these parishes The declaration of the species as ‘unprotected wildlife’ enabled the destruction of *V. ursinus* wombats was restricted to by landholders, their families/families, and employees by means of fumigation, trapping or shooting on freehold or leasehold land, and within 1 km of such land on

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adjoining crown land. In June of 1997, the Act was modified to enable destruction only on the occupier's property with a high-powered, centre-fire rifle of .222 calibre or larger.

Current Legislation

In February 2020, an amendment to the *Wildlife Act* 1975 revoked the unregulated control of wombats across 193 parishes in eastern Victoria. It is now an offence to kill, take, control or harm *V. ursinus* wombats across the entire state of Victoria without authorisation. To destroy a wombat or its burrow, landowners need to apply for an authority to control wildlife permit (ATCW) from the Department of Energy, Environment and Climate Action which can be done online, by snail mail post or email. Applicants are required to demonstrate damage to their property, crops or pasture, impacts on biodiversity values, or risks to human health or safety and all other reasonable options have been considered. There is a 'wombat management factsheet' outlining non-lethal management options. Applications are reviewed by a forest and wildlife officer which can take up to six weeks to be processed and may require a property inspection. Each ATCW specifies the species of wildlife that can be controlled and the method of control. Anyone shooting wildlife under the *Wildlife Act* 1975 must comply with the *Firearms Act* 1996. To destroy a wombat without a permit carries a penalty ranging from \$8,261 to \$39,652 and/or six to twelve months in jail.

Table 1. The number of permits issued to control bare-nosed wombats and the number of animals to be harmed in Victoria over the last seven years.

Year	Number of permits	Animals authorised to be culled
2023	222	1902
2022	226	1862
2021	207	1675
2020	273	1478
2019	268	3655
2018	252	3830
2017	270	3374

2.1.2. New South Wales

Legislative History

New South Wales was home to all three species of wombat until the last claimed sighting of northern hairy-nosed wombats in 1909. Bare-nosed and northern hairy-nosed wombats had partial protection under the *Native Animals Protection Act* 1903 with a closed season from August to January each year. Partial protection was removed with the enactment of the *Animals and Birds Protection Act* 1918. Under the *Fauna Protection Act* 1948 wombats were provided protection except in main Pasture Protection Board areas. Despite this, *V. ursinus* wombats were regarded as a noxious pest by the Department of Agriculture in some regions adjacent Pasture Protection Board areas and landholders were required to destroy them. The National Parks and Wildlife Service could prosecute the same landholders for destruction of wildlife under the *Fauna Protection Act* 1948. In 1959 a compromise between the National Parks and Wildlife Service and the Department of Agriculture was reached, leaving *V. ursinus* wombats unprotected, but no longer declared noxious. *Vombatus ursinus*

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Commented []: So I don't understand it. How was protection removed under an Act that is focused on protection? Do you mean full protection was granted?

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Wombats became fair game for sports shooters. In March 1973, ~~V. ursinus was wombats were~~ awarded full protection under the *Fauna Protection Act 1948-67*, with provision for destruction for damage control purposes by being removed from the first schedule (list of unprotected animals) ~~of the Fauna Protection Act 1948-67~~. This changed was enshrined in the *National Parks and Wildlife Act 1974*.

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Commented []: So how was provision for their destruction allowed for under this Act?

Current Legislation

Wombats are protected under the *NSW Biodiversity Conservation Act 2016*. It is an offence to harm a wombat unless a licence is obtained from the Department of Climate Change, Energy, the Environment and Water. To obtain a licence it needs to be demonstrated animals are threat to human safety, damaging property and/or causing economic hardship. Where possible, the department seeks to resolve negative interactions using non-destructive methods and recommends non-lethal methods on their [website](#). However, a licence to harm individual animals may be required to mitigate problems. To apply for a licence, landholders must contact their local National Parks and Wildlife Service (NPWS) office to discuss the nature and severity of the issue and any non-lethal measures that may resolve the problem. They can then download and fill in an application [form](#) and lodge it with their local NPWS. The National Parks and Wildlife Service may grant a licence to the owner or occupier of a property, to cull or ~~catch and release the animals~~. Records of the number of animals harmed need to be kept on a record sheet provided and lodged with the NPWS office within 7 days of the licence expiry. All people operating under the licence must comply with the *Firearms Act 1996* and the *Code of Practice for the Humane Destruction of Wombats by Shooting in NSW*. Harming wildlife without a permit may receive a maximum fine of \$330,000 with an additional \$33,000 for each animal harmed or two years in jail.

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Within the last seven years a small number of permits have been issued. The maximum number of ~~V. ursinus~~ wombats to be harmed on any one permit was 50 animals. More commonly permits range from 1 – 20 animals for issues including damage to crops, competition with stock, hazard for vehicles, damage to fencing, causing erosion and disease.

Table 2. The number of permits issued to control bare-nosed wombats and the number of animals to be harmed in New South Wales over the last seven years.

Year	Permits issued	Number of wombats to be harmed
2023	34	187
2022	38	219
2021	26	138
2020	42	221
2019	76	501
2018	103	752
2017	40	193

2.1.3. Queensland

Legislative History

The two species of wombats, the Northern Hairy-nosed and Bare nosed, occurring in Queensland were protected under the *Native Animals Protection Act* 1906. However, this and subsequent Acts provided provisions for damage control. The *Fauna Conservation Act* 1974-1989 provided permanent protection for the Northern Hairy-nosed Wombat with no provision for damage control. Northern Hairy-nosed Wombats were declared endangered under the *Nature Conservation Act* 1992. Bare-nosed Wombats remained protected with provision for damage control under a permit system.

Current Legislation

Both species of Wombats are protected under the *Nature Conservation Act* 1992, though there are provisions to control Bare-nosed Wombats *V. ursinus* for damage mitigation purposes. A damage mitigation permit is required to take wildlife to minimise damage or loss of property (e.g. crops) or to protect human health or wellbeing. There are two types of damage mitigation permit, one to remove and relocate problem animals and one to lethally control animals.

To obtain a three-year permit to remove and relocate wildlife applicants must demonstrate the following:

- Certificate of completion of a training course concerning the keep, relocation, and safe handling of relevant wildlife.
- A current first aid certificate issued by an approved first aid provider.
- Referee reports from two suitably skilled and qualified persons.
- Statements outlining the ability to handle wildlife, including safety procedures to be applied when handling or moving wildlife and access to appropriate equipment.
- Statements outlining wildlife identification skills.
- A resume including details of qualifications provided with the application.

If an applicant does not have any experience, they are recommended to contact a local damage mitigation permit holder for guidance and possible endorsement under this permit type.

To obtain a permit to lethally control wildlife, applicants must demonstrate damages caused and the economic losses incurred, or any or threats to human health (e.g. disease or injury risks). Two non-lethal damage mitigation measures to prevent or minimise damage need to have been attempted prior to application for lethal control. A statement outlining the applicant's relevant knowledge and experience enabling them to correctly identifying the requested-relevant species is required. Permits are issued for one-year unless the landholder has an approved property management plan, in which case permits can be issued for three years. The Department of Environment Science and Innovation offers a service to guide applicants through the assessment process. The service includes meeting with a departmental project manager to discuss the information needed for the application. Applications can be lodged online or by downloading a form and may take up to 40 business days to process. Once a permit has been granted, permit holders are required to lodge a return of operations form every three months and within 10 days of the permit expiry detailing how many animals were taken under the permit. The maximum penalty for controlling protected wildlife without a permit is \$15,480 (100 penalty units).

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2.1.4. Tasmania

Legislative History

Wombats were not protected in Tasmania until the passing of the *National Parks and Wildlife Act* 1970, which provided partial protection allowing for an open season to be declared. Despite this no open seasons were declared, and destruction for damage control purposes was undertaken by permit.

Current Legislation

Wombats are protected under the *Nature Conservation Act* 2002 with provision for damage control. A property protection permit is needed to control protected wildlife, including wombats. Permits can be applied for by landholders, managers or lessees of land to prevent the destruction of, or injury to any stock, crops and equipment or infrastructure used in crop and/or stock production. Applications must identify the damage caused, the method of control to be used and the number of animals they want to take. The Department of Natural Resources and Environment must be satisfied a financial loss is likely to occur if the crop, stock, equipment or infrastructure is not protected. Applications are assessed on a case-by-case basis, which may include a visit to the applicant's property. The local abundance of wombats, the impacts they may have on the property, and whether non-lethal measures will be effective at the site are considered when issuing permits. Population data is considered from trends in annual spotlight monitoring of 190 10 km transects across the state conducted by the Department of Natural Resources and Environment Tasmania. Issued permits will specify a timeframe of up to 12 months and the number of wombats authorised to be taken. Permit holders are required to maintain accurate records of animals destroyed and report them within 28 days of the expiry. Persons controlling wildlife without a permit or who do not comply with the terms of their permit can receive a penalty of up to \$19,500 (100 penalty units).

Table 3. The number of permits issued to control bare-nosed wombats and the number of animals to be harmed in Tasmania from 2016 to 2022. Blank cells indicate a lack of data.

Year	Number of permits	Total quota issued	Wombats culled
2022	9	165	29
2021	6		17
2020	5	51	20
2019	4		107
2018	6	110	
2017	22	160	
2016	52	2171	

2.1.5. Western Australia

Legislative History

Early game acts provided protection to other native species, but not Southern Hairy-nosed Wombats, which occur in the south-east corner of Western Australia. The *Game Act* 1912 provided protection to all "non harmful" native fauna; it is not clear whether this extended to Southern Hairy-nosed Wombats. The *Fauna Protection Act* 1950 was the first to provide blanket protection to all indigenous fauna in the state,

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Commented []: This is a little confusing. Is the game Act 1912 not considered an early Act?

including ~~Southern Hairy-nosed Wombats~~wombats. It was re-named to the *Wildlife Conservation Act* 1950 in 1975 which ~~had included~~ provisions for damage control permits. The perceived potential of ~~Southern Hairy-nosed Wombats~~ wombats to become a problem led to the Agricultural Protection board declaring ~~Vombatus~~ ~~Southern Hairy-nosed Wombats~~ vermin throughout WA, except in the south-east corner where wombats occurred. In 1973, the declaration was amended to ~~include Southern Hairy-nosed Wombats as a pest species~~ ~~Lasiorhinus~~ under the *Vermin Control Act* 1918-1970. When the *Vermin Control Act* was replaced by the *Agriculture and Related Resources Protection Act* 1976 the ~~Southern Hairy-nosed Wombats~~ ~~southern hairy-nosed wombat~~ was included as a category 7 declared animal, meaning if it became a ~~problem a management~~ plan would be developed.

Current legislation

In 2019 the *Wildlife Conservation Act* 1950 was replaced by the *Biodiversity and Conservation Act* 2016 and the Biodiversity Conservation Regulations 2018. ~~The current Act does not list the~~ ~~Southern Hairy-nosed Wombats~~ ~~southern hairy-nosed wombat~~ as a protected species. ~~There~~ Under the Biodiversity Conservation Regulations 2018, ~~there~~ are provisions for controlling ~~listed?~~ fauna ~~causing that have the potential to cause damage to....?~~ under the Biodiversity Conservation Regulations 2018, but the ~~Southern Hairy-nosed Wombats~~ ~~southern hairy-nosed wombat~~ is not listed as a managed fauna species. ~~When they cause damage to agriculture, N~~ native animals may be declared pests under the *Biosecurity and Agriculture Management Act* 2007 (BAM Act), ~~where they cause damage to agriculture.~~ ~~The~~ ~~Southern Hairy-nosed Wombats~~ ~~southern hairy-nosed wombat~~ is currently listed as a Permitted species S11 (exempt). They are not a declared pest and are permitted to be imported into the state provided they satisfy import permits.

2.1.6.South Australia

Legislative History

Wombats gained their first legal recognition under the *Animals protection Act* 1912 on the schedule of unprotected animals with no distinction of species. Partial protection was achieved under the provision of *Animals and Birds Protection Act* 1919 with the declaration of a ~~closed season on wombats~~ from July to December however, ~~destruction for damage provision~~ was still permitted during the closed season ~~for damage provision~~. The Fauna Conservation Act 1964 provided full protection with a provision for ~~damage-controlling wombats for the purpose of mitigating -damagepurposes~~. Under the *National Parks & Wildlife Act* 1972, the ~~B~~bare-nosed ~~W~~wombat was listed as ~~Vvulnerable~~ with full protection. The ~~S~~southern ~~h~~Hairy-nosed wombat was permitted to be controlled for damage mitigation purposes.

Current legislation

The ~~B~~bare-nosed ~~W~~wombat is ~~currently~~ listed as ~~R~~rare and ~~southern hairy-nosed wombat as least concern~~, both ~~species~~ are protected under the *National Parks and Wildlife Act* 1972 (NPW Act). It is an offence to catch,

Commented [REDACTED]: This implies that they didn't occur anywhere else, and that they were declared a pest where they didnt occur, which doesn't make a lot of sense?

Commented [REDACTED]: Is this what you mean?

Commented [REDACTED]: By whom, and how is it reviewed/approved and permits for management/ control given?

Commented [REDACTED]: So in many Acts protected species are not listed, instead they meet specified requirements like 'present before European settlement' or such. It is their listing under other Acts or declarations that removed protection.

Commented [REDACTED]: Sorry I don't understand this section. Under what piece of legislation are they "listed" as a permitted species (BAM Act?) and what does exempt mean? Does it mean that they are exempt from control but you can import them? Needs to be clearer

Commented [REDACTED]: That permitted destruction and hunting?

Commented [REDACTED]: As opposed to hunting?

Commented [REDACTED]: Do you mean they were an identified threatened species in the IUCN category of Vulnerable?

interfere with, harass, or kill ~~them both species~~ without a permit. The Department for Environment and Water recommends using non-lethal means for managing wombats prior to resorting to culling and has a "living with wombats" factsheet. ~~The Department of Environment Water can issue Destruction permits can be issued by the Department of Environment Water~~ in circumstances where wombats cause damage or threaten human safety (section 53.1c of the SA National Parks and Wildlife Act 1972). ~~There~~ is a code of practice for the humane destruction of wombats which permit holders need to abide by. The penalty for killing a wombat without a permit is a \$2,500 fine or six months in prison.

Commented [REDACTED]: Can you add in here how the permits are applied for, any considerations given/ how they are assessed and the online link of possible

An amendment was made to the National Parks and Wildlife Act in 2023 prohibiting the destruction, damage or disturbance of wombat burrows without a permit ~~granted by the Minister~~ with a maximum penalty of \$5 000 or imprisonment for 12 months. ~~Permits are not required if a burrow is outside a wombat burrow protection zone, although no wombat protection zones currently exist. The~~ the person ~~is must be~~ the owner of the land or authorised by the owner of the land, the burrow is causing or likely to cause damage to crops, stock, machinery or infrastructure or may constitute a safety risk or hazard to people. ~~No wombat protection zones currently exist.~~ There is a protection for wombat burrows factsheet.

Commented [REDACTED]: Ok so this is weird. Is this to allow for the development of permit zones? Basically you are saying that there is no current protection for wombat burrows as they are all outside a protection zone (as no zones)... have I got this correct?

Table 4. Table 5.2. The number of permits issued to control southern hairy-nosed wombats and the number of animals to be harmed in South Australia over the last seven years.

Year	Permits issued	# wombats permitted
2016-17	44	803

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Commented [REDACTED]: Awesome thanks

2.1.7. Australian Capital Territory

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Legislative History

~~The bare nosed wombat was~~Wombats were protected early in the Australian Capital Territory in comparison with most other states. ~~There has been full protection without provision for destruction in the Australian Capital Territory since the Animals & Birds Protection Ordinance 1918, which has remained in place in all following acts.~~ Successive Commonwealth ordinances and the *Nature Conservation Act* 1980 kept full protection in place, making made no provisions for destruction permits to be issued for damage control purposes. ~~There has been full protection without provision for destruction in the Australian Capital Territory since the Animals & Birds Protection Ordinance 1918, which has remained in place in all following acts.~~

Current legislation

Under the *Nature Conservation Act* 2014, bare nosed wombats remain protected without provisions for damage control. To kill a protected animal will result in a maximum penalty of \$16,000 (100 penalty units) and/or imprisonment of up to 1 year. Under part 6.1 of the Act, it is an offence to conduct any activity that interferes with a nest (or burrow), endangers progeny or breeding, kills, injures, or endangers a native animal. However, some activities, such as nest destruction, may be carried out under a licence issued by the *Conservator of Flora and Fauna*. The maximum penalty for a damage land offence is \$2,025,000 for a Corporation or 7 years imprisonment and/or \$400,000 for an individual. It is the responsibility of the applicant to apply for a licence for any proposed activity that may otherwise be an offence under the Act. The Parks and Conservation Service administers the Act, with conservation officers being responsible for conducting compliance activities, including public education, inspections, audits, and investigations to promote and support compliance.

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2.1.8. Limitations to current policy and legislation

~~With the except of the ACT, Within all states jurisdictions have a with provision under legislation for to enable wombat control for the purpose of damage mitigation. Control is regulated via a permit system, although the under a permit system, except Tasmania, the with the exception of Tasmania, the~~ number of animals allocated on the permit is not based on ~~evidence survey data~~ or knowledge of ~~populations abundance~~. This makes it ~~rendering the culling difficult to assess the impact of culling on program ineffective for conservation or management outcomes (Taggart et al. 2008) populations.~~

Tasmania is the only state which considers trends in wombat populations from spotlight surveys when setting permit allocations. Transect surveys in Tasmania are conducted by vehicle along 190 x 10km transects across five management regions for several controlled species. Wombats are not a target species, and while the methods are insufficient to allow density analysis due to low detectability of wombats, they can provide an indicator of population trends (ref Tas spotlight report). Surveying wombat populations over large areas in Victoria, South Australia and New South Wales would be time consuming and expensive to conduct on a yearly basis.

Commented []: This sentence doesn't make sense as culling is not done for conservation outcomes, and I imagine it would be targetting individuals not populations that would address damage concerns.

For most states the permit application system is lengthy, and landholders find it frustrating. Most states have an online permit application system, however there are some that require the forms to be delivered to the nearest environment department office which for some landholders is a very long drive. The waiting times for a permit application to be processed is anywhere from 4-weeks. If landholders have an immediate problem like a wombat burrowing into a dam wall, under a building or water tank, they need to take immediate prompt action is needed to prevent further damage. Most states require the applicant to have tried non-lethal damage mitigation strategies before applying for a permit, however, there is currently a lack of effective, economically viable non-lethal damage mitigation strategies available to landholders.

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Commented []: Is this what you mean? I would say shooting is an effective and economically viable option for land holders...

In all states there has been a substantial reduction in the number of permits and the number of wombats permitted to be culled within the last decade. This is in response to owing to increased mounting public pressure on government agencies for from conservationists and animal welfare advocates. Landholders are increasingly, landholders are unable to manage wombats populations on their property to reduce damages, which may lead to significant leading to increased frustration and economic loss. For many farmers, the lengthy application process is not worth the time it takes to apply for a permit if they are only permitted to cull 10-25 wombats. As such some landholders act outside of permit systems and official government registers are considered an underestimate of the true numbers of wombats culled {St John, 1989 #62; Taggart, 2008 #160}.

Commented []: What is missing here is what changes would be needed in the ACT to support targeted lethal control . You can do this through either licencing permits, which is potentially an issue as they are an appealable decision through ACAT, or through a controlled native species management plan. Probably worth a paragraph on this.

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2.2. Licencing compliance and regulation

2.2.1. APMVA regulations for mange treatment

The Australian pesticides and veterinary medicines authority (APVMA) is an independent statutory Authority of the Commonwealth under the Agricultural and Veterinary Chemicals (Administration) Act 1992. They are responsible for the regulation and control of agvet chemicals in Australia up to the point of retail sale including the import and export of chemicals. The Agricultural and Veterinary Chemicals Act 1994 contains the provisions allowing the APVMA to evaluate, approve or register agricultural and veterinary chemical products; issue permits for use, license the manufacture of chemical products, regulate the supply of chemical products and ensure compliance with, and enforcement of the Agvet code. The Agricultural and Veterinary Chemicals Code Regulations 1995 prescribe detailed provisions of the Agvet Code. The Agricultural and Veterinary Chemicals Code (Application Requirements) Instrument 2014 defines the information that must be contained in, or accompany an, an application for the registration of a chemical, including the distinguishing number, instructions for the use of the product and other particulars prescribed by the regulations. This includes the distinguishing name of the chemical product, it's constituents and their concentrations, if possible the composition and purity of active constituents, formulation type, the net contents for the chemical product and the chemical manufacturer(s). Identifying information of the holder of the registration of the chemical product -(viii) the address of each site at which the chemical product is manufactured by the manufacturer (x) identifying information for any nominated agent for the registration.

There are three active permits which apply to all states and territories in Australia and two active permit holders. The wombat protection society holds two permits for the use of cydectin pour-on for cattle with 5g/L Moxidectin as the active constituent. One permit allows for a dose 4 ml per kg of body weight with a max single dose of 100 ml on an adult wombat (>15 kg) with 5 days between doses and no more than 5 doses. The efficacy and toxicity associated with this dose rate has not been fully evaluated. Users must observe wombats for any toxicity signs as detailed in the critical-use comments. Any wombats that die after treatment should be reported to a veterinarian and a detailed postmortem must be carried out. The second permit allows 0.8 ml per kg of body weight with a max dose of 20 ml applied once weekly for 15 weeks. Intervet Australia holds the third permit for Bravecto with 280 mg/ml fluralaner as the active constituent which will expire on 31st of July. The dose is 25 mg/kg of wombat body weight with a maximum of three doses one month apart on wombats > 5 kg.

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It is the permit holder's responsibility to ensure people operating under the permit are trained in the identification and treatment of mange in wombats. Permit holders must notify the APVMA of new information, including information in accordance with section 161 of the Schedule to the Agricultural and Veterinary Chemicals Code Act 1994. The supplier must provide the product in a container compliant with the requirements of section 18 of the Agricultural and Veterinary Chemicals Code Regulations. Cydectin can be decanted into smaller containers (1L poison bottles with a child proof lid), and is then considered unregistered, and is referred to as 'Moxidectin for Wombats with Mange'. the decanted amount must be used within 1 treatment cycle (5 weeks) in 1-2 wombats. A label identical to Attachment 1 of the APMVA permit must be affixed to the container. Moxidectin for Wombats with Mange must only be supplied as part of a wombat mange treatment kit, which contains a copy of the label for the registered product that has been supplied in the smaller container, a printout of the sign consistent in content with Attachment 2 of the APVMA permit and instructions on its placement and a copy of the permit. Additional directions for use of the product must be consistent with the permit. The Permit Holder must record any adverse experience associated with the use of the product they are made aware of and report them to the APVMA as soon as possible.

Commented []: Are there regulations with regard to distance from water?

3. Wombats in the ACT

3.1. Distribution and abundance

Prior to European settlement ~~bare nosed~~ wombats were thought have a continuous distribution across much of their range, including the ACT, however a lack of historical records makes this difficult to confirm (figure).

Commented []: Prob worth a sentence in the introduction which defines their range.

Following European settlement, the establishment of farming along with the introduction of rabbits is thought to have had a significant reduction on the distribution and abundance of wombats (ref). Newspaper articles dating back to 1925 indicate wombats were numerous 30 miles southwest of Canberra (ref). Stockman's accounts in 1967 indicate wombat numbers were on the increase on the snow belt (ref) and they were forced out of their homes as Canberra expanded in 1970's (ref)

The earliest study ~~of on the bare-nosed wombat~~ distribution of wombats was a PhD dissertation by McIlroy in 1973, approximately 150 years after Canberra was first settled. Wombat ~~distribution was were~~ likely already significantly impacted by ~~Agricultural agricultural~~ and urban development ~~within by~~ that time. Current distribution maps indicate ~~bare-nosed~~ wombats are now restricted to the southern end of the ~~territory~~ ACT (insert map). Occurrence records from the Atlas of Living Australia and WomSAT show the distribution of wombats is much more widespread with most records occurring in the ~~n~~Northern half of the ACT (fig x).

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Commented []: Conflicting?

Commented []: Agree, completely conflicting. Most records are in the south, with few in the north. Nearby NSW may have more records

~~Apps that rely on the~~Applications that enable public reporting of ~~reporting of wombat~~ sightings from members of the public ~~enable allows~~ data to be collected over large areas that would otherwise be infeasible to survey, ~~by trained professionals, however, they have limitations.~~ Sightings made on these applications ~~Two major limitations of using public sightings to ascertain wombat distribution include that sightings~~ are usually biased towards areas of high human traffic such as roads, ~~and that sightings. They do not record presence only~~absence data, ~~and thus a~~ This means that lack of ~~recordings sightings~~ in an area does not ~~mean indicate lack the species is not of~~ presence, but instead may reflect low survey effort. Additional limitations include that ~~S~~signs of an animal's presence, such as faeces and burrows, can be misidentified ~~or missed altogether~~. Burrows which can persist in the environment long after a wombat is gone can be mistakenly identified as active, ~~especially if or be~~ used by another species. ~~This may result in providing~~ false records of wombat activity (insert paper on culling example).

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Animals can ~~also~~ be misidentified. For example, door knocking surveys conducted throughout the Yorke Peninsula to locate populations of ~~SHNW~~ found many landholders did not know what a wombat looked like, with some mistaking them for possums (E. Sparrow pers comms). ~~there is an increased margin of error in the accuracy of sightings.~~ Opportunistic sightings also do not provide data that can be used to estimate population density or abundance, and this is important data for evaluating the impact of control programs or conservation action.

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Abundance is likely to vary locally and regionally, depending on a range of factors, such as habitat type, soil type and climatic conditions. There are currently no reliable estimates of ~~the abundance of bare-nosed for~~ wombats in the ACT. ~~Abundance is likely to vary locally and regionally, depending on a range of factors, such as habitat type, soil type and climatic conditions.~~ ~~After an initial likely decline from habitat loss the expansion of agriculture and urbanisation,~~ anecdotal reports from landholders suggest wombat numbers in the ACT have increased over the last 10-20 years. Historic anecdotal reports from park rangers dating back to 1975 indicate wombats were not present on the Canberra plains or in ~~the~~ Canberra Nature ~~p~~Park, though they were present in Tidbinbilla and Namadgi National ~~P~~ark and have increased in distribution in the last few years. ~~Though records specific to the ACT are lacking, prior to the protection of wombats in 1980, they were likely~~populations would likely have been impacted by ~~incidental killed culling by rabbits~~Rabbit control officers were known to target wombats ~~due because of~~ the holes they made in rabbit proof fencing (ref). ~~Competition from rabbits and kangaroos for food resources likely limited wombat numbers, thus a reduction in rabbit and kangaroo numbers could result in an increase in wombats.~~

Commented []: Distribution or abundance. If distribution, where do they now inhabit which they didn't before?

Commented []: Did we have rabbit proof fencing in the ACT??? I never knew!

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Commented []: Resource limitation is entirely speculation. Without evidence or ref I would leave it out. We do, however have a healthy population of dingoes in NNP...

To gain a better understanding of monitor changes in wombat populations abundance and -and-mange prevalence and severity over time, the EPSDD is currently undertaking uses line transects to surveys at 13 sites in across the ACT (see section 3.2.1 for more information). The current methods of 1 km walked transects conducted twice in winter survey effort is not sufficient to gain an understanding a robust estimate of wombat abundances, as they. Wombats can remain underground for extended periods of the time and activity levels can vary greatly at both an individual and population level, and be dependent on are influenced by climatic conditions. Suggestions to improve the monitoring program are provided in. A greater survey effort and alternate survey methods are needed to determine wombat abundance. (see section x for more information).

3.2. Threats to wombats

3.2.1. Mange

Sarcoptic mange is a skin condition caused by the *Sarcoptes scabiei* mite, is as an issue of great concern for wildlife carers within the ACT. While it is an animal welfare concern with severely affected individuals suffering an agonizing death. Mange initially presents as skin reddening and hair thinning. As the disease progresses, visible signs of itching, alopecia and epidermal crusting appear (Pence & Ueckermann, 2002). Mange has strong animal welfare implications as affected individuals can suffer a slow and agonizing death, usually through secondary infection, blindness and/or starvation (Ref). Prevention of mange in Australia is considered almost impossible, as all disease transmission pathways would need to be interrupted, including transmission from host species such as foxes (ref).

Ideally mange should be diagnosed and treated by qualified veterinarians, so that the condition is correctly identified, and animals can receive appropriate treatment. This is not feasible for wildlife populations. Mange in wombats is typically diagnosed and treated by wildlife carers and volunteer groups with varied levels of training, experience and coordination. Diagnosing the disease in its early stages can be difficult without catching and examining animals. The same symptoms can be caused by malnourishment from low quality feed, creating the potential for misdiagnosis (Fraser et al., 2018; Valdeperes et al., 2019).

The full extent of its distribution and impact of mange on wombat populations is poorly understood. Wombat populations can often persist in the presence of mange, its and prevalence within these populations is often usually $\leq 15\%$ (which could indicate low mortality or intraspecific transmission, or high mortality of infected wombats - Carver 2021). During outbreaks, mange prevalence can rise to $> 50\%$, with near 100% mortality of infected individuals (ref). In some cases, mange outbreaks have resulted in $> 90\%$ decline in local wombat abundance (Skerratt 2005; Martin et al. 2018a). Increased rates of mange are often associated with high wombat densities and periods of drought or high stress (e.g. seasonal stress in winter) (ref). Burrows are thought to be the mode of sarcoptic mange transmission in wombats due to their solitary lifestyle and patterns of burrow use and sharing (Evans, 2008) (Martin, Ricardo, et al., 2019) (Beeton et al., 2019; Martin et al., 2019b). The humid and cool microclimate within wombat burrows provides favourable conditions to maximise mites off-host survival, particularly in cooler months which is predicted to be highest in winter (16.4 days) and lowest in late summer (5.96 days). The mites average off host survival Mites can survive in burrows longer exceeds than

Commented [1]: Fair but require a solution

Commented [2]: Is the solution presented in x? this sentence is saying the same thing as the above so have removed as redundant

Commented [3]: There's a bit of background info in this section that's not ACT specific and was mostly for my benefit having not worked on mange. If I'm telling you things you already know feel free to delete.

Commented [4]: Hi [5] I think this section is useful but some of the arguments need refining. Have highlighted.

Commented [6]: I have also merged the mange information from below otherwise it is repetitive and interrupts the flow of the document.

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the minimum known frequency of wombat burrow switching of (4- 10 days). Transmission is exacerbated by patterns of alternative burrow use and sharing (Evans, 2008; Martin et al., 2019b). Higher mange prevalence does not appear to be connected to higher predicted mite survival (ref).

Regulation of veterinary chemicals used to treat mange in Australia To gain a better understanding of the distribution of mange in the ACT, the EPSDD have developed an app to enable people to report sightings of wombats and mange to gain a greater understanding of its distribution. Sightings of wombats with mange within the ACT have also been reported on WomSAT, an application developed by researchers at the University of New South Wales to gain a better understanding of the distribution and prevalence of mange in wombats Australia wide. Users of WomSAT need to create a user account and sightings of mange must include a photo for verification to reduce false identification of mange. While applications of this nature are great for surveying large areas researchers would otherwise not have the resources for, reporting is typically skewed towards areas of high human activity and may not accurately represent the presence/absence of mange as users typically only report positive sightings. The apps are not reliable predictors of the prevalence of mange as they are not based on repeated or comparable survey efforts.

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To progress research and monitoring relating to mange treatment in the ACT, EPSDD convenes the wombat mange and monitoring group (initiated March 2021). Members include two community wildlife care groups (Wombat Rescue and ACT Wildlife), UTAS and EPSDD staff. The group takes a collaborative approach to addressing wombat mange and coordinates activities of the community and ACT Government. Current activities of the Wombat Mange Stakeholder Subgroup and Monitoring Group include:

- Trialling the use of Bravecto, as a potentially longer-lasting, more effective, and target-specific treatment for mange to the currently used veterinary chemical, moxidectin, including developing a new remote delivery method of Bravecto.
- Developing a collaborative monitoring program to provide information on mange prevalence and distribution across the ACT, supported by a data-gathering application that is shared between stakeholders.
- Developed an approach to enable mange treatment in public reserves while minimising risks associated with using moxidectin near waterways, using a permit process. This has allowed for interim treatment of mange affected animals while research is undertaken.
- Progress knowledge of the impacts of moxidectin on aquatic ecosystems to guide protocols around where it can be used in riparian areas of the ACT.
- Develop and promote a publicly accessible web-based communication portal to enable community members to report wombat sightings and incidence of mange.

The EPSDD has commenced a long term monitoring program at specific sites within the ACT to monitor changes in populations over time including gathering data on mange prevalence and severity. Thirteen Eleven sites were selected based on the known presence of wombats and ease of accessibility. Surveys consist of 1 km transects

walked at a slow pace (45 mins) from 30 mins after sunset in areas where wombats are present. Surveys are carried out in teams of at least two, for health and safety purposes. Surveyors use night vision binoculars to reduce disturbance of wombats that may occur if using torches. When a wombat is seen, the surveyor notes their location (using GPS), takes a compass bearing and estimates the distance to the wombat. Wombats are given a body condition score (ranked 1-5 with 1 being poor and 5 being excellent), a mange score for the wombat, a confidence score (how confident the surveyor is that the animal was properly assessed) and other weather variables. A further two sites are surveyed in the same manner but from a vehicle and with longer transects in the more remote Namadgi National Park by Parks and Conservation Service staff. The surveys are carried out by local wildlife care groups who have expressed concern the data may be used to provide evidence for the need to cull wombats and a reluctance to share the results.

The Australian pesticides and veterinary medicines authority (APVMA) is an independent statutory Authority of the Commonwealth under the *Agricultural and Veterinary Chemicals (Administration) Act 1992*. They are responsible for the regulation and control of agvet chemicals in Australia up to the point of retail sale including the import and export of chemicals. The *Agricultural and Veterinary Chemicals Act 1994* contains the provisions allowing the APVMA to evaluate, approve or register agricultural and veterinary chemical products, issue permits for use, license the manufacture of chemical products, regulate the supply of chemical products and to enforce compliance with the Agvet code.

The *Agricultural and Veterinary Chemicals Code Regulations 1995* prescribe detailed provisions of the Agvet Code. The *Agricultural and Veterinary Chemicals Code (Application Requirements) Instrument 2014* defines the information that must be contained in, or accompany, an application for the registration of a chemical product. This includes the distinguishing name and number, instructions for the use, its constituents and their respective concentrations, the composition and purity of active constituents, formulation type, the net contents, the chemical manufacturer(s) and any other particulars prescribed by the regulations. Identifying information of the holder of the registration of the chemical product (viii) the address of each site at which the chemical product is manufactured by the manufacturer (x) identifying information for any nominated agent for the registration.

There are three active permits which apply to all states and territories in Australia and two active permit holders. The wombat protection society holds two permits for the use of cydectin pour on for cattle with 5g/L Moxidectin as the active constituent. One permit allows for a dose 4 ml per kg of body weight with a max single dose of 100 ml on an adult wombat (>15 kg) with 5 days between doses and no more than 5 doses. The efficacy and toxicity associated with this dose rate has not been fully evaluated. Users must observe wombats for any toxicity signs as detailed in the critical use comments. Any wombats that die after treatment should be reported to a veterinarian and a detailed postmortem must be carried out. The second permit allows 0.8 ml per kg of body weight with a max dose of 20 ml applied once weekly for 15 weeks. Intervet Australia holds the third permit for Bravecto with 280 mg/ml fluralaner as the active constituent which will expire on 31st of July. The dose is 25 mg/kg of wombat body weight with a maximum of three doses one month apart on wombats > 5 kg.

Commented []: ACT Gov holds the data. Discussion point

Commented []: Ive deleted this sentence as its inappropriate to include here. If this is a concern of the stakeholders it needs to be captured in the stakeholder section below.

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It is the permit holder's responsibility to ensure people operating under the permit are trained in the identification and treatment of mange in wombats. Permit holders must notify the APVMA of new information, including information in accordance with section 161 of the Schedule to the Agricultural and Veterinary Chemicals Code Act 1994. The supplier must provide the product in a container compliant with the requirements of section 18 of the Agricultural and Veterinary Chemicals Code Regulations. Cydectin can be decanted into smaller containers (1L poison bottles with a child proof lid), and is then considered unregistered, and is referred to as 'Moxidectin for Wombats with Mange'. the decanted amount must be used within 1 treatment cycle (5 weeks) in 1-2 wombats. A label identical to Attachment 1 of the APMVA permit must be affixed to the container. Moxidectin for Wombats with Mange must only be supplied as part of a wombat mange treatment kit, which contains a copy of the label for the registered product that has been supplied in the smaller container, a printout of the sign consistent in content with Attachment 2 of the APVMA permit and instructions on its placement and a copy of the permit. Additional directions for use of the product must be consistent with the permit. The Permit Holder must record any adverse experience associated with the use of the product they are made aware of and report them to the APVMA as soon as possible.

There are two APVMA approved treatments for mange in wombats, cydectin[®], a Pour-on for Cattle & Red Deer (active ingredient moxidectin 5g/L) and Bravecto[®] (active ingredient fluralaner)(see section 2.2.1). Both are delivered by topical application using a pole and scoop to pour a dose onto the wombat's back, or a burrow flap that doses the wombat when passing under the flap. The mites survive for 3-4 weeks, while moxidectin is metabolised within 1 week, thus, it requires weekly reapplication for at least 5 weeks to successfully treat mange. Fluralaner is more expensive but longer lasting, it requires three applications at monthly intervals which is much less time consuming for wildlife carers to administer. Moxidectin and Ivermectin have been used effectively to treat wild wombats (Death et al. 2011), following a regime of weekly treatment for 8- 12 weeks (Skerratt 2003b). Preliminary findings from a mange treatment trial in a relatively isolated population at Bents Basin dramatically reduced the number of wombats with signs of mange but required significant manpower. All burrows needed to be treated regardless of status, regular searches for new or previously overlooked burrows were essential. Camera monitoring was needed to detect burrow flap avoidance & guide adjustment (2015) Leary et al. Fluralaner[®] has been used in wild common wombats with success (Wilkinson et al. 2021).

The indiscriminate application of moxidectin at all burrows within an area can lead to accidental overdosing of individual wombats throughout the course of treatment owing to incorrect dosage measurements or wombats moving to a new burrow. Some wombats may not receive a full dose if the chemical splashes as they are exiting a burrow or they move away from the treatment area. Healthy animals within the population will also unnecessarily receive treatments. This could lead to the development of mite resistance arising from inadequate treatments. Anecdotally this has not been observed by carers and it will likely take time for mites to develop resistance. There is also a risk non-target animals are treated, as wombat burrows are known to be used by a range of other native species (ref) and the impacts of moxidectin on these species is unknown. The broadscale use of these chemicals can result in chemical residues within the environment which can have negative impacts on native flora and fauna. Application with a pole and scoop though more time consuming can

Commented []: Are there regulations with regard to distance from water?

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Commented []: Impact on waterways

be targeted specifically to wombats with mange, and will reduce the risks associated with chemical build up in the environment.

More recent and less invasive approaches include the one-off or repeated administration of a topical acaricide. However, topical treatments may not reach mites due to a failure to penetrate parakeratotic scale crust or be adequately absorbed systemically due to a thickened epidermis. Some carers believe other products are safer or more effective and use a range of alternative treatments or supplementary products to relieve itching and treat secondary infection (Table 6). Products other than moxidectin and Fluralaner must be prescribed by a veterinarian.

Outbreaks in populations that normally maintain low mange prevalence (8-20%) are often preceded by environmental stresses, such as droughts. Water and/or food supplementation may be a useful management method to reduce the risk of mange outbreaks after a drought event, however, additional research is needed to understand which environmental variables result in population stress.

Table 6. The products used to treat mange in wombats by wildlife carers surveyed by (review)

Product	Active ingredient	Application
Ivomec®, Genesis®	Ivermectin	Pour on and injectable
Revolution®	selamectin	Pour on
Sulphur and oil		
Advocate®	moxidectin and imidacloprid	
Advantage Plus®	imidacloprid	
Antibiotics		injected
Cetrigen®		Antibacterial Wound Spray
Chloromide®		Antiseptic Pump Spray
oils		Suffocates mites, soften scabs, flush out maggots and soothes skin
iodine		
Malaseb®		
Human skin antiseptic products		
Cattle pink eye spray		
Vitamins		

Current treatment of mange in the ACT

In the ACT, Wombats are currently being treated for mange primarily by Wombat rescue-Rescue volunteers, as well as ACT Wildlife carers. They-Volunteers operate under a-the APVMA permit PER89982 and PER90837 and associated sub-permits, which -to-cover treatment of mange Australia-widenationally. These permits are, issued by-mange-management-under section 112 of the Agricultural and Veterinary Chemicals Code 1994,-under APVMA-permit PER89982-and-PER90837. The-The first permitpermits allows for the treatment of wombats with wombats-mange-using-with-20 ml of M-moxidectin using-via-the-burrow flap application method-or pour on/pole

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and scoop application. ~~and the~~ The second permit allows for the treatment of wombats ~~using~~ with the chemical Fluralaner using a pour pour on methods only.

Wombats are treated at a population level along river corridors using moxidectin. Due to the time intensive nature significant time it takes to ~~of~~ install burrow flaps on every burrow, and because of permit restrictions, volunteers in the area they are only able to treat burrows along a 1 km stretch of the river at a time. They have Mange can be successfully eliminated mange in isolated areas, but where connected populations of wombats occur along river corridors, it is difficult to eradicate mange as infected wombats from outside the 1 km treatment zone can wander in following the course of treatment.

In the ACT, mange-affected wombats are treated both individually and at a population level. Population level treatments are conducted by Wombat Rescue and occur mainly in riparian areas along river corridors and are approved under a permit from EPSDD. Even among experienced careers there is wide disagreement about how best to treat mange [redacted] review)

ACT wildlife-Wildlife administer administers mange treatments in areas that are suitable for rehabilitated wombats to be released but have isolated incidence of mange prior to the release of wombats in care to maximise their chances of survival. Wombat rescue-Rescue regularly responds to call outs to treat and rescue mangy wombats from concerned members of the public and ACT parksPCS. They are concerned rangers do not have the knowledge and training to assess the condition of mangey wombats and determine if euthanasia is necessary. Wombat rescue offer training courses, but they are not mandatory for rangers to attend.

Insert Map known mange distribution

To gain a better understanding of the distribution of mange in the ACT, EPSDD have developed an online portal to enable community to report sightings of mange-affected wombats. Sightings are also reported on WomSAT, an online application developed by researchers at the University of New South Wales. This data adds helps inform the national distribution and prevalence of mange in wombats. Users of WomSAT create an account and sightings must include a photo for verification. While applications of this nature enable capture of data across broad regions, reporting is typically skewed towards areas of high human activity and therefore may not accurately represent the presence/absence of mange.

To progress treatment of mange and improve monitoring of wombats in the ACT, EPSDD convenes the wombat mange and monitoring group (initiated March 2021). Members include two community wildlife care groups (Wombat Rescue and ACT Wildlife), Prof. Scott Carver of the University of Georgia USA (formerly of the University of Tasmania) and EPSDD staff. The group takes a collaborative approach to addressing wombat mange and coordinates activities of the community and ACT Government. Current activities of the Wombat Mange and Monitoring Group include:

- Trialling the use of Bravecto, as a potentially longer-lasting, more effective, and target-specific treatment for mange.

Commented [redacted]: I asked the fauna team to send you a copy of this permit, did you receive it? [redacted] would have one as well.. It has explicit conditions such as only treating a certain length of the river at one time, and minimum distance away from the water that the flaps must be placed. Moxidectin is extremely toxic to aquatic life, including native fish, and these restrictions help prevent disastrous influx of the chemical into the waterways which pose a significant threat of fish kills. I think you should capture the permit conditions here and the risks of mange treatment, before going into the next paragraph to present both sides.

Commented [redacted]: This sentence makes no sense. I don't know what you are trying to say.

Commented [redacted]: This needs to go into the stakeholder section as it is perception, not fact. I think any perceptions/opinions need to go into the stakeholder section and be captured there. There is a decision sheet for the euthanasia of wombats inflicted with mange that rangers follow pulled together by the chief vet for this explicit purpose. It might be worth a revisit though. Again this should have been part of the documents sent across to you.

Commented [redacted]: Add to stakeholder section. Maybe this could be a discussion that can be explored/recommended

Commented [redacted]: Do we have one?

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- Developing a collaborative monitoring program to provide data on wombat populations, distribution, and mange prevalence across the ACT.
- Support mange treatment in public reserves while minimising risks associated with using moxidectin near waterways.
- Undertake collaborative research on the impacts of mange treatment chemicals on aquatic ecosystems.
- Develop and promote a publicly accessible web-based communication portal to enable community members to report wombat sightings and incidences of mange.

EPSDD has commenced a long-term monitoring program at eleven sites within the ACT. The purpose of these surveys is to detect changes in populations over time, and to collect data on mange prevalence and severity. Survey sites were selected based on known presence of wombats and ease of accessibility. Surveys consist of walking 1 km transects at a slow pace (45 mins), commencing 30 mins after sunset. Surveys are carried out in teams of at least two people for health and safety reasons. Surveyors use night vision binoculars to reduce disturbance of wombats. When a wombat is seen, the surveyor notes their location using a GPS, takes a compass bearing and estimates the distance to the wombat. Wombats are given a body condition score (ranked 1-5, with 1 being poor and 5 being excellent), a mange score (same categories as BCS?), and a confidence score (how confident the surveyor is that the animal was properly assessed). Weather variables (describe) are measured at the time of the detection. A further two sites in Namadgi National Park are surveyed annually using the same method as above, with the exception that surveys are undertaken from a vehicle.

3.2.2.Road vehicle collisions

3.2.2.1.1.1. Road vehicle collisions

Collisions with vehicles are a source of mortality or injury for bare-nosed wombats and a safety concern for people. Roadkill records reported in the WomSAT app between 2015-2019 are relatively low in the ACT in comparison to other states (Mayadunnage et al., 2024) (Figure 1). WomSAT relies on citizen scientists to report sightings and thus data may not be representative of all road kills occurring in the ACT. Roadkill records are collected by the urban wildlife team, and it is worth reviewing them to gain a better understanding of the frequency of collisions and identify hotspot areas where intervention may help to reduce collisions. The frequency of vehicle collisions is likely to vary depending on traffic levels, vehicle speed, the density of wombat populations, climate and season (Mayadunnage et al., 2024, Ramp et al., 2005). Wombat road mortalities are higher in winter and early spring (Roger et al., 2011, Mayadunnage et al., 2024, Nguyen et al., 2022). This could be linked to seasonal changes in the activity periods of wombats or more cars being on the road at dawn and dusk due to shorter winter days. Higher wombat road mortalities have been linked to areas of dense forest cover and the greenest ground cover in areas where wombat burrows are present (Roger & Ramp). Within the ACT, most wombats (approximately 50 a year) come into care because of injuries from road vehicle collisions. Adult wombats more often than not die or have life threatening injuries as a result of vehicle

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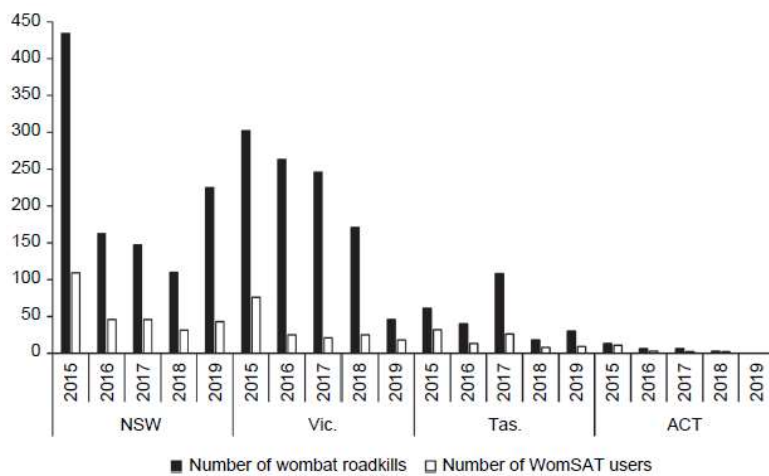
collisions, wombats coming into care are typically young joeys found in the pouches of their deceased mums. The relatively small number of wombats taken into care does not represent the total number of wombats killed.

Wombats can cause substantial damage to vehicles [and](#), it is not known what the average cost of wombat damage is. Analysis of 17,000 animal collision claims between 1 January – 31 December 2023 by Suncorp Group has revealed the most common animals drivers collide with are kangaroos, wallabies, wombats, deer, dogs, cows, emus. [Pigs, foxes and rabbits Group \(2024\)](#). The average cost of an animal collision insurance claim is greater than \$5,000 and 16% of vehicles were written off in claims that involved wildlife. The study revealed 76% of Australians believe kangaroos would cause the most damage to a car if involved in a collision, followed by wombats (16%).

Even if roadkill is not causing widespread declines of wombats, it should be reduced where possible for animal welfare and to reduce road accident, associated vehicle damage and occupant injury. Measures to reduce wildlife vehicle collisions include installing wildlife warning signs, use of deterrent devices mounted on vehicles or posts along roads and installing under and overpasses. Drivers ignore most standard wildlife warning signs. (see deterrents section for more information [on on](#))

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Figure 1. Temporal distribution of wombat roadkill records reported in WomSAT between 2015 and 2019 for New south Wales (NSW), Victoria (VIC), Tasmania (TAS) and the Australian Capital Territory (ACT) (Mayadunnage et al., 2024)

Add Map of roadkill distribution

Commented [redacted]: Urban wildlife data probably more relevant for ACT

3.2.3.Habitat loss

The ACT is around 236,000 hectares, protected National Parks and Nature [reserves-Reserves](#) make up 43.6% (103,026 ha), highly modified urban land accounts for 10%, and 15% is highly modified rural and broadacre

lands. Wombats are predominantly distributed across ~~insert land zone~~. However, it is important to note land zoning may not reflect actual land use, as changes may reflect updates in zoning, rather than actual land development. Land zoned for urban areas may still be undeveloped or may be rezoned to another land use prior to development taking place. Between 2006 and 2022, the ACT's urban area increased by 2,760 ha, a growth of 9%. Most development has been in Gungahlin (Taylor, Throsby, Jacka and Moncrieff) in the north of the ACT, West Belconnen (Ginninderry) and the Molonglo Valley (Whitlam and Denman Prospect). The increase in urban land has been driven by strong and sustained population growth over the last decade. The ACT population is projected to grow to 696,000 by 2050. If historic population density patterns (1,154 people per km²) and urban growth continue unchanged, a 50% increase (14,000 ha) in the urban footprint would be needed by 2050 to accommodate the growing population.

Commented [REDACTED]: Will do rough calculation of wombat presence in parks, rural areas once [REDACTED] has shared data

In recent years the expansion of urban development has caused concern for the safety of wombats and a loss of habitat. Urban development is thought to be pushing wombats into river corridors where wombat densities are already high, resulting in increased stress from resource competition and territoriality (pers. comm wildlife carers 2024) (see section 4.1.43.3-4). However, reports from other stakeholder groups indicate the distribution and abundance of wombats is increasing.

4. Wombat management: ~~Causes-Why is it so complex? of conflict~~

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4.1. Causes of conflict

The management of wombats is highly contentious. Issues arise when ~~trying~~ governments try to balance the competing interests of differing stakeholder groups (Table 5).

Within the ACT, wildlife care groups are concerned for the welfare of the species and advocate for better protections. On the other hand, agriculturalists want to manage the species under an authorised culling program similar to that of eastern grey kangaroos to minimise the damage they can cause to infrastructure, stock and farm personnel. Such a program could take a similar form to that of eastern grey kangaroos, with permits provided through licencing or a Controlled Native Species Management Plan.

Commented [REDACTED]: You might want to list the stakeholder groups in the ACT here. Other stakeholders that are missing below include the Conservator of Flora and Fauna who has a responsibility to conserve and protect native wildlife, parks and Cons who manage much of the land, the general community, and First Nations (Ngunnawal people) who have cultural obligations and connections to fauna on Country.

It is unlikely all stakeholder groups will ~~reach a consensus~~ agree on how best to manage wombats. However, education and participatory planning can improve communication and understanding of the issues and challenges, and increase other stakeholder's awareness of other groups face which can help to increase tolerance and reduce conflicts between groups perspectives. Involving stakeholders in the decision-making and planning process can result in greater ownership and acceptance in the outcome,s; enhance program credibility and transparency, and achievement realization of long-term wildlife management goals (Hewitt, 1997 #1155). Stakeholders are less likely to adopt or support management practices if they feel their opinions have not been taken into consideration and may take management actions into their own hands.

Commented [REDACTED]: Add a sentence here on the other stakeholders in my comment above.

If you could provide some good references that have looked at the complexities in this space that would be great. Then you can say common causes of conflict and stakeholder expectations are further explored in this section.

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3.3.1.4.1.1. Burrowing behaviour

Wombats are one of the largest burrowing herbivores in the world and create warren complexes that vary in complexity from single entrance burrows to a collection of interconnected burrows (warren). Burrows can vary in depth (0.4- 2.8 m) and length (0.5-20 m), as such the spoil mound can be anywhere from 2.5-8 m² {McIlroy, 1973 #78(Triggs, 2009 #64)}. A single wombat can use up to 11 burrows within their home range, though they typically favour the use 1-2 burrows within their home range most of the time (ref). Though their burrowing provides essential ecosystem services it often leads to conflicts with people. Wombat burrows can undermine infrastructure such as roads, buildings, water tanks, fencing, dams which can result in substantial damage, financial costs and safety concerns.

Commented [1]: You have listed all the issues that farmers have with wombats (and urban development), but what is missing from this section is the responsibilities and needs from the conservation side. I would suggest two additional sections here at least: one on native species conservation, and the second focused on First Nations cultural value and connection to the species and Country. You might want to add an animal welfare angle.

One of the main points of contention for landholders with wombats on their properties in the ACT is the damage and occupational health and safety risks wombat burrows can cause. This includes damage to fencing, dams, roads, buildings and erosion. Damage to fencing, caused by wombats burrowing underneath it can result in stock escaping from paddocks, posing a safety risk to both stock and people. Livestock may become injured or lost once they escape from the safety of a property resulting in financial losses to the landholder. Where properties adjoin parks and reserves there is a risk escaped stock may wander in and are not able recovered, resulting in damage to parks and reserves and potential fines and financial loss for landholders. Furthermore, landholders have a legal responsibility to ensure their animals do not stray from their property and can be held liable for any damages if their stock escape and cause a road accident or any other damage to personal property. Fence damage can also allow access to properties from undesirable pest species such as pigs.

Landholders and Icon water have reported issues with wombats burrowing into the sides of dams or reservoirs. This is not only a safety concern for people but also the wombat. If a dam wall breaks it has the potential to release large volumes of water threatening farm water supplies and downstream properties and on a much larger scale could impact Canberra's water supply if not appropriately managed. In addition, it could cause increased erosion and sediment washing into the Murrumbidgee River. This places a significant financial burden on the landholder who is responsible for appropriately maintaining their dam and the associated damage it may cause if it fails. Icon water have been managing this by using one-way gates to force the wombat to leave the burrow and filling the hole with cement once the wombat has been evicted.

Wombats burrowing under roads, tracks and in paddocks is a serious safety concern for people and has been reported as an issue by Icon water, landholders and park rangers. It would also be worth checking with local councils. The weight of a vehicle driving over a wombat tunnel, particularly if it is close to the surface can cause the tunnel to collapse. It often results in damage to the vehicle, associated time costs recovering the vehicle from the hole and time and costs repairing the damage to both vehicle and roads. For landholders vehicles and

Commented [2]: The ACT government is the local council

stock falling in wombat burrows in the middle of paddocks is also a significant safety concern for people and stock. If travelling by motorbike it can lead to significant injuries, such as broken limbs and subsequent lost income while recovering. Landholders have reported [this occurring](#) as frequently as once a month with estimated damages costing ~\$1,000. During summer when grasses are high visibility of wombat burrows is greatly reduced increasing the risk of falling into a wombat burrow. It is the responsibility of the landholder to maintain a safe working environment and in some instances, contractors who have sustained injuries and subsequently lost work as a result of falling into a wombat hole have sued. Stock also fall in wombat burrows resulting in broken legs, raising concerns for stock welfare and resulting in financial losses. One landholder has had to remove high value stock from a particular paddock due to the risks wombat burrows pose to their safety. Due to safety concerns some landholders don't access parts of their properties which can make land management practices such as weed control difficult. Park rangers have reported growing discontent among the community due to wombats burrowing on walking and cycling trails and staff and contractors are unsure how to deal with them, often leading to trails being rerouted along sub-optimal routes. While burrow entrances can be mapped to reduce the likelihood of driving into them it would need to be done on a regular basis as new burrows could be created at any given time. The mapping of wombat tunnels is possible but on a large scale it is likely infeasible for landholders (see section [6.25-2](#)).

Commented [redacted]: What exactly - motorbike accidents, road collapse? This seems high

Wombats have also been known to burrow under other infrastructure, such as buildings, water tanks and wastewater treatment drying beds. They can be removed with the use of one-way gates, and the burrow filled back in, however, re-excavation is an ongoing issue. Landholders have tried using mesh to prevent wombats digging back in however it only proved effective for six months. Icon water use a range of methods to prevent wombats re-excavating under infrastructure including the installation of cement skirts, placement of large rocks or mesh skirting. It requires ongoing maintenance and monitoring to [keep](#) wombats out of undesirable areas. Wombat burrows can also harbour rabbits adding an extra layer of complexity when it comes to controlling them. Where rabbits are found to be using wombat warrens, [Icon water](#) install one-way gates and once the wombat has vacated, they fumigate the warren to kill the rabbits before letting the wombat back in.

Icon water have sought advice from ecologists on how best to manage the damage wombats cause to essential services infrastructure, [however, they have had trouble getting ecologists on site to implement their recommendations](#). Icon water have had to manage wombat damage in house with a variety of management strategies dependent on the problem at hand. While they are happy with their current management program, it requires [ongoing](#) monitoring and maintenance. As a large government owned organisation they have a lot more resources than a small-scale farm who may find the same management practices infeasible.

Commented [redacted]: Who do they expect to do this?

[3.3.2.4.1.2.](#) Grazing competition

Within the ACT there are 20,869 ha of [Agricultural-agricultural](#) land, [the](#) majority of that is stock grazing land, with a small amount of cropping. Though competition with livestock for food has been reported as an issue of concern in other states ([O'Brien, 2019 #72](#) [stott](#)), landholders in the ACT have not reported it as an issue, stating Kangaroos pose a significant grazing impact but wombats do not. While wombats have a low metabolic rate when they can occur in high densities and are known to create visible grazing halos around their warrens.

The density of wombats on properties can vary both regionally and locally and may influence reports of grazing competition. For example, within the Murraylands of South Australia southern hairy-nosed wombats have an estimated DSE (dry sheep equivalent) of 0.5, comparatively sheep have a 1.2 DSE. Dry sheep equivalent represents the energy requirement of a dry 50 kg ewe which is 8.3 megajoules metabolisable energy per head per day (MJ ME/hd/day). Landholders have had to reduce their stocking rate by 20%, to account for the impacts of growing wombat populations. Without the ability to control the growth of wombat populations the viability of some farms is being threatened. It is possible the differing climatic conditions in which bare-nosed wombats in the ACT occur means they might not have a substantial grazing impact. However, only three landholders were consulted in the writing of this document, and it is recommended further consultation is undertaken to understand the extent of the problems landholders are facing within the ACT.

Commented [REDACTED]: On average?

Commented [REDACTED]: Further consultation at this stage? It is not an issue I have heard brought up at this stage

3.3.3.4.1.3. Erosion

Wombat burrows are often perceived to cause erosion in creeks and gullies; however, the extent of damage has not been quantified. It is possible past land clearance resulted in increased soil instability and lead to wind and water erosion of creek lines over time resulting in steep sloping creek banks. When wombats burrow into steep banks, they undercut and destabilise them, the effects are exacerbated in unstable soils where there is a lack of vegetation to hold the soil together. The eroding soils get washed into the Murrumbidgee River which has environmental implications for the river systems. Landholders have taken steps to reduce erosion risks such as fencing stock out of creek lines, however they are unable to prevent wombats from digging into the banks of creeks and wombat damage to fences can allow stock into the creek lines. One landholder remediated the creek line of his property to reduce the erosion and subsequent damage to the surrounding aquatic environment, with the help of ACT NRM and community groups. It took significant effort getting the necessary approvals and on top of the time and costs of the work itself, totalling over \$50,000. This work was undertaken as part of a grant program and would otherwise have been infeasible on a small landholder scale. Furthermore the landholder reported difficulty in dealing with 'red tape' associated with the project and would not have completed it without the help of the ACT NRM. Assessment of erosion damage is needed to determine the underlying cause and quantify the damage so remediation can take place and the most appropriate management action can be implemented. If remediation work is to take place on a small landholder scale they will need support from the government to implement it.

Commented [REDACTED]: Those in the ACT are leaseholders, not landholders.

Commented [REDACTED]: Need to clearly differentiate between fact and opinion.



Figure 2. Top – the eroding creekline on a landholders property prior to remediation works. Bottom – the creekline after remediation works.

3.3.4.4.1.4. Land clearance for urban development

Recent expansion of urban development has caused concern for wombats. Though wombats are a protected species they are not threatened and thus do not need to be considered when assessing a [property-site](#) for development approval. As such, developments have been planned, approved and construction commenced in areas where wombats occur without consideration for the impacts of roads and buildings. Though it is an offence to kill or interfere with a wombat under the Nature ~~conservation~~-Conservation Act 2014, burrows have reportedly been destroyed during earthworks by developers, potentially burying wombats alive ([pers. comm wildlife carers 2024](#)). Wildlife carers have reported increased numbers of call outs in areas where urban development has or is occurring. This has highlighted the need for a greater understanding of the impacts of development on wombats.

[As a response to these potential impacts from development on wombats and other burrowing animals, the Conservator of Flora and Fauna has developed Conservator Guidelines for Burrowing Animals. The impacts of urban development on wombats and other burrowing animals has highlighted the need to develop guidelines to](#)
[The purpose of the guidelines is to](#) improve consideration of [them-burrowing animals](#) during development and

Commented [redacted]: Reword. The wombats are not concerned, but may be impacted. Wildlife groups are concerned

Commented [redacted]: Single or plural?

provide direction to developers on best practice methods to minimise harm. The guidelines will apply to any new developments within the ACT, ~~and the conservator of flora and fauna any decisions made are consistent with implementing the guidelines.~~ Developers will need a suitably qualified ecologist to identify burrow and shelter sites, ~~and~~ monitor them for activity ~~and ensure they are vacant or~~ avoided ~~them during planning stages wherever practicable.~~ Wombat ~~R~~rescue and ICON water have highlighted there are a ~~lack of qualified ecologists~~ in the ACT that make it difficult to conduct appropriate assessments. Wombat ~~rescue~~ ~~Rescue~~ are often called by ecologists seeking advice on how to manage wombats (pers. comms wombat rescue 2024). Where avoidance of burrows is not possible developers can apply for a licence to destroy burrows and must follow the guidelines to ensure this is done with minimal disturbance to animals (see section ~~6.35.3~~ for more information on burrow management).

Commented [REDACTED]: This is not a lack of qualified ecologist, this is a lack of ecologists with relevant experience/capacity.

The guidelines don't take into consideration the potential for new developments to fragment and isolate populations, limiting dispersal and resulting in genetic differentiation over time. Prior to any new land use zoning consideration should be given to whether wildlife populations will be disconnected resulting in small and isolated populations that over time could result in inbreeding. There is also concern development is pushing wombats into narrow river corridors where increased densities of wombats could result in increased stress competition for resources placing animals under increased stress. Without a more detailed understanding of the abundance of wombats ~~and carrying capacity~~ in the ACT it is difficult to determine the impacts of increasing development and expansion. Furthermore the carrying capacity of wombats is unknown and likely to vary from region to region based on habitat and resource availability.

If wombat densities are reaching a critical limit with food resources it can increase stress, competition and ultimately population declines. Increased stress and high wombat densities are often associated with increased mange prevalence (~~ref~~). Areas closer to fresh water are also predicted to have the highest suitability for mange (*Ringwaldt, 2023 #21*). Urban areas abutting river corridors where wombats occur could result in increased human-wombat interactions due to increased public access which could be positive or negative. Dispersing wombats may wander into urban areas where conflicts can occur (e.g. burrow damage) and be more susceptible to road vehicle collisions. There could be increased interactions with pet dogs being walked in river corridors resulting in injuries to wombats or dogs. Dogs have been known to enter wombat burrows where they may contract mange, get stuck or become injured. Increased ~~Public-public~~ education on the implications of living near wombats and what to do if they encounter one will be essential (~~see recommendations~~).

It is important to note no developers were consulted in the preparation of this report and consultation with them is recommended to improve wombat management in areas under development.

3.3.5.Human conflict on how to manage wombats

~~The management of wombats is highly contentious, issues arise when trying to balance the competing interests of differing stakeholder groups (Table 5). Within the ACT, wildlife care groups are concerned for the welfare of the species and advocate for better protections. On the other hand, agriculturalists want to manage the species under an authorised culling program similar to that of eastern grey kangaroos to minimise the damage they can~~

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cause to infrastructure, stock and farm personnel. It is unlikely all stakeholder groups will reach a consensus on how best to manage wombats. However, education and participatory planning can improve communication and understanding of the issues other stakeholder groups face which can help to increase tolerance and reduce conflicts between groups. Involving stakeholders in the decision-making process can result in greater ownership and acceptance in the outcomes, enhance program credibility, and realization of long-term wildlife management goals (Hewitt, 1997 #1155). Stakeholders are less likely to adopt or support management practices if they feel their opinions have not been taken into consideration and may take management actions into their own hands.

4.5. Stakeholder consultation and community engagement in the ACT

4.1. Wombat working group

The EPSDD developed-initiated at the wombat working group in 2021. The working group brings together stakeholders with interests in wombat management in the ACT to share knowledge and discuss wombat management issues. The group consisted of wildlife carers, ACT government, Agriculturalists-agriculturalists and researchers. The group initially met quarterly via zoom but as the need for meetings decreased due to a lack of evidence on which to base decision making it was scaled back until it was eventually suspended in 2024. A manage management sub group is ongoing (see section 3.2.1). The EPSDD reported they had trouble engaging landholders-land managers within the working group.

Separate sub-groups that address issues relevant to each stakeholder group may prove more fruitful in engaging with landholders and potentially developers. Nominated representatives from each sub-group could report to a wombat working group where broader discussions and decisions about wombat management in the ACT as a whole can be made.

Table 75. Identified stakeholders within the ACT

Group	Organisation/name	Role
ACT Gov	~~Conservator liaison~~ Office of the Conservator of Flora and Fauna, Environment, Planning and Sustainable Development Directorate	Acts on issues that affect the conservation matters embodied in the NC Act, particularly protecting native plants and animals
	Policy ONC	
	Office of Nature Conservation, Environment, Planning and Sustainable Development Directorate	undertakes a range of nature conservation programs in the ACT, including research on local flora and fauna, preparing scientific advice on ecological and natural resource management, conducting ecological surveys, biodiversity monitoring
	Transport Canberra and City Services	Deliver a range of services, including shop and playground upgrades, road and path maintenance, domestic animal services, and the management of urban open spaces including tree planting and grass mowing

Commented [1]: Do I have that right?

	Natural Resource Management ACT, Environment, Planning and Sustainable Development Directorate	Integrated management of ACT's natural resource, including biodiversity, sustainable agriculture and cultural history
	DP	
	Parks and Conservation service	Administering the nature conservation Act 2014
	VetVeterinarians	Administering treatment and care of animals including wildlife within the ACT
Industry	Developers	Responsible for construction of new developments within the ACT
	Icon Water	Supplier of water and sewage services in the ACT
Agriculturalists	LandholdersRural leaseholders	Land management and agricultural production
	ACT Farmers association	Advocates for farmers and best practice farming within the ACT
Wildlife carers	Wombat Rescue	Caring for injured wombats and treating mange
	ACT Wildlife	infected populations within the ACT. Advocate for wombats.
Researchers	Prof Scott Carver	Conducting research on wombat ecology, biology and management
Ngunnawal		

Commented []: Hmm, this needs reworking

Relevant roles include land management of the conservation estate, licensing and compliance under the Nature Conservation Act, vertebrate pest and weed control programs

Commented []: vague

Commented []: Though you are not currently working with them I've added a few more academics here that I thought might be of interest to you.

Commented []: DNCCC

This section lists the primary stakeholders invested in wombat management in the ACT, and their interests in this issue.

4.2.5.1. [LandholdersRural leaseholders](#)

[Rural leaseholders Landholders](#) within the ACT are quite frustrated by the current level of engagement with government on wombat management issues. Those involved in the wombat working group found it to be dominated by the opinions of wildlife carers with a strong focus on wombat conservation and mange treatment. The only researcher in the group while knowledgeable on mange management had little to no knowledge of the issues [landholders-rural leaseholders](#) face managing wombats on agricultural land and the group could have benefitted from expertise from other researchers. As such, [rural leaseholders landholders](#) feel their voices aren't being heard or were not comfortable speaking out in an environment dominated by conservationists due to a fear of bullying and persecution and they disengaged from the working group. A greater focus should be placed on working with [rural leaseholders landholders](#) to better understand the management issues they are facing and develop damage mitigation strategies to improve co-existence with wombats. Even where damage mitigation strategies have been proven to be effective if they are not readily accepted by [rural leaseholders landholders](#) they will not be implemented. A stakeholder sub-group focused on damage mitigation in an environment landholders feel safe expressing their views is recommended to improve landholder participation (see section [7.1.16.1.1](#)).

Increased [rural leaseholders landholder](#) education of the ecological role wombats play is also likely to not only help managing the species but also improve [rural leaseholders rural leaseholders landholder](#) tolerance of them.

Commented []: Need to make this clear how representative this is. Is this a couple of leaseholders or the majority? The people who have no issues don't generally say anything

Research has shown that landholders who view pest species as having an ecological role to play are more likely to be tolerant of them (Schumann, 2012 #387).

Commented [REDACTED]: This suggests they are a pest species, which they are not

4.3.5.2. Wildlife carers

Commented [REDACTED]: Not the right spot for this

There are two wildlife rescue organisations within the ACT that care for and rehabilitate sick and injured wombats, Wombat ~~rescue-Rescue~~ and ACT ~~wildlife-Wildlife~~. Wombat ~~rescue-Rescue~~ is dedicated specifically to wombats and in addition to caring for sick and injured animals they offer a range of other services including education and training sessions and population treatment of mange. The organisation has about 60 members, 20 of whom actively care for wombats and respond to calls for help. Wombat ~~rescue-Rescue~~ operates under a licence to take, rehabilitate and release wildlife in the ACT- LT202224 issued under Section 273 of the Nature Conservation Act 2014. Wombat ~~rescue-Rescue~~ have reported responding to several call outs a day and [REDACTED] has switched to part time work so she can meet the demands of caring for wombats in the ACT. ACT Wildlife ~~Act~~ not only care for wombats, but all injured wildlife within the ACT. They work closely with Wombat Rescue and NSW care groups to coordinate the care of wombats and make the best use of available resources. For example, when NSW care groups have too many wombats to care for and not enough carers and ACT wildlife have carers without wombats, they will transfer animals in care and vice versa. In the last 6 months wombat rescue have taken 19 wombats into care.

Lastly the availability of ~~available~~-release sites for rehabilitated wombats is a concern ~~to the wildlife carer groups~~. There are certain criteria both groups look for including areas of a suitable size, free from mange, away from roads where vehicle collisions may occur, have a low density of resident wombats to compete with for resources and have available food and water. ACT ~~wildlife-Wildlife~~ procure empty burrows to release animals into by placing one way gates on occupied burrows to prevent the resident wombat entering so they have an empty burrow to release a rehabilitated wombat into. In the last 6-7 years have released 10-15 of 60 wombats in ACT the rest have been released in NSW. Wombat ~~rescue-Rescue~~ create burrows to release animals into by digging a 70 cm deep L shaped tunnel in flat ground and placing a 45 cm diameter trench liner half pipe over the hole before filling it back in to make a tunnel. When creating tunnels on private land they use soft release techniques, fencing in the burrow and providing supplemental food. ~~If releasing an animal into a park or reserve they use hard release techniques~~. They monitor the release site for a few weeks using motion sensor cameras, however the released animals rarely stay in the release area. Both groups are investigating the use of GPS tracking technology to monitor released wombats.

Commented [REDACTED]: Digging a burrow in a reserve?

4.4.5.3. Community engagement

As urban sprawl encroaches on wombat habitat there will likely be increases in human-wombat interactions and potential conflicts in urban areas. Increased community education on wombat biology and ecology and what to do of wombats are encountered are recommended. Increased public awareness of the problems that arise from living with wombats and the costs of damages may help to overcome resistance to their control, as those who

Commented [REDACTED]: Ok so again loads of major stakeholders missing from this section. ICON water and other government agencies e.g. NCA and Defence which are Commonwealth Government, the NPA (national Parks association), the broader community, the Ngannawal community, the conservator, Parks and Conservation service, universities and academics, developers etc. It's a lot messier than this.

are aware of the damage animals cause are more likely to support control {Reiter, 1999 #543}. Surveying the public's knowledge and views towards wombats and their management will give wildlife managers a better understanding of the disparities between stakeholder groups and how best to reconcile them. A more participatory approach between [landholders, rural leaseholders, land managers](#), government departments, and conservation groups is recommended for the continued development of effective management strategies.

5.6. Wombat management tools and options

The management of wombats is a highly contentious issue. Problems arise when trying to strike a balance between the competing interests of farmers, conservationists, the public, and the needs of the species. Conflicts have traditionally been resolved using lethal controls, however, there is increasing advocacy for the development of non-lethal management options. There is currently a lack of quantitative evidence on the effectiveness and humaneness of damage interventions on which to base policy and advice. Many damage mitigation techniques have not been adequately researched in natural environments, produced mixed results, or fail to provide long-term relief from conflict {Barlow, 2010 #274; Koehler, 1990 #857; Mason, 1998 #916; Barlow, 2010 #274}. Given the nature of conflicts vary greatly, no single management technique will alleviate all conflicts. A variety of damage mitigation techniques are needed that can be tailored to the ecological, social, cultural and economic realities in which conflicts occur {Dubois, 2017 #1046}. Quantified research on the extent and impact of conflicts, the distribution and abundance of wombats and the effectiveness of lethal and non-lethal conflict mitigation measures is required to guide decision makers and develop successful management strategies that balance the needs of wombats with stakeholders.

5.1.6.1. Fencing

5.1.1.6.1.1. Foot netting

Excluding wombats from areas where they are causing damage such as to high value infrastructure or resources can help to reduce damages and increase landholder tolerance towards wombats. Several wombat exclusion fence designs have been trialled. Attaching foot netting to the bottom of fences has been found to temporarily reduce the number of holes dug in fencing by 35-63% for up to 3 weeks {Marks, 1998 #116}. {Borchard, 2009 #23@@author-year;, #1281@@hidden;Borchard, 2009 #1281@@author-year;Borchard, 2009 #1281@@author-year;Borchard, 2009 #23@@author-year;Borchard, 2009 #23@@author-year} trialled using hinged joint wire (80 cm wide x 15 cm spacings) attached to the outside of existing fence and flattened along the ground and secured with tent pegs every 1 m along a 100 m section of fence and silt fencing (770 mm wide) laid out in the same manner and secured every 30 cm. In both designs hinge wire foot netting was also placed on the inside of the fence at wombat breach points. The foot netting trial resulted in a mean exclusion rate of 35% for a one month. In the absence of aversive stimuli wombats quickly learned to chewed through the silt fence or dig under the wire netting.

Commented [1]: This needs to be more than just tools, it needs to include options of "no management" and consequences (could just be a sentence at the beginning but that is what the status quo is!!!). This section would also benefit from a split into lethal and non-lethal methods.

5.1.2.6.1.2. Wombat gates

Commented []: Read up on the latest research

Swinging gates have been recommended to reduce fence damage by wombats in Australia {Breckwoldt, 1983 #843;Triggs, 2009 #121} which can allow stock to escape paddocks or other unwanted animals from entering crop fields. Wombats can make numerous breaches in fencing and the installation of gates at every breach point may be impractical. The placement of gates would depend on the density of wombats in the area and the number of access points being used. Gates should be installed at the most well-used breaches and exclusion netting can be used to 'train' wombats to use the gates. Anecdotal evidence suggests wombats will use gates placed up to 800 m apart without making new holes (Triggs, 2009). {Breckwoldt, 1983 #843@@author-year} recommends gates of a timber construction which is likely to require regular maintenance. Newer fence designs consist of heavy-duty weld mesh gates weighing at least 2-3kg if trying to exclude other animals such as wallabies (Statham and Statham, 2009, Driessen). If wombats could not see through gates they would dig a hole next to it rather than use it (stathan). Gates weighing between 4.5-16 kg have also been reported to be used by wombats (Coates, 2013). Borchard et al. (2009) found wombats continued to breach the foot netting of fencing for the first few months while they learned to use the gates requiring ongoing repairs. Driessen et al. (2020) wired the gates open for two weeks to allow wombats a habituation period, but did not report on fence breaches throughout the study.

The decision to use wombat gates or a combination of wombat gates and exclusion fencing will depend on the extent of the problem, the cost of the damage and the cost to purchase, erect and maintain the length of fence protection required. The installation of gates can be laborious and will likely require ongoing maintenance. The installation of gates in fencing will prevent damage to fencing but it does not prevent wombats from accessing areas where their behaviour may cause further damage on the property, thus not all property managers will readily accept the use of swinging gates or view it to be a successful damage mitigation strategy (Borchard and Collins, 2001).

5.1.3.6.1.3. Electric fencing

Electric fencing has been shown to exclude wombats from areas where their behaviour conflicts with human land use {Marks, 1998 #116;St John, 1989 #62}. The electrification of the dog fence along the Nullarbor Plain in south east Australia has reduced southern hairy-nosed wombats digging under fences and allowing dingoes (*canis lupis dingo*) to enter agricultural properties {St John, 1989 #62}. To electrify the fence, an additional two strands of wire 15 and 30 cm above the ground, positioned approximately 30 cm away from the original fence were constructed. The fence is patrolled regularly by dog baiters who also assess the fence for signs of damage. Most damage occurs from wombats inside the fence attempting to travel north, however, it has prevented them from doing so and resulted in wombats moving south of the highway into crop land where they had not previously been transferring the conflicts to different locations (pers coms landholders). Marks (1998) found electric fencing produced variable results, with electric fencing reducing the number of holes by 0-92% over 13 weeks. Landholders who used electric fencing to exclude southern hairy-nosed wombats from their properties reported it to be unsuccessful as the electrified strands were often shorted out by vegetation or debris and it

was to time intensive to check [REDACTED]. Electric fencing is costly and time consuming to maintain on a small scale. Landholder perceptions of success may not be influenced solely by damage reduction, but also by the time and costs associated with implementing and maintaining control measures.

The use of electric fencing to reduce wombat damage is best suited to protecting small areas with important assets inside wombat free areas. Electric fencing will require regular inspections to ensure the fence hasn't been damaged or shorted out and involves construction costs and ongoing costs to run.

Insert images of fence design

5.2.6.2. Ground penetrating radar

Ground penetrating radar has been used successfully to map southern hairy-nosed wombat burrows (Swinbourne* et al., 2015). While it is not a direct damage mitigation method it may prove useful for choosing the most appropriate management action for burrows in unfavourable locations. Ground penetrating radar can be used to determine the length, depth and direction of wombat tunnels and help determine if a burrow is main, secondary or starter burrow. Mapping the locations of tunnels can help to prevent accidents. For example, vehicles or machinery sometimes fall down tunnels as they collapse under their weight particularly in agricultural settings knowing the locations of tunnels means this can be avoided. However, in areas with a high density of tunnels this may be unavoidable. There are various ground penetrating radar systems available, simple units can be hired for between \$200-400 a day and can reach up to 8 m depth.

5.3.6.3. Burrow collapsing

The removal of burrows from problem locations where they pose a threat to human safety or infrastructure may serve as a means of reducing conflicts. As wombats are known to use multiple burrows within their home range, the opportunity exists to remove problem warrens and moderate their burrowing activity with minimal impact on the wombats. However, widespread burrow destruction is not recommended as it can lead to the displacement of wombats. It is also important to consider the impact of burrow collapsing on young at foot who may not be able to travel long distances. Historically burrow collapsing has been used following fumigation to prevent neighbouring wombats from recolonising the area, however, it was rarely successful with wombats reopening burrows (Marks, 1998). Burrow collapsing in combination with other methods to exclude wombats from areas where they are causing damage may prove more effective.

The gradual collapsing of occupied wombat burrows over three days in combination with the use of deterrents has been trialled as a management option for southern hairy-nosed wombats (Sparrow, 2016 #912; O'brien, 2018 #1266). This method involves collapsing the first 1-2 m of the tunnel on day one, followed by another several meters on day two. The tunnel is left open, providing a clear exit point for wombats. The disturbance of the burrow on over the first two days is 93% effective in getting wombats to exit the burrow before ripping the tunnel on day three (O'brien, 2018 #1266). On day three the tunnel is carefully ripped with a backhoe, stopping every few meters to check the direction of the tunnel and look for signs of occupancy. If a wombat is still within

the tunnel, it can be left for another day to see if the wombat will leave. On one occasion a wombat failed to leave on the fourth day and had excavated a further 7 m of tunnel despite the presence of alternate inactive burrows nearby ($\leq 50\text{m}$ away). The failure of burrow disturbance to get the wombat to leave may reflect the importance of the burrow. Although wombats may use up to 10 different warrens within their home range, they usually use 1-2 warrens on most occasions to which they display high site fidelity (Shimmin *et al.* 2002; Finlayson *et al.* 2005).

Both studies trialled the effectiveness of dingo urine and faeces in deterring wombats from re-excavating collapsed tunnels and produced mixed results. Sparrow *et al.* (2016) found untreated collapsed wombat burrows on the Nullarbor plain in South Australia were recolonised within 75 days while those treated with dingo scents showed minimal activity. In contrast, collapsed warrens in the Murraylands of South Australia were recolonised within a month in 58% of cases while others were not recolonised for up to 6 months and dingo urine and faeces were not found to significantly impact the time taken for wombats to recolonise burrows (O'Brien, 2018 #1266). The differences in results between the two studies could be attributed to variances in the methods used or environmental factors such as predator densities at the sites or burrow availability and importance and warrants further investigation. Although burrow collapsing is considered non-lethal its impacts on evicted wombats has not been studied and warrants further investigation. Studying the impact of burrow collapsing on wombats may help to answer questions about the reasons for its success or failure. Burying steel mesh at the location of the collapsed burrow is untested but may prevent wombats from re-excavating.

Alternate methods could trap and relocate wombats or empty burrows using one-way gates placed in burrow entrances prior to collapse. Trapping is more time consuming and costly as traps need to be checked every morning and it requires careful planning and trained personnel to handle and relocate the wombat(s) but removing animals from the area may provide longer term relief from conflict (see section 6.55-6). One-way gates can be installed and left in place until the burrow is empty, though regular assessment of the gate is recommended as wombats have been known to dig around or under them. Motion sensor cameras can be used to determine if a burrow is empty. Low-cost methods such as raking the soil to assess for footprints or the placing of sticks in a burrow entrance can be used to determine if a burrow is empty however, it is not always possible to determine if a wombat has gone into the burrow or exited.

The time and costs of burrow collapsing will vary on a case-by-case basis. Some burrows may be simple single entrance tunnels that take 1.5 hrs to rip while other more complex 5 entrance warrens that are 4 m deep can take up to 10 hours (O'Brien, 2018 #1266). Soil type and burrow depth will impact the time and costs associated with burrow destruction. Given the time and costs of collapsing burrows along with the low success rate it is not a viable long-term solution to wombat management, but it may prove useful in certain situations. Given wombats within the ACT breed year-round consideration needs to be given to the potential for there to be young at foot that may not be able to travel to the next nearest burrow or move through a wombat gate. Though these studies found burrow collapsing did not result in new burrows being dug in other locations it is always possible that it could transfer the conflict to a new location.

5.4. Mange treatment

Prevention of mange in Australia is considered almost impossible. All disease transmission pathways would need to be stopped to prevent mange outbreaks in wildlife populations, including the control of transmission from all host species carrying the mite such as foxes. However, treatment can alleviate mange at a population level, though ongoing monitoring is required to ensure it does not return through outside pathways. Diagnosing the disease in its early stages can be difficult without catching and examining animals. It initially presents as skin reddening and hair thinning which can also occur because of malnourishment often associated with low feed quality and low rainfall, creating the potential for false negatives and positives (Fraser et al., 2018; Valdeperes et al., 2019). As the disease progresses visible signs of itching, alopecia and epidermal crusting can be seen (Pence & Ueckermann, 2002). Ideally mange should be diagnosed and treated by qualified veterinarians, so they can receive the proper chemical administration and dosage. However, this is not possible in wildlife populations and mange is typically diagnosed and treated by well-meaning wildlife carers and volunteer groups with varied levels of training, experience and coordination. Even among experienced carers there is wide disagreement about how best to treat mange (review).

There are two APVMA approved treatments for mange in wombats, cydectin[®], a Pour-on for Cattle & Red Deer (active ingredient moxidectin 5g/L) and Bravecto[®] (active ingredient fluralaner) (see section 2.2.1). Both are delivered by topical application using a pole and scoop to pour a dose onto the wombat's back, or a burrow flap that doses the wombat when passing under the flap. The mites survive for 3-4 weeks, while moxidectin is metabolised within 1 week, thus, it requires weekly reapplication for at least 5 weeks to successfully treat mange. Fluralaner is more expensive but longer-lasting, it requires three applications at monthly intervals which is much less time consuming for wildlife carers to administer. Moxidectin and Ivermectin have been used effectively to treat wild wombats (Death et al. 2011), following a regime of weekly treatment for 8-12 weeks (Skerratt 2003b). Preliminary findings from a mange treatment trial in a relatively isolated population at Bents Basin dramatically reduced the number of wombats with signs of mange but required significant manpower. All burrows needed to be treated regardless of status, regular searches for new or previously overlooked burrows were essential. Camera monitoring was needed to detect burrow flap avoidance & guide adjustment (2015) Leary et al. Fluralaner[®] has been used in wild common wombats with success (Wilkinson et al. 2021).

The indiscriminate application of moxidectin at all burrows within an area can lead to accidental overdosing of individual wombats throughout the course of treatment owing to incorrect dosage measurements or wombats moving to a new burrow. Some wombats may not receive a full dose if the chemical splashes as they are exiting a burrow or they move away from the treatment area. Healthy animals within the population will also unnecessarily receive treatments. This could lead to the development of mite resistance arising from inadequate treatments. Anecdotally this has not been observed by carers and it will likely take time for mites to develop resistance. There is also a risk non-target animals are treated, as wombat burrows are known to be used by a range of other native species (ref) and the impacts of moxidectin on these species is unknown. The broadscale use of these chemicals can result in chemical residues within the environment which can have negative impacts on native flora and fauna. Application with a pole and scoop though more time consuming can

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be targeted specifically to wombats with mange, and will reduce the risks associated with chemical build up in the environment.

More recent and less invasive approaches include the one-off or repeated administration of a topical acaricide. However, topical treatments may not reach mites due to a failure to penetrate parakeratotic scale crust or be adequately absorbed systemically due to a thickened epidermis. Some carers believe other products are safer or more effective and use a range of alternative treatments or supplementary products to relieve itching and treat secondary infection (Table 6). Products other than moxidectin and Fluralaner must be prescribed by a veterinarian.

Outbreaks in populations that normally maintain low mange prevalence (8-20%) are often preceded by environmental stresses, such as droughts. Water and/or food supplementation may be a useful management method to reduce the risk of mange outbreaks after a drought event, however, additional research is needed to understand which environmental variables result in population stress.

Table 6. The products used to treat mange in wombats by wildlife carers surveyed by [redacted] (review)

Product	Active ingredient	Application
Ivomec®, Genesis®	Ivermectin	Pour on and injectable
Revolution®	selamectin	Pour on
Sulphur and oil		
Advocate®	moxidectin and imidacloprid	
Advantage Plus®	imidacloprid	
Antibiotics		injected
Cetrigen®		Antibacterial Wound Spray
Chloromide®		Antiseptic Pump Spray
oils		Suffocates mites, soften scabs, flush out maggots and soothes skin
iodine		
Malaseb®		
Human skin antiseptic products		
Cattle pink eye spray		
Vitamins		

5.5.6.4. Deterrents

Designed to capitalise on an animal's mechanisms of threat detection, deterrents aim to discourage the use of human resources with aversive stimuli (Ramp, 2005 #322; Apfelbach, 2005 #328; Schakner, 2013 #840). A wide range of deterrents, such as chemical cues, novel objects, and painful stimuli are increasingly being marketed as non-lethal means of reducing human wildlife conflict (Breitenmoser, 2005 #296). Although there are numerous studies on the use of deterrents, many devices have not been quantitatively field-tested, and their perceived effectiveness lies in testimonial and anecdotal reports. Controlled lab studies often do not translate to field situations, where numerous uncontrollable environmental factors can influence the way animals detect and

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respond to threats {Mason, 1998 #916;Koehler, 1990 #857;Barlow, 2010 #274}. Even where devices have been field tested, they often produce conflicting results.

Olfaction is known to play an important role in social communication in wombats {Taggart, 2008 #96;Triggs, 2009 #121}, little is known about its role in threat perception. Anecdotally, fertilisers such as blood and bone, dog and human urine are thought to deter wombats (NSW fact sheet). Field trials found no difference in wombat activity before and after placing a cup of blood and bone in burrow entrances (O'Brien et al., 2021). Dingo urine and faeces has been trialled with mixed results. Captive *L. latifrons* increased their exploratory behaviour in response to dingo faeces placed inside burrows, followed by increased use of burrows and concealed locations (Descovich et al., 2012). Sparrow et al. (2016) reported *L. latifrons* showed greater avoidance and prolonged time to recolonisation of collapsed warrens treated with dingo odours than control warrens on the Nullarbor in South Australia. Conversely, the application of dog urine and dingo faeces had no significant impact on the time taken for wombats to recolonise collapsed warrens in the Murraylands of South Australia (O'Brien, 2018). The presentation of dingo urine and faeces at burrow entrances did not deter *L. latifrons* from using them (O'Brien, 2019). The differing results of these studies indicate *L. latifrons* responses to predator odours may be context dependent, but disparities in experimental design and analyses make it difficult to determine which factors are influencing threat perceptions. Control-impact studies like Sparrow et al. (2016) may lead to a misconception of the effectiveness of treatments as they don't consider differences in pre-existing activity levels at treatment sites {Koehler, 1990 #857;Parsons, 1996 #1246;Rytwinski, 2016 #924}. Captive studies

Rather than expend energy fleeing, avoidance measures such as reduced activity or altered space use may be more beneficial for species with effective concealment from threats {Merkens, 1991 #888;Ydenberg, 1986 #886;Kats, 1998 #848}. It is possible *L. latifrons* responded to BB and dingo odours placed in burrow entrances with increased hiding, or reduced ranging behaviour in a manner that was not evident from the camera data. The application of odours inside the burrows or in open areas further from the safety of a burrow may heighten risk perceptions, resulting in greater avoidance responses {Atkinson, 1994 #537}. In contrast, the single application of BB at burrow entrances may have been perceived as low risk and the use of a greater volume and repeated or more widespread application of BB may elicit greater avoidance responses.

Anecdotal evidence suggested wombats are fearful of shiny objects and actively avoid them. Stationary CDs have been found to elicit avoidance responses in *L. latifrons*, with a decrease in the number of visits to burrows following their application (O'Brien et al., 2021). Visual stimuli produced avoidance responses most likely due to an immediate fear response (neophobia) of an unknown object within their environment {Harris, 2001 #982;Davidson-Nelson, 2010 #834;Bruggers, 1986 #1007}. Wombats may have responded more readily to visual cues as they are easily detected from further away than olfactory cues, which require closer investigation. Though these preliminary investigations are encouraging, habituation to visual stimuli is a major limiting factor to their long-term use, particularly when unaccompanied by negative reinforcement {Koehler, 1990 #857;Gilsdorf, 2002 #858}. Though habituation to CDs was not observed in wombats, and anecdotal accounts suggest it does not occur in response to moving CDs, only 5 nights of data were analysed.

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Before deterrents are recommended to mitigate wombat damage, a better understanding of the factors influencing wombat threat perceptions and responses to them is needed. Further research is needed to evaluate responses in different environmental conditions such as varying distance to cover, and with different methods of application and placement, to determine the optimal conditions for success. In addition, future studies should consider conducting trials in a closed system with known individuals or capturing and marking individuals prior to commencing trials for ease of identification so individual variation in responses can be taken into consideration.

Species with effective concealment from predators often reduce the probability of an encounter by decreasing their movement or altering their space use towards increased cover rather than expend energy fleeing and potentially drawing the attention of a predator {Merkens, 1991 #888; Lima, 1998 #345; Borowski, 1998 #908; Kotler, 1997 #1035}. Burrows provide wombats with refuge from the threat of predation; thus, rather than fleeing they may reduce their ranging behaviour to be in closer proximity to the protection of a burrow-. Increased burrow use was observed in captive *L. latifrons* following exposure to dingo faeces (Descovich et al., 2012). The importance of the area being treated may reflect the effectiveness of deterrents, with animals being more difficult to deter from important resources that are in limited supply, or areas where they are well established {Gilsdorf, 2002 #858; Koehler, 1990 #857}. Repeated or more widespread application of odours may produce greater avoidance responses {Eichholz, 2012 #1021}.

Dingo urine is difficult and expensive to source, while faeces is much easier to collect from a zoo.

5.5.1.6.4.1. Virtual fencing

Virtual fencing is a term often used for placing deterrents along roadsides that are activated by approaching vehicle headlights. On activation the device emits a sound, flashing lights or both with the aim of scaring away any animals that may be adjacent to the roadside. Virtual fencing is not a physical barrier and allows animals to move through the landscape. Early trials in Tasmania reported a 50% reduction in roadkill over a three-years ((Fox et al., 2018), but the trial had many design flaws. More recent trials show no effect of virtual fencing on possums, wallabies or wombats (ref). A [Study study](#) on the impacts of virtual fencing on wombats found a small reduction in the number of wombats killed after the virtual fence was installed (Stannard), however the study design was flawed and widely disputed (Coulson and Bender, 2022{Candy, #286}). Similarly, other deterrent devices mounted to vehicles like the Shuroo have been found ineffective, as the noise the device makes ~~can~~ [not cannot](#) be heard over the vehicle noise from >50 m away (Bender and Coulson, 2022).

5.6.6.5. Translocation

Translocation is a widely used “non-lethal” human-wildlife conflict mitigation measure, but its effectiveness is disputed. The survival of translocated animals is often low, and the conflict may not be resolved or could be transferred to the release site {Bradley, 2005 #133; Linnell, 1997 #162}. Translocation has been trialled on southern hairy-nosed wombats (SHNW) to relieve conflicts with agriculturalists [ref](#). Wombats were translocated from areas of conflict to a property where species numbers were low and there were lots of inactive burrows

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were available. Though SHNW's had high survival rates and exhibited release site fidelity. Similarly, the critically endangered northern hairy-nosed wombat has been successfully re-introduced into areas they were extirpated from by releasing them into starter burrows (NHN Management strategy). A study on the survival of rescued and rehabilitated bare-nosed wombats also reported high survival (94.5%) of animals released onto a private property within the first 42 days following release and 77% survival after eight years (Saran et al., 2011). Survival was not found to be related to age, sex, provision of supplemental food, season or time spent in rehabilitation.

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Translocation did not relieve conflicts, with neighbouring wombats moving into vacated burrows at the source site within a matter of weeks. Landholders using culling as a control measure to reduce conflicts with SHNW have reported similar results, with neighbouring animals recolonising vacated warrens (St John, 1989 #62).

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Translocation of a larger number of wombats may have provided longer relief from conflict. However, SHNW's evaded traps by remaining underground or digging under fencing, resulting in a low trap rate of 5.95%. Similarly, the trapping success of bare-nosed wombats was 7.9% and northern hairy-nosed wombats as low as 1-2%, all species avoid capture by remaining underground for extended periods of time (McIlroy, 1977; Alan Horsup, pers. comm 2018). Thus, large scale translocation could be labour intensive and cost prohibitive. Furthermore, the ongoing translocation of large numbers of wombats would over time lead to shortages of suitable conflict free release sites with low numbers of conspecifics in the species natural range. Translocation could be used as a tool to repopulate areas where numbers are known to have declined, however, it may result in further deaths if the cause of the decline has not been addressed.

Despite its limitations, translocation may prove useful for removing a small number of individuals from areas of conflict, where alternative measures fail or are unsuitable. When used in combination with burrow collapsing or deterrent use it may yield more promising results in reducing conflict at the source site. Prior to carrying out a translocation careful planning is needed. The IUCN translocation guidelines should be followed (Germano, 2015 #727) and a translocation plan developed. Important biological and ecological factors need to be taken into consideration, such as capture stress, disease transmission, habitat suitability, and competition with conspecifics. The availability of burrows at the release site is a key consideration when it comes to translocating wombats, which would require up to date knowledge of wombat distribution and density. Follow up monitoring is imperative to ensure survival of translocated animals.

5.7.6.6. Lethal control

Historically, conflicts with wombats have been managed using lethal controls. In most states, there are provisions to cull wombats causing damage or threatening human safety under permit systems (see section 2.1). The lethal control of wombats has become a highly contentious and controversial issue in the last few decades, due to changing public attitudes towards its use and concerns about wombat conservation. Permits to destroy bare-nosed wombats have decreased greatly in Tasmania and other states where it is allowed in the last few years due to increasing public pressure. The impacts of culling on wombats populations are poorly understood (Tartowski, 1998 #782; Taggart, 2008 #160). If conducted at unsustainable levels it can result in range contractions and population isolation (Powell, 2006 #251; Fuller, 1992 #711; Woodroffe, 2005 #709). In contrast,

killing an insufficient number of animals can fail to reduce damage to an acceptable level {Hone, 2007 #1120}. In some cases, the removal of animals from a population can encourage population growth and immigration, thereby increasing conflict {Treves, 2016 #1140}. The indiscriminate culling of dingoes can disrupt stable pack structures and territorial behaviour that leads to fractured social groups of younger more inexperienced dingoes that are more likely to target livestock (Wallach et al. 2009; Allen 2014, 2015; Imbert et al. 2016). Social instability can result in increased reproduction, as multiple subordinate females may breed (Glen et al. 2007). Despite the limitations of culling, there may always be some situations in which it is the best intervention method {Warburton, 2009 #944}.

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There is one known study examining the effects of culling on southern hairy-nosed wombats. The study compared changes in the number of active burrows in an area where wombats were culled and an adjacent area where they were not (2.4km²). Over the two-year term of the study an estimated 12% of the wombat population was culled per year and despite this there was an estimated 30-40% increase in the number of wombats, while in the uncultured area there was an estimated 50-60% increase in the number of wombats. The increase in wombat numbers over this time frame could have been a result of increased rainfall and recovery from the 1981-83 drought, the effects are unlikely to be the same on a stable or decreasing population (tartowski & stelmann).

Culling it is often preferred as a conflict reduction tool by landholders, as it is convenient, immediately shows results, satisfies their need for control, and is perceived as cost effective {Horton, 1997 #494; Zinn, 1999 #508; Treves, 2005 #303}. Landholders surveyed in South Australia most widely used culling to reduce conflicts with SHNW in South Australia and those who were financially dependent on their property or had experienced wombat damage were more likely to cull wombats (O'Brien, 2019). Despite the widespread use of culling, only half of the landholders using it perceived it to be effective. A lack of data on wombat numbers makes it difficult for state agencies to set balanced culling quotas often resulting in ineffective conflict resolution {Taggart, 2008 #160}. Many landholders feel they are rarely permitted to cull enough wombats to mitigate damage with recolonisation of burrows being an ongoing problem {Stott, 1998 #114; Taggart, 2008 #160; St John, 1989 #62; Stott, 1998 #114; St John, 1989 #62}. Official government registers are considered an underestimate of the true numbers of wombats culled, as some landholders resort to culling outside the permit system {St John, 1989 #62; Taggart, 2008 #160}. The use of lethal controls needs to be carefully evaluated and managed based on scientific evidence, to ensure conflict reduction without threatening species conservation.

6.7. Recommendations

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6.1.7.1. Stakeholder consultation and engagement

6.1.1.7.1.1. Greater landholder consultation

There are 381 farmers within the ACT, only three were consulted in the writing of this review. While they predominantly reported similar issues there may be some circumstances that are unique to a particular location.

It is recommended that further consultation with landholders be undertaken to gain a better understanding of breadth of wombat management issues they are experiencing, how frequently damage occurs and the financial and legal liability costs of damages. The EPSDD has taken steps to consult with stakeholders on issues of wombat management, including the establishment of the wombat working group. However, the group also consisted of wildlife carers and a large contingent of government staff and according to landholders was skewed towards conservation and mange management. There is a clear concern from landholder groups that their views and interests are not being taken seriously. A separate in person working group consisting of landholders in an environment in which they feel comfortable expressing their views without fear of bullying or harassment by animal advocacy groups is recommended. It is also recommended that researchers with knowledge of wombat ecology and management strategies attend to share information with landholders. Educating landholders of the ecological role of the species can increase their tolerance towards them [Schumann, 2012 #387] and aid in developing effective management strategies. Understanding and incorporating landholder views into management and research decisions will be essential for implementing successful management strategies that balance the needs of wombats with the agricultural sector.

6.1.2.7.1.2. Developer consultation

Over the next few years there is x planned urban development in areas where wombats reside. No developers were spoken to during this review. It is recommended to consult with developers

6.1.3.7.1.3. Public education

People who do not live with wombats on their properties do not understand the issues they can cause. Education of these impacts can improve acceptance of species management. There is currently a lot of information available on the EPSDD website on kangaroo management and for a range of other managed species. However, no information is available for wombats. It is recommended the EPSDD develop a page on their website about wombats and their management.

People who do not live with wombats on their property do not understand the issues that can arise

6.2.7.2. Wombat management and research

6.2.1.7.2.1. Survey the abundance of wombats in the ACT

The distribution and abundance of a species are fundamental parameters for determining their conservation status. Reliable methods providing accurate data on the population trends of a species are required to enable better population management. Currently there is not enough information on the abundance of wombats within the ACT on which to base management decisions and more research is needed. Due to the nocturnal and burrowing nature of wombats they are difficult to survey. Direct counting using spotlight surveys are labour intensive, unfeasible over large areas and have been found to bare no relationship to population numbers, as wombats may remain in their burrows for prolonged periods (McIlroy 1977). Mark recapture studies of wombats are challenging, as wombats are difficult to capture, remaining underground or digging past traps resulting in low recapture rates {McIlroy, 1977 #77{Skerratt, 2004 #54}}. Imprecise abundance estimates will result if only a

portion of burrows are trapped at any one time {Banks, 2003 #6}. Due to time and labour intensities trapping is not practical, on a large scale. Alternatively Taggart, Finlayson *et al.* (2003) developed a stunning technique, where Southern hairy-nosed wombats were captured using large custom made hoop nets, following stunning with a spotlight and a rifle shot fired between the wombats ears. This technique has higher capture success (24.6%) than trapping, but it is only effective under specific temperature and humidity conditions. Attempts have been made to link the size of grazing halos around warrens to wombat abundance, but it was only successful under very stringent conditions, as background grass biomass was required to be $\geq 60 \text{ gm}^2$ (Tiver 1981). The number of active wombat warrens has been linked to wombat abundance using mark recapture methods {McIlroy, 1977 #77}{Tiver 1981} |

The number of active wombat burrows have successfully been linked to wombat abundances and used to survey their distribution (St John and Saunders 1989; Taylor 1998; Tiver 1981). The mean number of wombats present has been linked to the number of active burrows using mark-recapture methods {McIlroy, 1977 #55}, burrow flap counters (Tiver 1981) and remote cameras {Swinbourne, 2018 #66}. Estimates of the number of wombats per active burrow has been found to vary from 0.2-0.6 wombats (Taylor 1998; Tiver 1981). Using remote cameras to determine an index of the number of wombats per active burrow combined with broader surveys counting the number of active burrows is a relatively low-cost method used to infer population abundances. Whilst these calculations are not precise, they would provide a valuable information on population changes. In open areas burrow counts could be conducted from the air, however caution needs to be taken in vegetated areas as not all burrows are visible from the air (Taggart, Olds *et al.* 2008). Observer errors can result in inaccurate counts, but correction factors can be developed to overcome this, by flying over transects of a known number of warrens and calculating percentage errors (Tiver 1981), or taking video recordings of transects, allowing for more accurate and repeatable scores of wombat warrens (McGregor and Wells 1998). Aerial surveys are effective at determining expansions in range, as new warrens can be easily detected, however decreases in distribution are unobservable as warrens remain long after they have been vacated.

6.2.2.7.2.2. Quantify the frequency and occurrence of wombat damage

Landholders perceptions and tolerance of damage are often shaped by their financial dependence on their crop or stock and their previous experiences {Naughton-Treves, 2005 #638; Van Tassell, 2000 #1043} and can be disproportionate to actual damages {Dickman, 2010 #562; Knight, 2000 #813; Madden, 2004 #805; Wigley, 1986 #839}. Quantifying the frequency and costs of wombat damage is important to determine whether damage is real or perceived and is essential to better manage conflicts. In some situations, damage may be incorrectly attributed to the animal in question or it could be overestimated and stakeholder education may be the key to resolving the conflict. In other situations animals can cause substantial damage and management interventions are needed to reduce damages. The frequency and severity of conflicts can vary based on land use, animal densities and economic situation. Quantifying damages can help to identify high conflict zones and prioritising management efforts towards those areas may enhance co-existence with wombats.

~~6.2.3.7.2.3.~~ Work with landholders to develop damage mitigation strategies

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It is important to note only three landholders rural leaseholders were consulted in this review process, however it is clear wombats have become a significant cause of concern over the last few decades. Researchers and potentially ACT gov should work with landholders to develop damage mitigation strategies and improve co-existence with wombats.

~~6.2.4. Development of a mange severity assessment tool~~

~~Arming rangers with the information needed to make a decision on whether a wombat should be euthanised due to the severity of their condition. Reduce the number of call outs wombat rescue need to attend.~~

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~~Could be developed in conjunction with wildlife carer and vets.~~

~~However, there is much subjectivity within the wildlife care community as to the point at which that should occur~~

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Glossary

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- **City and Environment Department (CED)** – ACT government department responsible for managing conservation estate and public land
- **Closed season** – A defined period during which hunting or capturing was prohibited for listed species.
- **Deterrent** – Something that discourages or prevents someone from taking an action due to the perception of negative consequences.
- **Dry sheep equivalent (DSE)** – A unit of measure used to assess the nutritional needs of livestock and the carrying capacity of a farm. It equates to the amount of feed required daily by a two-year-old, 50 kg Merino wether.
- **Leaseholder** – A person or entity granted a Crown lease by the Territory, giving them the right to occupy and use land according to the terms and conditions of the lease.
- **Noxious pest/pest** – An animal, insect, or plant considered harmful to agriculture, the environment, or human health, and officially declared or classified as such under relevant legislation or regulations.
- **Olfaction** – The sense of smell.
- **Open season** – A specific period during which it is legally permissible to hunt, take, or possess certain wildlife species that are otherwise protected. An open season is officially declared by the relevant authority (e.g., the Minister responsible for wildlife or a delegated agency) and specifies:
 - The dates during which hunting or taking of wildlife is allowed.
 - The species to which it applies.
 - Any conditions or restrictions, such as location, bag limits, or methods of hunting.
- **Pasture Protection Board** – Local government bodies established under the *Pastures Protection Act 1934*. The 59 boards in NSW were responsible for managing grazing, controlling pests like rabbits and feral animals, and promoting sustainable land management.
- **Protected species** – Species protected by law that cannot be taken, harmed, or interfered with without appropriate authorisation.
- **Reintroduction** – The movement of wild animals into part of their former range from which they have been extirpated.
- **Translocation** – The deliberate movement of wild animals from one part of their range to another.
- **Vermin** – Species of animals not protected by law and often considered pests due to their negative impacts on agriculture, native species, or the environment.
 - Declared vermin can usually be destroyed or managed at any time, including outside of open seasons, unless other laws (such as firearms laws) apply.
 - The list of vermin is not fixed and can be updated by regulation or proclamation.

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Executive Summary

This document reviews the status and management of Bare-nosed Wombats (*Vombatus ursinus*) in the Australian Capital Territory (ACT), considering stakeholder views, current legislation and policy, management and monitoring of populations. It draws on past and current practice from across the Australian states and territories to inform a path forward. It also highlights current challenges within the ACT, including the complexities involved in balancing conservation with stakeholder needs.

As native marsupials wombats are integral to the region's ecosystem but present several management issues. These include wildlife-vehicle collisions and conflict with agricultural activities. The species is challenged by threats such as urban expansion, habitat loss and the prevalence of sarcoptic mange.

By adopting a holistic and informed approach to wombat management, the ACT can balance species conservation and protection of infrastructure and agricultural interests, ensuring a sustainable future for both local wildlife and the community.

Key findings from the review include:

- **Legislation and Policy:** Unlike other Australian jurisdictions, the ACT does not allow control permits for mitigating wombat damage. This has led to frustration among leaseholders managing wombat-related damages.
- **Threats to Wombats:** Habitat loss and sarcoptic mange remain the primary threats. Management of sarcoptic mange is complex and is currently conducted by wildlife carers. .
- **Stakeholder Conflicts:** With diverse stakeholders the ACT has conflicting views on how wombats should be managed.
- **Management Tools:** Fencing, burrow modifications, and deterrents are available but are often resource-intensive and may yield inconsistent results. Many have not been trialled in the ACT and stakeholders may not be aware of the available options.

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Key Recommendations

Recommendations are to implement a more coordinated, balanced and evidence-based approach to wombat management in the ACT, involving government agencies, local communities, and wildlife organisations.

Specifically:

1. **Policy**– Assess the suitability of policy that establishes mechanisms for wombat management. This may include provisions for damage mitigation, the development of a controlled native species management plan, wildlife release guidelines, and guidelines for the controlled use of veterinary products for mange in the ACT. Broader community consultation should be undertaken as part of policy development.
2. **Stakeholder Engagement** – Establish a streamlined consultative committee to support policy development and ensure diverse stakeholder input is considered, and needs are balanced.
3. **Public Education** –Increase community awareness of potential human-wildlife conflicts where wombats are present in urban and peri-urban areas, available damage-mitigation strategies and conservation initiatives. Deliver targeted media and communications for transparency of government strategies and collaborative actions.
4. **Community and Volunteers** – Acknowledge community concerns and volunteer efforts to enhance animal welfare for wombats in the ACT. .
5. **Research Partnerships** – Collaborate with universities and citizen scientists to support ongoing research and data collection to inform management decisions. This includes exploring new technology to develop improved and cost-effective options for monitoring wombat populations in the ACT.

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1 Introduction

Wombats are iconic Australian marsupials, deeply embedded in the cultural heritage of First Nations Peoples and the national identity (Garvey et al., 2016). There are three extant species: the Bare-nosed Wombat (*Vombatus ursinus*), the Southern Hairy-nosed Wombat (*Lasiorhinus latifrons*), and the Northern Hairy-nosed Wombat (*Lasiorhinus krefftii*). Although once likely widespread, all three species have experienced significant declines and range contractions since European settlement (Aitken, 1971, Gordon et al., 1985, Buchan A and DC, 1998, Cooke, 1998, McIlroy, 2008). The clearing of land for agriculture and urban development, coupled with the introduction of European rabbits (*Oryctolagus cuniculus*), has had a profound impact on wombat populations (Aitken, 1971, Cooke, 1998). Rabbits provided competition for food and shelter (Cooke, 1998), and wombat warrens were often destroyed during rabbit control efforts (Triggs, 2009). Increasing conflict with livestock (Crossman et al., 1994) also contributed to population pressures. The Northern Hairy-nosed Wombat suffered the greatest decline, reduced to a single known population of approximately 30 individuals by 1982 (Gordon et al., 1985). It is now listed as endangered under the *Nature Conservation Act 1992*. In contrast, the Bare-nosed Wombat was declared vermin as early as 1906 in Victoria, and considered a pest in other states (Temby, 1998).

Historically wombats were widely regarded as pests, particularly because their burrowing behaviour damaged rabbit exclusion fencing (Aitken, 1971, Temby, 1998). This perception contributed to sustained population control efforts and legislative measures in all jurisdictions to reduce their impact. The Australian Capital Territory (ACT) awarded early protection to Bare-nosed Wombats under the *Animals & Birds Protection Ordinance 1918*. Growing public concern over animal welfare, conservation, and sarcoptic mange have pressured other state governments to adopt more protective policies. Though wombats are now protected species in most states, they can be controlled under permit systems where they cause damage. Landholders are required to pursue alternative management methods in almost all states before seeking a culling permit.

The management of wombats has become a highly contentious issue due to the complexities of trying to balance competing interests of stakeholder groups, including but not limited to local government, leaseholders, first peoples and wildlife care groups. Conservation and wildlife care groups are concerned for the welfare of Bare-nosed Wombats and advocate for better protections. Agriculturalists and developers want to manage the species to minimise the damage they can cause to infrastructure, stock and farm personnel. Given the diversity of stakeholder interests, reaching agreement on the best approach to wombat management is a persistent challenge.

This review explores the management of Bare-nosed Wombats (*Vombatus ursinus*) in the Australian Capital Territory, highlighting the legislative, ecological, and stakeholder challenges involved in balancing species conservation with human land use and infrastructure needs. It uses past and current legislation across the Australian states and territories as frameworks to inform the conservation and management of wombats in the ACT.

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2 Legislation, policy and regulation

2.1 Policy and legislation

Following European settlement and the expansion of agriculture in Australia, all three Vombatid species, the Bare-nosed (*Vombatus ursinus*), Northern Hairy-nosed (*Lasiorhinus krefftii*), and Southern Hairy-nosed Wombats (*Lasiorhinus latifrons*) have experienced conflicts with humans. Initially, conflicts arose because wombats caused damage to rabbit exclusion fencing and wombat burrows provided refuge for rabbits. As a result, wombats were commonly viewed as pests and were able to be lethally controlled under legislation in most states.

The range of all three species of wombat contracted significantly as a result of large-scale land clearance for agricultural and urban development, and the introduction of European rabbits (*Oryctolagus cuniculus*) (Aitken, 1971, Temby, 1998, Gordon et al., 1985, Buchan and Goldney, 1998, McIlroy, 2008, Cooke, 1998). Over time attitudes towards wombats and concern for their conservation increased and legislation changed to reflect this.

This section provides an overview of the legislative frameworks and policies related to wombat management across various Australian states and territories. These frameworks serve to inform the management approaches in the Australian Capital Territory (ACT) and offer potential insights into improving wombat conservation and management strategies.

2.1.1 Victoria

Legislative history

The Bare-nosed Wombat was declared vermin throughout the state of Victoria in a 1906, under provisions of the *Vermin Destruction Act 1890* (Seebeck 1988). In 1925, a bounty was placed on Bare-nosed Wombats under the *Vermin and Noxious Weed Act 1922*, with more than 60,000 bounties paid up until 1955. The bounty was subsequently suspended in 1966 and officially abolished in 1971. Bare-nosed Wombats remained a pest to many and from 1971 to 1986 government officials fumigated their burrows on crown land.

In 1977, Bare-nosed Wombats were declared protected under the *Wildlife Act 1975* in the region west of the Melbourne to Sydney railway line, where they occurred in low numbers. The vermin status of the species was maintained in eastern Victoria until 1984, when Bare-nosed Wombats were protected under the *Wildlife Act 1975* across all Victoria. Lobbying by farmers led the species to be declared 'unprotected wildlife' in 193 parishes in eastern Victoria under the *Wildlife Act 1975*. The declaration of the species as 'unprotected wildlife' enabled the destruction of Bare-nosed Wombats by landholders, their families, and employees by means of fumigation, trapping or shooting on freehold or leasehold land, and within 1 km of such land on adjoining crown land. In June 1997, the *Wildlife Act 1975* was modified to enable destruction only on the occupier's property with a high-powered, centre-fire rifle of .222 calibre or larger.

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Current Legislation

In February 2020, an amendment to the *Wildlife Act 1975* revoked the unregulated control of Bare-nosed Wombats across 193 parishes in eastern Victoria. It is now an offence to kill, take, control or harm Bare-nosed Wombats across the entire state of Victoria without authorisation. This includes activities such as destroying or disturbing their burrows. To destroy a wombat or their burrows landowners need to apply for an authority to control wildlife permit (ATCW) from the Department of Energy, Environment and Climate Action which can be done [online](#), by post or email (Table 1). Applicants are required to demonstrate damage to their property, crops or pasture, impacts on biodiversity values, or risks to human health or safety. Applicants must also demonstrate that all other reasonable options have been considered. A [wombat management methods factsheet](#) outlines “non-lethal” management options for landholders. Forest and Wildlife Officers review applications and may require a property inspection. This process can take up to six weeks to complete. Each ATCW specifies the species of wildlife that can be controlled and the method of control. Anyone shooting wildlife under the *Wildlife Act 1975* must also comply with the *Firearms Act 1996*. To destroy a wombat without a permit carries a penalty ranging from \$8,261 to \$39, 652 and/or six to twelve months in jail.

Table 1. The number of permits issued to control Bare-nosed Wombats and the number of animals to be harmed in Victoria over the last seven years.

Year	Number of permits	Animals authorised to be culled
2023	222	1902
2022	226	1862
2021	207	1675
2020	273	1478
2019	268	3655
2018	252	3830
2017	270	3374

2.1.2 New South Wales

Legislative History

New South Wales was home to all three species of wombat until the last claimed sighting of Northern Hairy-nosed Wombats in 1909. Bare-nosed and Northern Hairy-nosed Wombats had partial protection under the *Native Animals Protection Act 1903*. Under this act both species were protected from destruction during the declared closed season from August to January each year. Bare-nosed Wombats lost these protections when they were not included on the list of protected species under the *Animals and Birds Protection Act 1918*. Bare-nosed Wombats regained legal protection under the subsequent *Fauna Protection Act 1948*. Landholders were required to obtain permits for wombat destruction, except in areas governed by Pasture Protection Boards. At this time, wombats were also regarded as a noxious pest by the Department of Agriculture under the *Pastures Protection Act 1934*. This created a conflict in areas where landholders were required to destroy wombats under the *Pastures Protection Act 1934*, but could be prosecuted for doing so under the *Fauna Protection Act 1948*. In 1959 the National Parks and Wildlife Service and the Department of Agriculture reached a compromise, leaving

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Bare-nosed Wombats unprotected but no longer declared noxious. As a result, both species of wombat became fair game for sports shooters and landholders. In March 1973, Bare-nosed Wombats were awarded full protection with provision for destruction for damage control purposes by being removed from the First Schedule (list of unprotected animals) of the *Fauna Protection Act 1948-67*. The following *National Parks and Wildlife Act 1974* provided full protection to Northern Hairy-nosed Wombats which were classed as endangered. Bare-nosed Wombats were also given protection with a provision for damage control under a permit system.

Current Legislation

Wombats are protected under the *NSW Biodiversity Conservation Act 2016*. It is an offence to harm a wombat unless a licence is obtained from the Department of Climate Change, Energy, the Environment and Water. To obtain a licence landholders must demonstrate animals are a threat to human safety, damaging property and/or causing economic hardship. Where possible, the department seeks to resolve negative interactions using non-destructive methods and recommends non-lethal methods [on their website](#). However, a licence to harm individual animals may be required to mitigate problems. To apply for a licence, landholders must contact their local National Parks and Wildlife Service (NPWS) office to discuss the nature and severity of the issue and any non-lethal measures that may resolve the problem. They can then [download and fill in an application form](#) and lodge it with their local NPWS. The National Parks and Wildlife Service may grant a licence to the owner or occupier of a property to cull wombats. Records of the number of animals harmed need to be kept on a record sheet provided and lodged with the NPWS office within 7 days of the licence expiry. All people operating under the licence must comply with the *Firearms Act 1996* and the Code of Practice for the Humane Destruction of Wombats by Shooting in NSW. Harming wildlife without a permit may receive a maximum fine of \$330,000 with an additional \$33,000 for each animal harmed or two years in jail.

Within the last seven years a small number of permits have been issued (Table 2). The maximum number of Bare-nosed Wombats to be harmed on any one permit was 50 animals. More commonly permits range from 1 – 20 animals for issues including damage to crops, competition with stock, hazard for vehicles, damage to fencing, causing erosion and disease.

Table 2. The number of permits issued to control Bare-nosed Wombats and the number of animals to be harmed in New South Wales over the last seven years.

Year	Permits issued	Number of wombats to be harmed
2023	34	187
2022	38	219
2021	26	138
2020	42	221
2019	76	501
2018	103	752
2017	40	193

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2.1.3 Queensland

Legislative History

The Northern Hairy-nosed Wombat and Bare-nosed Wombat were protected in Queensland under the *Native Animals Protection Act* 1906. However, this and subsequent Acts provided provisions for damage control. By 1982, the Northern Hairy-nosed Wombat was restricted to a single population of approximately 30 animals (Gordon et al., 1985). The *Fauna Conservation Act* 1974-1989 provided permanent protection for the Northern Hairy-nosed Wombat with no provision for damage control. Northern Hairy-nosed Wombats were declared endangered under the *Nature Conservation Act* 1992. Bare-nosed Wombats remained protected with provision for damage control under a permit system.

Current Legislation

Northern hairy-nosed and Bare-nosed Wombats are protected under the *Nature Conservation Act* 1992, though there are provisions to control Bare-nosed Wombats for damage mitigation purposes. [A damage mitigation permit](#) is required to take wildlife to minimise damage or loss of property (e.g. crops) or to protect human health and wellbeing. Damage mitigation permits may cover the removal and translocation of problem animals or lethal control.

To obtain a three-year permit to remove and relocate wildlife applicants must demonstrate the following:

- Certificate of completion of a training course concerning the keep, relocation, and safe handling of relevant wildlife.
- A current first aid certificate issued by an approved first aid provider.
- Referee reports from two suitably skilled and qualified persons.
- Statements outlining the ability to handle wildlife, including safety procedures to be applied when handling or moving wildlife and access to appropriate equipment.
- Statements outlining wildlife identification skills.
- A resume including details of qualifications provided with the application.

If an applicant does not have any experience, they are recommended to contact a local damage mitigation permit holder for guidance and possible endorsement under this permit type.

To obtain a permit to lethally control wildlife, applicants must demonstrate damages caused and the economic losses incurred, or any threats to human health (e.g. disease or injury risks). Two non-lethal damage mitigation measures to prevent or minimise damage need to have been attempted prior to application for lethal control. There are no specifications about suitable non-lethal methods to be used or the duration of use. A statement outlining the applicant's relevant knowledge and experience in correctly identifying the relevant species is required. Permits are issued for one-year unless the landholder has an approved property management plan, in which case permits can be issued for three years. The Department of Environment Science and Innovation offers a service to guide applicants through the assessment process. The service includes meeting with a departmental project manager to discuss the information needed for the application. Applicants can email a [downloadable](#)

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[form](#) to the permits and licensing department and may take up to 40 business days to process. Once a permit has been granted, permit holders are required to lodge a return of operations form every three months and within 10 days of the permit expiry detailing how many animals were taken under the permit. The maximum penalty for controlling protected wildlife without a permit is \$15,480 (100 penalty units).

2.1.4 Tasmania

Legislative History

Bare-nosed Wombats were not protected in Tasmania until the passing of the *National Parks and Wildlife Act* 1970, which provided partial protection allowing for the declaration of an open season. The Minister by order, could declare the dates and places on which the taking of any partially protected wildlife may start, stop, be prohibited or permitted and impose any conditions on the order. No open seasons were declared, and destruction for damage control purposes was undertaken by permit.

Current Legislation

Bare-nosed Wombats are protected under the *Nature Conservation Act* 2002 with provision for damage control. The Department of Natural Resources and Environment encourages people to use non-lethal management options for mitigating wombat damage and several factsheets can be found on their website for [Living with Wombats](#). A [property protection permit](#) is needed to control protected wildlife, including Bare-nosed Wombats (Table 3). Permits can be applied for by landholders, managers or lessees of land to prevent the destruction of, or injury to any stock, crops and equipment or infrastructure used in crop and/or stock production. Applications must identify the damage caused, the method of control to be used and the number of animals they want to take. The Department of Natural Resources and Environment must be satisfied a financial loss is likely to occur if the crop, stock, equipment or infrastructure is not protected. Applications are assessed on a case-by-case basis, which may include a visit to the applicant's property. The local abundance of Bare-nosed Wombats, the impacts they may have on the property, and whether non-lethal measures will be effective at the site are considered when issuing permits. The Department of Natural Resources and Environment Tasmania assesses population trends using annual spotlight monitoring of 190 10-km transects across the state. Issued permits specify the number of Bare-nosed Wombats that may be taken and a timeframe of up to 12 months. Permit holders are required to maintain accurate records of animals destroyed and report them within 28 days of the permit expiry. Persons controlling wildlife without a permit or who do not comply with the terms of their permit can receive a penalty of up to \$19,500 (100 penalty units).

Table 3. The number of permits issued to control Bare-nosed Wombats and the number of animals to be harmed in Tasmania from 2016 to 2022. Blank cells indicate a lack of data.

Year	Number of permits	Total quota issued	Wombats culled
2022	9	165	29
2021	6		17
2020	5	51	20
2019	4		107
2018	6	110	
2017	22	160	

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Year	Number of permits	Total quota issued	Wombats culled
2016	52	2171	

2.1.5 Western Australia

Legislative History

Southern Hairy-nosed Wombats were not provided protection under early game acts in Western Australia. The *Game Act 1912* provided protection to all “non harmful” native fauna, but it is unclear whether this extended to Southern Hairy-nosed Wombats. The *Fauna Protection Act 1950* was the first to provide blanket protection to all native fauna in the state, including Southern Hairy-nosed Wombats. In 1975 it was re-named the *Wildlife Conservation Act 1950* and included new provisions for damage control permits.

To prevent Southern Hairy-nosed Wombats from becoming an agricultural threat across the state, the Agricultural Protection Board declared them as vermin in areas of WA outside their known range. In 1973, the declaration was amended to include Southern Hairy-nosed Wombats as a pest species under the *Vermin Control Act 1918-1970*. When the *Vermin Control Act* was replaced by the *Agriculture and Related Resources Protection Act 1976*, the Southern Hairy-nosed Wombat was included as a category seven declared animal. As a category seven species, the Minister had the authority to recommend and approve a species management plan that included management by lethal control.

Current legislation

In 2019 the *Wildlife Conservation Act 1950* was replaced by the *Biodiversity and Conservation Act 2016* and the Biodiversity Conservation Regulations 2018. Under the Biodiversity Conservation Regulations 2018, there are provisions for controlling fauna that have been listed as managed species. Fauna may be listed as a managed species if they are determined to be impacting public safety or biosecurity, or causing economic or ecological damage. The Southern Hairy-nosed Wombat is not currently listed as a managed species. There are no records of licence applications or grants for Southern Hairy-nosed Wombat control in Western Australia.

When fauna cause damage to agriculture, native animals may be declared pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Under the BAM Act, every organism except a human being has a legal status assigned through a declaration made by the Minister. If the Minister has not made a declaration, the status automatically remains unlisted. BAM status determines whether a permit is required to import the organism into Western Australia. The Southern Hairy-nosed Wombat is listed as a Permitted species S11 (exempt) on the Western Australian organism [list](#) under the BAM Act. This means they are not a declared pest and can be imported into the state without a permit provided they satisfy import permits and can be kept without a permit.

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2.1.6 South Australia

Legislative History

Wombats gained their first legal recognition under the *Animals protection Act* 1912 on the schedule of unprotected animals. Partial protection was achieved under the provision of *Animals and Birds Protection Act* 1919 with the declaration of a closed season on wombats from July to December. During the closed season landholders were only permitted to cull wombats for damage control purposes. The Fauna Conservation Act 1964 provided full protection with a provision for controlling wombats for damage mitigation. Under the *National Parks & Wildlife Act* 1972, the Bare-nosed Wombat was listed as 'Vulnerable' with full protection. The Southern Hairy-nosed Wombat was permitted to be controlled for damage mitigation purposes.

Current legislation

The Bare-nosed Wombat and Southern Hairy-nosed Wombat are protected under the National Parks and Wildlife Act 1972 (NPW Act). It is an offence to catch, interfere with, harass, or kill both species without a permit. The Department for Environment and Water recommends using non-lethal means for managing wombats prior to resorting to culling and has a "Living with Wombats" [factsheet](#). The Department of Environment Water can issue destruction permits in circumstances where wombats cause damage or threaten human safety (*section 53.1c of the SA National Parks and Wildlife Act 1972*). Permit application forms are available [online](#) and can be emailed, posted or dropped off at the nearest regional office. Applications are considered by National Parks and Wildlife rangers on an individual basis. Consideration is given to whether non-lethal means may resolve the problem, the extent of the damage and threats to safety. There is a [code of practice for the humane destruction of wombats](#) which permit holders must abide by. The penalty for killing a wombat without a permit is a \$2,500 fine or six months in prison.

An amendment was made to the National Parks and Wildlife Act in 2023 prohibiting the destruction, damage or disturbance of wombat burrows without a permit, with a maximum penalty of \$5 000 or imprisonment for 12 months. Permits are not required if:

- you are the owner of the land where the burrow is located,
- you are authorised to destroy, damage or disturb the burrow by the owner of the land where the burrow is located; and
 - the burrow is located outside of a Wombat Burrow Protection Zone; and
 - the burrow is causing, or is likely to cause, damage to crops, stock, machinery or infrastructure (including tracks and built structures) or may constitute a safety risk or hazard to people.

If a burrow is located within a declared Wombat Burrow Protection Zone a person must not, without a permit, destroy, damage or disturb the burrow. No Wombat Burrow Protection Zones currently exist so a permit is not presently needed to destroy a wombat burrow. There is a protection for wombat burrows [factsheet](#) outlining the new changes.

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2.1.7 Australian Capital Territory

Legislative History

The Bare-nosed Wombat was protected early in the Australian Capital Territory (ACT) in comparison with most other states. There has been full protection without provision for destruction in the ACT since the *Animals & Birds Protection Ordinance* 1918. Successive Commonwealth ordinances and the *Nature Conservation Act* 1980 kept full protection in place, making no provisions for destruction permits to be issued for damage control purposes.

Current legislation

Under the *Nature Conservation Act 2014*, Bare-nosed Wombats remain protected without provisions for damage control. To kill a protected animal will result in a maximum penalty of \$16,000 (100 penalty units) and/or imprisonment of up to 1 year. Under part 6.1 of the Act, it is an offence to conduct any activity that interferes with a nest (or burrow), endangers progeny or breeding, kills, injures, or endangers a native animal. However, some activities, such as nest destruction, may be carried out under a licence issued by the [Conservator of Flora and Fauna](#). The maximum penalty for a damage land offence is \$2,025,000 for a corporation or 7 years imprisonment and/or \$400,000 for an individual. It is the responsibility of the applicant to apply for a licence for any proposed activity that may otherwise be an offence under the Act. The Parks and Conservation Service administers the Act and conservation officers are responsible for conducting compliance activities. These include public education, inspections, audits, and investigations to promote and support compliance.

In 2025, the ACT Government strengthened its regulatory framework for wildlife protection during development by introducing the Nature Conservation ([Protection of Burrowing Animals During Development](#)) Conservator Guidelines. These guidelines, issued by the ACT Conservator of Flora and Fauna, are a notifiable instrument under the *Nature Conservation Act 2014*, giving them legal force and requiring compliance from developers operating in areas with suitable habitat. The guidelines aim to minimise harm to native burrowing animals, such as Bare-nosed Wombats, by requiring site assessments, avoidance of active burrows, and consultation with the Conservator where disturbance is unavoidable.

2.1.8 Legislative differences between the ACT and other jurisdictions

Apart from the ACT, all jurisdictions have a provision under legislation to enable wombat control for the purpose of damage mitigation. Control is regulated by a permit system, and applicants may be required to prove alternative methods of damage mitigation were unsuccessful. Tasmania is the only state which considers trends in wombat populations when setting permit allocations. Understanding baseline population data is critical to assessing a program's efficacy and impacts. Controlling too few individuals can be ineffective at reducing damages, while removing too many can have negative conservation outcomes (Taggart et al. 2008).

Most states have an online permit application system or provide a form that can be submitted to the relevant department. Applications typically take 4-6 weeks to process, and landholders may be frustrated by these

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timeframes (Sparrow, 2011, Stott, 1998, Bunn, 2019). When landholders are faced with wombats burrowing under dams and other infrastructure, they feel prompt action is required to prevent further damage. Most states require the applicant to have tried 'non-lethal' damage mitigation strategies before applying for a permit, but guidance on 'non-lethal interventions' may not be provided. Further research into the efficacy and animal welfare considerations of common 'non-lethal interventions' is also required.

There has been a substantial reduction in the number of permits and the number of wombats permitted to be culled within the last decade across all states. This is in response to mounting public pressure on government agencies from conservationists and animal welfare advocates. As a result, landholders feel they are unable to reduce the damage caused by wombats on their property. For many farmers, the lengthy application process is not worth the time it takes to apply for a permit if they are only permitted to cull 10-25 wombats. As such some landholders act outside of permit systems and official government registers are considered an underestimate of the true numbers of wombats culled (St John and Saunders, 1989, Taggart et al., 2008).

3 Wombats in the ACT

3.1 Distribution and abundance

Prior to European settlement Bare-nosed Wombats were thought have a continuous distribution across much of their range including the ACT. Following European settlement, the establishment of farming along with the introduction of rabbits is thought to have had a significant reduction on the distribution and abundance of all three species of wombats (Buchan A and DC, 1998, Cooke, 1998). Current occurrence records from the ACT Wildlife Atlas show Bare-nosed Wombats are widespread across the ACT, particularly along the Murrumbidgee and Molonglo River (Figure 1). Wombats are also known to occur across Namadgi National Park (CED survey data).

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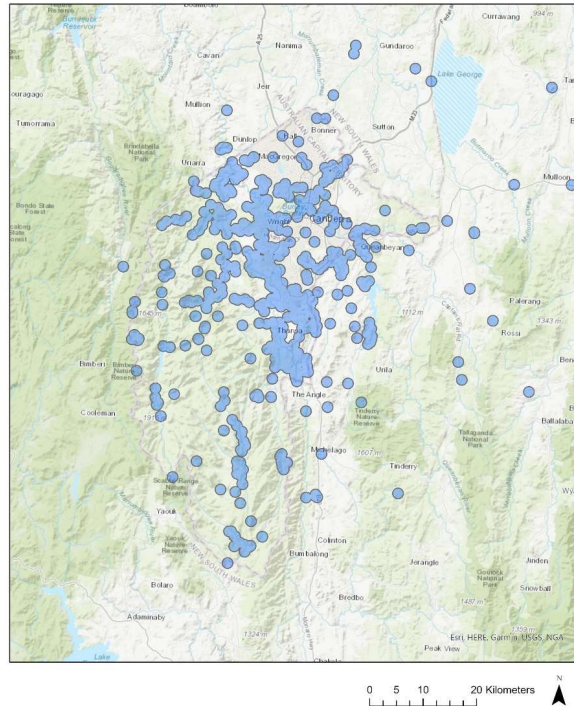


Figure 1. The known distribution of Bare-nosed Wombats (blue) in the Australian Capital Territory, taken from ACT Wildlife Atlas records, CED survey data and [the ACT Wombat Mange Portal Map](#).

Abundance is likely to vary locally and regionally, depending on a range of factors, such as habitat type, soil type and climatic conditions. Competition from rabbits and kangaroos for food resources also limits Bare-nosed Wombat numbers in many areas (Tamura et al., 2021, Bird et al., 2012, Cooke, 1998).

There are currently no reliable estimates of abundance for Bare-nosed Wombats in the ACT. After an initial likely decline from habitat loss, following the expansion of agriculture and urbanisation, anecdotal reports from leaseholders suggest the distribution and abundance of Bare-nosed Wombats have increased over the last 10-20 years. Anecdotal evidence from park rangers also support an increase in distribution. Reports dating back to 1975 indicate Bare-nosed Wombats were not present on the Canberra plains or in Canberra Nature Park at the time, though they were present in Tidbinbilla and Namadgi National Park. Rabbit control officers were known to target Bare-nosed Wombats because of the holes they made in rabbit proof fencing (Don Fletcher Pers comm) (Higgins, 1991).

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3.2 ACT Government Stakeholder engagement

The Office of Nature Conservation (CED) initiated a Wombat Working Group in 2021 to bring together stakeholders with interests in Bare-nosed Wombat management in the ACT to share knowledge and discuss management issues. The group consisted of wildlife carers, ACT government, agriculturalists and researchers. The group initially met via zoom, but a lack of attendance by rural lessees meant that it was disbanded. A mange management sub-group also commenced in 2021. The subgroup met quarterly until it was scaled back and eventually suspended in 2024. For more information on relevant stakeholders in the ACT see Section 4.

3.3 Monitoring and management

The Office of Nature Conservation (CED) currently conducts line transect surveys across 13 sites to monitor wombat populations in the ACT, but these methods are currently insufficient to robustly estimate abundance. For more information on monitoring wombat populations see Section 6.8.

Mange is treated by wildlife care groups under a CED permit (27378) for use of moxidectin on public land in the ACT, with strict conditions of its use around waterways due to its toxicity to aquatic species. For more information on the prevalence and treatment of sarcoptic mange in the ACT see Section 5.2.1.

3.4 Rescue and rehabilitation

There are two wildlife rescue organisations within the ACT that care for and rehabilitate sick and injured Bare-nosed Wombats. Wombat Rescue is solely dedicated to Bare-nosed Wombats, and ACT Wildlife cares for all injured wildlife. Wombat Rescue operates under a licence to take, rehabilitate and release wildlife in the ACT-LT202224 issued under Section 273 of the *Nature Conservation Act 2014*. Both groups work closely with each other and NSW care groups to coordinate resources for the care of Bare-nosed Wombats.

Wombat Rescue report responding to several call outs a day. In the last 6 months Wombat Rescue have taken 19 Bare-nosed Wombats into care. Records indicate up to 50 wombats are taken into care annually by Wombat Rescue and ACT Wildlife cares for 20-30. What most individuals take into care are pouch young orphaned as a result of road vehicle collisions. To a lesser extent Bare-nosed Wombats with severe mange are taken into care for treatment, with carers preferring to treat mange in situ where possible.

Of the approximately 50-60 Bare-nosed Wombats taken into care each year fewer than 10 animals are released in the ACT. In 2024, 28 wombats from the ACT were taken into care and only five were released into the ACT. Animals that come into care from New South Wales must be released in NSW. Release sites are resource intensive to find and must meet strict criteria, designed to improve an individuals' chances of survival. These criteria include a large enough area that is free from mange, away from roads, have available food and water, and have a low density of resident wombats. ACT Wildlife procure empty burrows to release animals by evicting resident Bare-nosed Wombats with the use of one-way gates. Wombat Rescue create artificial starter burrows to release animals by digging a 70 cm deep L-shaped tunnel in flat ground. They place a 45 cm diameter trench liner half pipe over the hole before filling it back in to make a tunnel. When creating tunnels on private land they

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use soft release techniques, fencing the burrow and providing supplemental food. Animals released into parks and reserves are not provided supplemental food or fenced burrows. Carers monitor released individuals for a few weeks using wildlife cameras, but released animals rarely stay in the release area.

More recently, there has been request from Wombat Rescue that ACT Government provide land for a pre-release wombat sanctuary or haven to prepare rehabilitated wombats for wild release. Areas would need to be designated and fenced for this purpose, and policy or guidelines developed around effective and safe release of wombats. The feasibility and need for a wombat sanctuary, and the role of the ACT Government in providing such a facility, is still in discussion.

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4 Stakeholder consultation and interviews

This section lists the primary stakeholders invested in Bare-nosed Wombat management in the ACT, and their interests in this issue (Table 4). It is important to note this is not a comprehensive review of stakeholder opinions on Bare-nosed Wombat management in the ACT and only expresses the views and opinions of a small number of people from each stakeholder group. Views and opinions are likely to vary within stakeholder groups. A formal review of stakeholder views is recommended.

Table 4. Identified stakeholders within the ACT with an interest in Bare-nosed Wombat management.

Group	Organisation/name	Role in relation to Bare-nosed Wombats
ACT Government	Office of the Conservator of Flora and Fauna, City and Environment Directorate	Acts on issues that affect the conservation matters embodied in the <i>Nature Conservation Act 2014</i> , particularly protecting native plants and animals
	Office of Nature Conservation Policy, City and Environment Directorate	Updates policy and legislation under the <i>Nature Conservation Act 2014</i>
	Office of Nature Conservation, City and Environment Directorate	Undertake a range of nature conservation programs in the ACT, including research on local flora and fauna, preparing scientific advice on ecological and natural resource management, conducting ecological surveys, biodiversity monitoring
	Transport Canberra and City Services	Deliver a range of services, including shop and playground upgrades, road and path maintenance, domestic animal services, and the management of urban open spaces including tree planting and grass mowing that may be impacted by Bare-nosed Wombat behaviour
	Natural Resource Management ACT, City and Environment Directorate	Integrated management of ACT's natural resources, including biodiversity, sustainable agriculture and cultural history
	ACT Parks and Conservation Service, City and Environment Directorate	Land management of the conservation estate, licensing and compliance under the <i>Nature Conservation Act 2014</i> , vertebrate pest and weed control, and managing visitor experiences.
	Urban Wildlife, ACT Parks and Conservation Service, City and Environment Directorate	Manage the outcomes of human-wildlife conflict, including nuisance animals, vehicle strikes and sick and injured animals
	Veterinarians, City and Environment Directorate	Administering treatment and care of animals including wildlife within the ACT
Industry	Icon Water	Responsible for maintaining supply of water and sewage services in the ACT. These services may be impacted by Bare-nosed Wombat activity on occasion and require management
	Developers	Construction of new developments within the ACT in compliance with Conservator Guidelines for Burrowing Animals.
Agriculturalists	Rural leaseholders	Land management and agricultural production which may be impacted by Bare-nosed Wombat behaviour
	ACT Rural Landholders Association	Advocacy for farmers and best practice farming within the ACT
Wildlife carers	Wombat Rescue	

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Group	Organisation/name	Role in relation to Bare-nosed Wombats
	ACT Wildlife	Caring for injured wombats and treating mange infected populations within the ACT. Advocate for wombat conservation.
Researchers	Prof Scott Carver	Conducting research on wombat ecology, biology and management
	[REDACTED]	
	[REDACTED]	
Ngunnawal	Dhawura-Ngunnawal Caring for Country Committee (DNCCC)	Traditional custodians of the Country in and around the ACT

4.1 Rural leaseholders

Rural leaseholders are frustrated by their current ability, or lack thereof, to manage Bare-nosed Wombats on their properties. Burrows and tunnels are becoming a big safety concern, with some paddocks described as 'Swiss cheese'. Staff and stock are frequently injured by falling into burrows (see section 9.2.1). Rabbits have become difficult to control, as they shelter in Bare-nosed Wombat burrows and cannot be treated. Landholders have expressed interest in the development of an authorised control program like the kangaroo management program in the ACT.

The management of mange on private properties is a cause of concern for rural leaseholders. Some leaseholders reported their dogs had contracted mange from the burrows of infected animals. This has resulted in expensive vet bills and distress to both dogs and their owners. Wildlife carers have also been caught trespassing on private property to treat mange. Landholders are concerned carers may be applying toxic chemicals without their knowledge. Furthermore, some leaseholders have experienced pressure from lobby groups in relation to kangaroo management and are apprehensive of similar dynamics with wombat carer groups.

Rural landholders within the ACT are frustrated by the current level of engagement with ACT Government on wombat management issues. Those involved in the wombat working group expressed concern that the group was heavily focused on conservation and mange treatment and did not adequately address the difficulties of managing wombats on rural properties. Rural landholders should be engaged directly to better understand the management issues they are facing, and to develop damage mitigation strategies to improve co-existence with wombats. For these strategies to be successfully implemented, they must be accepted by landholders as feasible and effective options. Additionally, continuing discussions between researchers, ecologists and landholders on the ecological value of wombats may improve landholder tolerance of wombats and facilitate effective management (Schumann et al, 2012).

It is important to note, there are 381 farmers within the ACT, only three rural leaseholders were consulted in the writing of this review. The views presented here do not necessarily represent the views of all rural leaseholders within the ACT.

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4.2 Wildlife carers

ACT Wildlife and Wombat Rescue are two groups rehabilitating Bare-nosed Wombats in the ACT. Wombat Rescue are often called out to assess the condition of injured or mange-affected animals by the ACT Parks and Conservation Service (PCS) and the public. Wombat Rescue has approximately 20 active members who respond to calls and their resources are strained. They are concerned about the level of awareness and training rangers have in assessing mange cases and determining if treatment or euthanasia is needed. While carers acknowledge assessing the severity of mange is subjective, they would like mange training courses to be mandatory for all rangers to attend. To address this issue in part, the ACT Chief Veterinary Officer developed the 'Assessment of sarcoptic mange in wombats: A guide for rangers' as a decision sheet for PCS rangers assessing mange severity and the need for humane euthanasia. Additionally, carers are concerned about the lack of suitable release sites for rehabilitated animals in the ACT, leading to most releases occurring in NSW. Both groups worry about post-release survival and are exploring GPS tracking to monitor outcomes.

Wombat Rescue leads efforts to treat mange across populations, while ACT Wildlife limits treatment to intended release areas (see section 9.3.1). Despite ongoing efforts, carers lack the resources to eliminate mange from populations and believe more needs to be done to control the disease. Wombat Rescue also notes that some leaseholders are reluctant to allow property access to wildlife carers to treat mange affected Bare-nosed Wombats, increasing tension between the stakeholder groups.

Urban development in the ACT is encroaching on Bare-nosed Wombat habitats, forcing them into river corridors and increasing population density (see section 9.3.2). While carers have positive relationships with some developers, they are concerned others neglect proper wombat management. Carers fear Bare-nosed Wombats are being pushed into narrow river corridors which will place a strain on resources and result in more aggressive territorial behaviour. They would like to see buffer zones placed around new developments to minimise impacts to Bare-nosed Wombats.

4.3 Community

Bare-nosed Wombats frequently interact with areas used by the broader community. As urban sprawl encroaches on Bare-nosed Wombat habitat there will likely be increases in human-wombat interactions and potential conflicts in urban areas. The broader community was not consulted as part of this review, and their opinions remain unknown.

Many people who do not live with wombats on their properties are often unaware of the issues these animals can cause, which contributes to resistance toward their management. Increasing public education about Bare-nosed Wombat biology, ecology, and the challenges they present can improve acceptance of species management strategies (Reiter et al., 1999). Including educational material on wombat ecology, impacts and management options on the CED website would be a valuable resource for the community. This could be similar to the information that is currently provided for other managed species (e.g. kangaroos). Public awareness

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campaigns should focus on the ecological role of Bare-nosed Wombats, the potential damage they can cause, and how to responsibly co-exist with them. Educational materials such as pamphlets, online resources, and community workshops can offer practical advice. This may include information such as what management is permitted under law, guidelines for effectively securing property, and safely driving in areas with high Bare-nosed Wombat activity. Additionally, encouraging the public to report wombat sightings and burrows would support monitoring and conservation efforts. Conducting surveys to assess public knowledge and attitudes toward wombats would help identify disparities between stakeholder groups and inform more inclusive management strategies. By fostering understanding through a well-structured information campaign, communities can better support responsible Bare-nosed Wombat conservation and reduce human-wombat conflicts across urban and rural settings.

4.4 Ngunnawal

Bare-nosed Wombats were widely used by First Nations people in many parts of southeast Australia. Much of the traditional knowledge has been disrupted due to the impacts of colonisation. Unfortunately, limited access to relevant contacts has constrained our ability to assess the importance of Bare-nosed Wombats to the Ngunnawal community at this stage. Reviving and incorporating First Nations perspectives into contemporary conservation efforts can help honour cultural importance and provide holistic approaches to managing Bare-nosed Wombat populations in the ACT.

4.5 Office of Nature Conservation (ONC)

The management of Bare-nosed Wombats is becoming an emerging and complex issue for ONC. ONC initiated a Wombat Working Group to work with stakeholders and better understand the complexities and conflicting viewpoints in this space, but reported they had trouble engaging leaseholders within the working group. The working group came to an end when there was no new information to guide decision-making. ONC faces pressure from wildlife groups to manage mange and has worked with researchers and wildlife carers to mitigate mange impacts. This includes the creation of the Wombat Mange and Monitoring Group, a subgroup of the Wombat Working Group focused on monitoring wombat populations and assessing mange. While there is a desire within ONC to effectively manage this species, a range of knowledge gaps and resource allocation has proven to be a significant hurdle.

4.6 ACT Parks and Conservation Service

Rangers find it challenging to manage community frustrations surrounding wombat burrow management in ACT parks and reserves. Walking and cycling trails are often re-routed along sub-optimal routes due to the presence of Bare-nosed Wombat burrows. As conservation officers, rangers are permitted to interfere with wombat burrows where necessary and are required to adhere to the Conservator Guidelines for the Protection of Burrowing Animals. Rangers would like support to manage burrows, particularly short starter burrows that are not used as a primary refuge.

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4.7 Natural Resource Management

The primary issues Natural Resource Management (NRM) encountered with Bare-nosed Wombat management were a result of conflicts with farmers. Anecdotally Bare-nosed Wombat numbers have increased in the last 15-20 years, and subsequently the number of conflicts has increased. Among landholders there is an appetite to declare Bare-nosed Wombats overabundant and allow lethal controls as a management tool. NRM would be reluctant to implement lethal control as there are multiple knowledge gaps around current population levels and minimum viable populations. NRM also highlighted the lack of resourcing for non-lethal options for managing conflict between landholders and Bare-nosed Wombats. Subsidising exclusion fencing in hotspot areas may be a feasible option for conflict resolution. One-way gates, another management option, may remove conflict in one area but relocate wombats and conflict to another area.

4.8 Icon Water

Bare-nosed Wombats have damaged Icon water essential services infrastructure (see section 9.2.1). Icon Water sought advice from ecologists on damage mitigation strategies but had difficulties finding skilled ecologists with capacity to assess the problem and implement recommendations. As a result, Icon Water now manages wombat damage independently based on online consultation with ecologists. They have adopted a variety of management strategies, but they require monitoring and management investments. Icon Water currently has sufficient resources to continue implementing their management program.

4.9 Licensing and Compliance

Lethal control of Bare-nosed Wombats in the ACT is not permitted, however there is pressure from rural communities for it to be permitted. If the ACT government was to permit lethal control of Bare-nosed Wombats it would need to be part of an evidence-based controlled native species management plan (CNSMP), similar to macropods. A CNSMP would require clear guidelines around when control is appropriate, and the criteria that must be met for control to occur. For example, the existing CNSMP for Eastern Grey Kangaroos clearly defines when control occurs, the number of animals to be removed, and benchmarks for shooter proficiency. A CNSMP for wombats would also require a new code under the Animal Welfare Act that defines how wombats are to be controlled humanely. The PCS licensing department is supportive of developing a CNSMP for wombats and indicated that this is preferable to issuing licenses for control. Currently there have been no formal complaints to the licensing department about Bare-nosed Wombats.

In recent years, wildlife carers have been concerned about the impacts of new development on Bare-nosed Wombats. In response, the Office of the Conservator for Flora and Fauna developed the Conservator Guidelines for the Protection of Burrowing Animals during development (Protection of Burrowing Animals During Development) Conservator Guidelines 2025 notified under the [Legislation Act 2001](#). There are currently two licences issued to interfere with Bare-nosed Wombat burrows.

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4.10 Scientists

The only scientist consulted during this review was Dr. Scott Carver, who specialises in researching wildlife disease ecology. Dr. Carver was a member of CED's [Wombat Working Group] and has worked with the ACT and Tasmanian governments on mange-related projects. He felt the Wombat Working Group effectively achieved its intended purpose. Similar to the Tasmanian wombat working group, the CED-led group came to a natural end when participants ran out of new information to bring to the table.

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Dr. Carver has worked extensively with wildlife carers on mange treatment. He noted that within the stakeholder group there is disagreement over best practice treatment methods and determining when euthanasia is appropriate. He noted that conversations in this space can escalate quickly, and more research is necessary. A recent study by the Wombat Protection Society and associated researchers trialled increasing the dose of moxidectin from 20 ml to 100 ml to treat mange in wombats. Dr. Carver noted that this is a large increase in dosage, and studies gradually increasing the treatment dose to determine the lowest effective amount would be key to preventing excessive use of moxidectin.

Dr. Carver acknowledged leaseholders had conflicts with Bare-nosed Wombats and more research was necessary in this space, but it was outside his area of expertise.

4.11 Chief Veterinary Officer

The ACT Government Chief Veterinary Officer (CVO) was primarily concerned Bare-nosed Wombats treated for mange *in situ* are not getting the proper care they need. Ideally animals would be diagnosed by a qualified veterinarian prior to being given treatment, although the CVO did acknowledge that this was not possible when treating wild animals *in situ*. They raised concern that the indiscriminate application of moxidectin at all burrows within an area can lead to accidental overdosing of individual Bare-nosed Wombats. Conversely, some wombats may not receive a full dose if the chemical splashes as they are exiting a burrow or they move away from the treatment area. Healthy animals within the population will also unnecessarily receive treatments, which could lead to the development of chemical-resistant mites.

The drugs being used to treat Bare-nosed Wombats have the potential to cause harmful side effects in other species. Dogs that ingest moxidectin can experience neurotoxic effects and possible mortality. Faecal matter from treated animals contains traces of moxidectin, which can wash into waterways and affect aquatic systems. Responsible use of mange treatment drugs is critical to ensuring the negative impacts on ecological function are minimised.

4.12 Developers

The ACT population is projected to grow to 696,000 by 2050. Over the next few decades urban expansion is likely to encroach on areas where Bare-nosed Wombats reside resulting in management issues for urban developers. No developers were spoken to during this review. Consultation with developers is recommended to ensure urban expansion can be managed with minimal impacts on Bare-nosed Wombats.

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5 Complexities of wombat management

The management of wombats is highly contentious, with challenges arising from the need to balance the competing interests of diverse stakeholder groups, including local government, leaseholders, First Nations, and wildlife care organisations (see Table 4). Conservation and wildlife care groups advocate for stronger protections for Bare-nosed Wombats, while agriculturalists and developers seek to manage the species to reduce damage to infrastructure, livestock, and personnel.

It is unlikely that all stakeholder groups will agree on a single approach to wombat management. However, participatory planning can improve communication and foster mutual understanding. Involving stakeholders in decision-making processes can lead to greater ownership of outcomes, enhance program credibility and transparency, and support the achievement of long-term goals (Hewitt and Messmer, 1997). Stakeholders are less likely to adopt or support management practices if they feel their opinions have not been taken into consideration and may take management actions into their own hands.

To date, there is no known research specifically examining the complexities of stakeholder relationships in wombat management. However, studies have explored landholder relationships with Southern Hairy-nosed Wombats (O'Brien, 2019, Sparrow, 2011, St John and Saunders, 1989, Stott, 1998) and Bare-nosed Wombats (Marks, 1998c). Additionally, the 5th IUCN World Parks Congress in 2004 brought together conservation experts to discuss human-wildlife conflict. Insights from this workshop, summarised by Madden (2004) provide a useful guiding resource for managing human-wildlife conflict.

5.1 Common causes of damage

5.1.1 Burrowing behaviour

Wombats are one of the largest burrowing herbivores in the world and create warren complexes that vary in complexity from single entrance burrows to a collection of interconnected burrows (warren). Burrows can vary in depth (0.4-2.8 m) and length (0.5-20 m), as such the spoil mound can be anywhere from 2.5-8 m² (Triggs, 2009, McIlroy, 1973). A Bare-nosed Wombat can use up to 11 burrows within their home range, though they typically favour the use of 1-2 burrows (Evans, 2008). Though their burrowing provides essential ecosystem services it often leads to conflicts with people. Bare-nosed Wombat burrows can undermine infrastructure such as roads, buildings, water tanks, fencing, dams which can result in substantial damage, financial costs and safety concerns.

One of the main points of contention for rural leaseholders with Bare-nosed Wombats on their properties in the ACT is the damage and occupational health and safety risks burrows can cause. This includes damage to fencing, dams, roads, buildings and erosion. Wombat damage to fencing can result in stock escaping from paddocks, posing a safety risk to both stock and people. Livestock may become injured or lost once they escape from the safety of a property resulting in financial losses to the rural leaseholders. Where properties adjoin parks and

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reserves there is a risk escaped stock may damage parks and reserves and incur fines for the landholder. Furthermore, rural leaseholders have a legal responsibility to ensure their stock does not stray from their property and can be held liable for any damages if they escape. Fence damage can also allow access to properties from undesirable pest species such as pigs.

Rural leaseholders and Icon Water have reported issues with Bare-nosed Wombats burrowing into the sides of dams or reservoirs. This is not only a safety concern for people but also the Bare-nosed Wombat. If a dam wall breaks it has the potential to release large volumes of water, threatening farm water supplies and downstream properties. In addition, it could cause increased erosion and sediment washing into the Murrumbidgee River and other major waterways. This places a significant financial burden on the rural leaseholders who are responsible for appropriately maintaining their dams. Icon Water have been managing Bare-nosed Wombats burrowing around dams by using one-way gates to force animals to leave the burrow and filling the hole with cement once they have been evicted.

Icon Water, rural landholders and PCS rangers have reported safety concerns with Bare-nosed Wombats burrowing under roads and tracks and within paddocks. The weight of a vehicle driving over a tunnel can cause the tunnel to collapse, causing damage to vehicles and necessitating vehicle and road maintenance. For rural leaseholders, burrows pose a significant safety risk to people and stock. Landholders using quadbikes and buggies can incur significant injuries if their vehicle falls into a burrow, which can lead to lengthy recovery times and a loss of income. Rural leaseholders have reported vehicles falling in tunnels as frequently as once a month with estimated damages costing ~\$1,000. This risk is increased in summer when grasses and other vegetation obscure burrow entrances. Landholders can also be liable for injuries to contractors and other staff working on their property, and landholders have been sued by injured contractors. Stock falling into wombat burrows can negatively affect animal welfare and lead to financial losses. One rural leaseholder has had to remove high value stock from a paddock with high levels of Bare-nosed Wombat activity. When wombat burrows limit accessibility of paddocks landholders may not be able to carry out other management tasks such as weed control. While burrow entrances can be mapped to reduce the risk, it would need to be updated regularly to account for new burrows. This is not feasible for rural landholders at a large scale.

Bare-nosed Wombats burrow under other infrastructure, such as buildings, water tanks and wastewater treatment drying beds. They can be removed with the use of one-way gates and burrows can be backfilled, but it is possible wombats will re-excavate the site. Rural leaseholders have tried using mesh to prevent re-excavation, but this treatment only lasts up to six months. Icon Water use a range of methods to prevent Bare-nosed Wombats re-excavating under infrastructure including the installation of cement skirts, placement of large rocks or mesh skirting. This requires ongoing maintenance and monitoring to keep animals out of undesirable areas. Burrows can also harbour rabbits, which creates an added layer of complexity in rabbit control. If rabbits are found using Bare-nosed Wombat warrens, Icon Water install one-way gates to remove the wombat before fumigating the burrow.

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5.1.2 Grazing competition/Crop damage

Within the ACT there are 20,869 ha of agricultural land, the majority of which is stock grazing land, with a small amount of cropping. Though competition for food resources between wombats and livestock has been reported as an issue of concern in other states (O'Brien, 2019, Stott, 1998, Marks, 1998c). Rural leaseholders in the ACT have not reported it as an issue. The density of wombats on properties can vary at local and regional scales and may influence reports of grazing competition. For example, within the Murraylands of South Australia, Southern Hairy-nosed Wombats have an estimated DSE (dry sheep equivalent) of 0.5, comparatively sheep have a 1.2 DSE. Dry sheep equivalent is a unit of measure used to assess the nutritional needs of livestock and assess the carrying capacity of a farm. It equates to the amount of feed required by a two-year-old 50 kg Merino wether per day. Landholders have had to reduce their stocking rate by 20%, to account for the impacts of growing Southern Hairy-nosed Wombat populations, threatening the viability of some farms. Due to the differing climatic conditions in the ACT Bare-nosed Wombats might not have a substantial grazing impact. However, only three rural leaseholders were consulted in the writing of this document. Further consultation with rural leaseholders is recommended to understand the extent of the problems they are facing within the ACT before ruling grazing competition or crop damage out as a potential cause of conflict.

5.1.3 Erosion

Wombat burrows are often perceived to cause erosion in creeks and gullies (O'Brien, 2019); however, the extent of damage has not been quantified. Past land clearance may have resulted in increased soil instability, facilitating wind and water erosion of creek lines over time. When Bare-nosed Wombats burrow into steep banks, they undercut and destabilise them, the effects of which are exacerbated in unstable soils where there is a lack of vegetation. Eroding soils get washed into the Murrumbidgee River which has environmental implications for aquatic systems. Assessment of erosion damage is needed to determine the underlying cause and quantify the damage so the most appropriate management actions can be implemented.

Rural leaseholders have used fencing to prevent stock from accessing creek lines and contributing to erosion risks. They are unable to prevent Bare-nosed Wombats from digging into creek banks and damaging the stock exclusion fencing. One rural leaseholder remediated the creek line of his property to reduce the erosion and subsequent damage to the surrounding aquatic environment with the help of ACT NRM and community groups (Figure 3). It took significant effort getting the necessary approvals on top of the time and costs of the work itself, totalling over \$50,000. This work was undertaken as part of a grant program and would otherwise have been infeasible for the rural leaseholder. The rural leaseholder reported difficulty in dealing with 'red tape' associated with the project and would not have completed it without the help of the ACT NRM.

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Figure 3. Top – the eroding creek line on a leaseholder's property prior to remediation works. Bottom – the creek line after remediation works.

5.1.4 Land clearance for urban development

Recent expansion of urban development has caused concern among wildlife groups for wombats. Though Bare-nosed Wombats are a protected species they are not threatened and thus do not need to be considered when assessing a site for development approval. As such, developments have been planned, approved and construction commenced in areas where Bare-nosed Wombats occur without considering the impacts. Though it is an offence to kill or interfere with a Bare-nosed Wombat under the Nature Conservation Act 2014, burrows have reportedly been destroyed during earthworks by developers, potentially burying Bare-nosed Wombats alive (pers. comm wildlife carers 2024). Wildlife carers have reported increased numbers of call outs in areas where urban development has or is occurring. This has highlighted the need for a greater understanding of the impacts of development on Bare-nosed Wombats.

As a response to potential impacts from development on Bare-nosed Wombats and other burrowing animals, the Conservator of Flora and Fauna has developed Conservator Guidelines for Burrowing Animals. The purpose of the guidelines is to improve consideration of burrowing animals during development and provide direction to developers on best practice methods to minimise harm. The guidelines will apply to any new developments within the ACT. During planning stages, developers will need a suitably qualified ecologist to identify burrow and

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shelter sites, monitor them for activity and ensure they are vacant or avoid developing over them wherever practicable. Wombat Rescue and ICON Water have highlighted the difficulties of conducting appropriate assessments due to the lack of capacity among suitably skilled ecologists in the ACT. Wombat Rescue are often called by ecologists seeking advice on how to manage wombats (pers. comms Wombat Rescue 2024). Where avoidance of burrows is not possible developers can apply for a licence to destroy burrows and must follow the guidelines to ensure this is done with minimal disturbance to animals.

The guidelines don't take into consideration the potential for new developments to fragment and isolate populations, limiting dispersal and resulting in genetic differentiation over time. Prior to any new land use zoning, consideration should be given to whether wildlife populations will be disconnected resulting in small and isolated populations that over time could result in inbreeding. There is concern development is pushing Bare-nosed Wombats into narrow river corridors where increased densities could result in increased competition for resources and creating stressful conditions for animals. Without a more detailed understanding of the abundance of Bare-nosed Wombats and carrying capacity in the ACT it is difficult to determine the impacts of increasing development and expansion. Furthermore, the carrying capacity of Bare-nosed Wombats is unknown and likely to vary from region to region based on habitat and resource availability.

If Bare-nosed Wombat densities are reaching a critical limit with food resources it can increase stress, competition and ultimately population declines. Increased stress and high Bare-nosed Wombat densities are often associated with increased mange prevalence (Sengupta, 2019). Areas closer to fresh water are also predicted to have the highest suitability for mange (Ringwaldt *et al.*, 2023). Urban areas abutting river corridors where Bare-nosed Wombats occur could result in increased human-wombat interactions. Dispersing Bare-nosed Wombats may wander into urban areas where conflicts can occur (e.g. burrow damage) and be more susceptible to road vehicle collisions. There could also be increased interactions between wombats and pets, resulting in injuries to domestic dogs and wombats. Dogs have been known to enter burrows where they may contract mange, get stuck or become injured. Increased public education on the implications of living near Bare-nosed Wombats will be essential.

It is important to note no developers were consulted in the preparation of this report. Consultation with developers is recommended to improve Bare-nosed Wombat management in areas under development.

5.2 Conservation concerns

5.2.1 Mange

Sarcoptic mange is a skin condition caused by the *Sarcoptes scabiei* mite. Mange initially presents as skin reddening and hair thinning. As the disease progresses, visible signs of itching, alopecia and epidermal crusting appear (Pence and Ueckermann, 2002). Mange has strong animal welfare implications as affected individuals can suffer a slow and agonising death, usually through secondary infection, blindness and/or starvation (WHA, 2021). Prevention of mange in Australia is considered almost impossible, as all disease transmission pathways would need to be interrupted, including transmission from host species such as foxes (WHA, 2021).

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Ideally mange should be diagnosed and treated by qualified veterinarians so the condition is correctly identified, and animals can receive appropriate treatment. This is not feasible for wildlife populations. Mange in wombats is typically diagnosed and treated by wildlife carers and volunteer groups with varied levels of training, experience and coordination. Diagnosing the disease in its early stages can be difficult without catching and examining animals. The same symptoms can be caused by malnourishment from low quality feed, creating the potential for misdiagnosis (Fraser et al., 2018).

The distribution of mange and its impacts on wombat populations is poorly understood. Bare-nosed Wombat populations often persist in the presence of mange, and prevalence is usually $\leq 15\%$ (Carver et al., 2021). During outbreaks, mange prevalence can rise to $> 50\%$, with near 100% mortality of infected individuals (WHA, 2021). In some cases, mange outbreaks have resulted in $> 90\%$ decline in local Bare-nosed Wombat abundance (Skerratt 2005; Martin et al. 2018a). Research suggests population decline and range retraction can occur when mange prevalence is $> 25\%$ (Carver et al., 2023). Additional research is needed to understand which environmental variables may lead to mange outbreaks.

Increased rates of mange are often associated with high wombat densities and periods of drought or high stress (e.g. seasonal stress in winter) (Sengupta, 2019). Burrows are thought to be the predominant mode of sarcoptic mange transmission in wombats (Evans, 2008, Martin et al., 2019, Beeton et al., 2019). The humid and cool microclimate within wombat burrows provides favourable conditions to maximise mites off-host survival, particularly in cooler months (16.4 days in winter and 5.96 days in summer). Mites can survive in burrows longer than the minimum known frequency of wombat burrow switching 4- 10 days. Transmission is exacerbated by patterns of burrow use and sharing (Evans, 2008; Martin et al., 2019b).

Regulation of veterinary chemicals used to treat mange in Australia

The Australian Pesticides and Veterinary Medicines Authority (APVMA) is responsible for the regulation and control of agricultural and veterinary chemicals in Australia. Under legislation, the APVMA can evaluate, approve and register agricultural and veterinary chemicals, regulate supply, undertake compliance and issue permits for use. There are currently four active permits (valid in all states and territories of Australia) and three active permit holders approved for veterinary chemicals use for the treatment of mange in wombats.

The Wombat Protection Society holds two permits for the use of a Cydectin (active constituent Moxidectin). One permit allows for a dose 4 ml per kg of body weight with a maximum single dose of 100 ml on an adult wombat (>15 kg) with five days between doses and no more than five doses. The efficacy and toxicity associated with this dose rate has not been fully evaluated and users must observe wombats for any signs of toxicity. Any wombats that die after treatment must be reported to a veterinarian and a detailed postmortem carried out.

A second permit held for the use of Cydectin allows 0.8 ml dosage per kg of body weight with a maximum dose of 20 ml applied once weekly for 15 weeks. This permit is also held by Mange Management Incorporated. Cydectin can be delivered directly or by topical application using a pole and scoop to pour a dose onto the wombat's back, or indirectly by using a burrow flap that doses the wombat when passing underneath.

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Intervet Australia holds a permit for use of Bravecto (active constituent Fluralaner) for mange treatment. The dose is 25 mg/kg with a maximum of three doses one month apart on wombats > 5 kg. Bravecto must be applied by topical application directly or by using a pole and scoop to pour a dose onto the wombat's back.

A condition of all these permits is that 'the product must only be used by persons who have appropriate experience in identifying mange infection and toxicity signs in wombats'. It is the permit holder's responsibility to ensure people operating under the permit are trained in the identification and treatment of mange in wombats. This is particularly relevant for care groups, where mange treatments may be administered by a range of volunteers. The permit holder must record any adverse experience associated with the use of the product and report them to the APVMA as soon as possible.

While there are no conditions on any of the APVMA permits with regards to Cydectin use near waterways, an environmental protection warning on the product states 'Moxidectin is extremely toxic to aquatic species. Do not contaminate dams, rivers, streams or other waterways with the chemical or used container.' This statement applies to use of the product under all APVMA permits.

Applying moxidectin indiscriminately across all burrows in an area may lead to unintentional overdosing of individual wombats over time, either from inaccurate dosage or from wombats relocating to treated burrows. Some wombats may not receive a full dose if the chemical splashes as they are exiting a burrow or they move away from the treatment area. Healthy animals within the population will also unnecessarily receive treatments. This could lead to the development of mite resistance arising from inappropriate chemical concentrations being administered.

There is also a risk non-target animals are treated, as wombat burrows are known to be used by a range of other native species (Linley et al., 2024, Thornett et al., 2016) and the impacts of moxidectin on these species is unknown. The broadscale use of these chemicals can result in chemical residues within the environment which can have negative impacts on native fauna, including invertebrates and aquatic species. Application with a pole and scoop though more time consuming can specifically target wombats with mange and promotes good chemical stewardship.

Some carers believe other products are safer or more effective and use a range of alternative treatments or supplementary products to relieve itching and treat secondary infection. Less invasive approaches include the one-off or repeated administration of a topical acaricide. However, topical treatments may not reach mites due to a failure to penetrate parakeratotic scale crust or be adequately absorbed systemically due to a thickened epidermis. Even among experienced carers there is wide disagreement about how best to treat mange (O'Sullivan, 2018).

Current treatment of mange in the ACT

In the ACT, Bare-nosed Wombats are primarily treated for mange by Wombat Rescue volunteers, and to a lesser extent ACT Wildlife carers. Volunteers operate under APVMA permits PER89982 and PER90837 issued under section 112 of the Agricultural and Veterinary Chemicals Code 1994. The first permit allows for the treatment of

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Bare-nosed Wombats with mange using up to 20 ml of Cydectin via burrow flap or pour on/pole and scoop application methods. The second permit allows for the treatment of Bare-nosed Wombats with Bravecto using pour on methods only. Volunteer groups must also apply for a licence under the *Nature Conservation Act 2014* to use a vehicle within a reserve.

In addition, Wombat Rescue has a TCCS permit for use of Cydectin on public lands to undertake population treatments, with strict conditions of its use around waterways due to its toxicity to aquatic species. Cydectin must not be used when there is a medium chance or greater (>40 %) of heavy rain (>10 mm) forecast and all treatments within 5-15 m of a permanent waterway must be removed within 24 hours in the catchment area. A treatment area cannot exceed 1km of river reach, can only be treated at the population level once annually and no more than 6 treatment areas can be treated annually along the Murrumbidgee and Molonglo Rivers. Population level treatment by burrow flap application must not be used within 15 m of permanent waterways but is permitted for treating a maximum of 5 individuals at any one time. Cydectin cannot be used within 5 m of the water's edge or within 5 m from the centre of drainage lines and intermittent gullies, including unnamed drainages at any time. No treatments are to be applied in the Cotter Catchment above Cotter Dam, Namadgi National Park or Tidbinbilla Nature Reserve. The location and dosage details of all treatments, particularly those within 5-15 m of a permanent waterway, must be entered into a shared spatial layer once treatment has commenced.

Mange-affected Bare-nosed Wombats are treated both individually and at a population level. Population level treatments are conducted by Wombat Rescue and occur mainly in riparian areas along river corridors. Due to the substantial time it takes to install burrow flaps on every burrow, and permit restrictions, volunteers are only able to treat burrows along a 1 km stretch of the river at a time. Mange can be successfully eliminated in isolated areas, but where connected populations of Bare-nosed Wombats occur along river corridors, it is difficult to eradicate mange as infected individuals from outside the treatment zone can wander in following the course of treatment. ACT Wildlife only administers mange treatments in areas where rehabilitated Bare-nosed Wombats are to be released if there has been isolated incidence of mange to maximise their chances of survival.

Wombat Rescue regularly responds to call outs to treat and rescue mangy Bare-nosed Wombats from concerned members of the public and ACT Parks and Conservation Service.

Mange distribution

To gain a better understanding of the distribution of mange in the ACT, CED have developed an online portal to enable the community to report sightings of mange-affected Bare-nosed Wombats. Sightings are also reported on WomSAT, an online application developed by researchers at the University of New South Wales. This data helps inform the national distribution and prevalence of mange in wombats. Users of WomSAT create an account and sightings must include a photo for verification. While applications of this nature enable capture of data across broad regions, reporting is typically skewed towards areas of high human activity and therefore may not accurately represent the presence/absence of mange (Figure 4).

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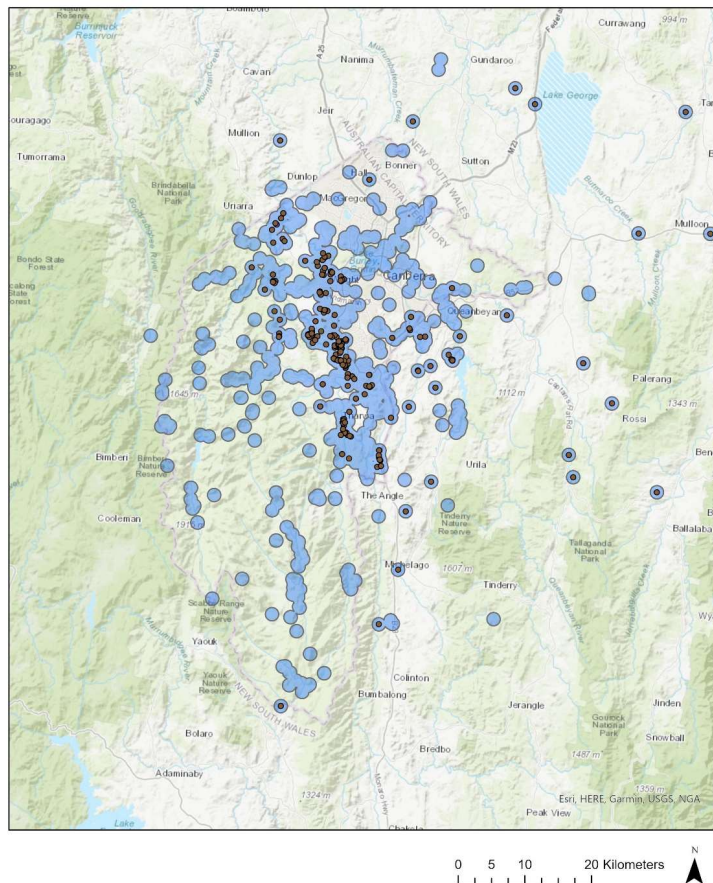


Figure 4. The known records of mange in Bare-nosed Wombats (red dots) in the ACT taken from CED survey data and ACT Wildlife Atlas wombat records and mange portal data.

Wombat Mange and Monitoring Group

To progress treatment of mange and improve monitoring of Bare-nosed Wombats in the ACT, CED convened the Wombat Mange and Monitoring Group (initiated March 2021). This group was formed as a subgroup of the Wombat Working Group. Members included two community wildlife care groups (Wombat Rescue and ACT Wildlife), Prof. Scott Carver of the University of Georgia USA (formerly of the University of Tasmania) and CED staff. The group took a collaborative approach to addressing mange and coordinates activities of the community and ACT Government. Previous activities of the Wombat Mange and Monitoring Group include:

- Trialling the use of Bravecto, as a potentially longer-lasting, more effective, and target-specific treatment for mange.

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- Developing a collaborative monitoring program to provide data on wombat populations, distribution, and mange prevalence across the ACT.
- Support mange treatment in public reserves while minimising risks associated with using Cydectin near waterways.
- Undertake collaborative research on the impacts of mange treatment chemicals on aquatic ecosystems.
- Develop and promote a publicly accessible web-based communication portal to enable community members to report Bare-nosed Wombat sightings and incidences of mange.

5.2.2 Road vehicle collisions

Collisions with vehicles are a source of mortality or injury for Bare-nosed Wombats and a safety concern for people. Roadkill records reported in the WomSAT app between 2015-2019 are relatively low in the ACT in comparison to other states (Figure 4, Mayadunnage et al., 2024). WomSAT relies on citizen scientists to report sightings and thus data may not be representative of all road kills occurring in the ACT. Roadkill records are collected by the Urban Wildlife Team, and it is worth reviewing them to gain a better understanding of the frequency of collisions and identify hotspot areas where intervention may help to reduce collisions.

The frequency of vehicle collisions is likely to vary depending on traffic levels, vehicle speed, Bare-nosed Wombat population density, climate and season (Mayadunnage et al., 2024, Ramp et al., 2005). Bare-nosed Wombat road mortalities are higher in winter and early spring (Roger et al., 2011, Mayadunnage et al., 2024, Nguyen et al., 2022). This could be linked to seasonal changes in the activity periods of Bare-nosed Wombats or more cars being on the road at dawn and dusk due to shorter winter days. High Bare-nosed Wombat road mortalities have been linked to areas of dense forest cover and the greenest ground cover in areas where wombat burrows are present (Roger and Ramp, 2009).

Within the ACT, most Bare-nosed Wombats (approximately 50 a year) come into care because of injuries from road vehicle collisions or being orphaned due to a vehicle collision. The relatively small number of Bare-nosed Wombats taken into care does not represent the total number of wombats killed.

Wombats can cause substantial damage to vehicles, the cost of which is unknown. Analysis of 17,000 animal collision claims between 1 January – 31 December 2023 by Suncorp Group revealed the most common animals drivers collide with are kangaroos, wallabies, wombats, deer, dogs, cows and emus (AAMI, 2024). The average cost of an animal collision insurance claim is greater than \$5,000 and 16% of vehicles were written off in claims that involved wildlife. The study revealed 76% of Australians believe kangaroos would cause the most damage to a car if involved in a collision, followed by wombats (16%).

Even if roadkill is not causing widespread declines of Bare-nosed Wombats, wildlife-vehicle collisions should be reduced where possible. Measures to reduce wildlife vehicle collisions include installing wildlife warning signs, installing underpasses or overpasses, and using deterrent devices (see section 10.5 for more information).

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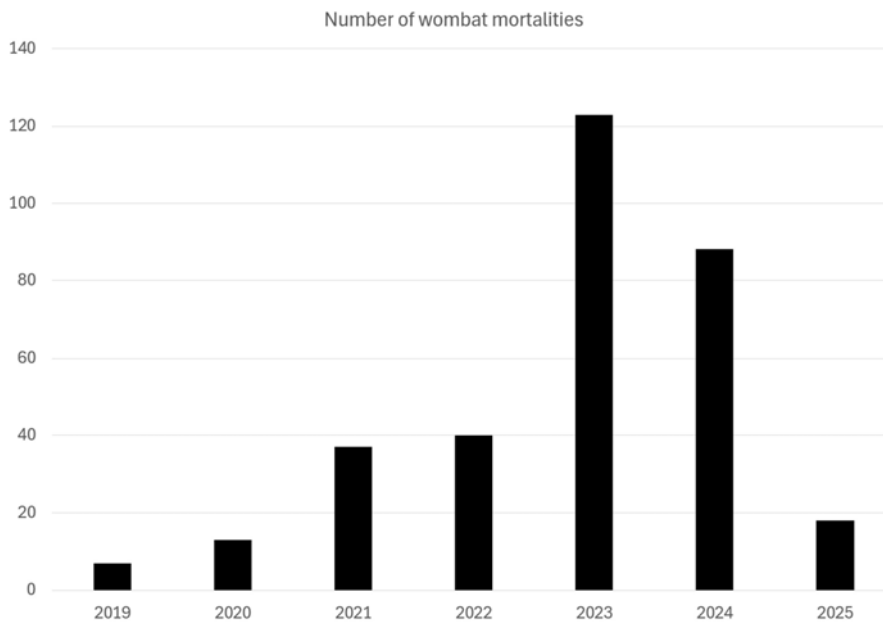


Figure 5. Temporal distribution of wombat roadkill records reported by the ACT Urban Wildlife Team between July 2019 and July 2025. For 2019, data is limited to July-December of that year; for 2025, data is limited to January-July of that year.

5.2.3 Habitat loss

The expansion of urban development has caused concern for the safety of Bare-nosed Wombats. The ACT is around 236,000 hectares, which is roughly 43.6 conservation estate, 10% highly modified urban land, and 15% highly modified rural and broadacre lands. The exact division of land may be different as land zoned for urban areas may still be undeveloped or rezoned to another land use prior to development. Between 2006 and 2022, the ACT's urban area grew by 9% (2,760 ha). Most development has been in Gungahlin (Taylor, Throsby, Jacka and Moncrieff), West Belconnen (Ginninderry) and the Molonglo Valley (Whitlam and Denman Prospect). The increase in urban land has been driven by strong and sustained population growth over the last decade. The ACT population is projected to grow to 696,000 by 2050. The *ACT Planning Strategy 2018* aims to accommodate this growth while limiting urban spread by setting a target of 70% of new housing being built within existing urban areas. The impact of urban expansion of Bare-nosed Wombat populations is poorly understood. Urban development is thought to be pushing Bare-nosed Wombats into river corridors where their densities are high, resulting in increased stress from resource competition and territoriality (pers. comm wildlife carers 2024). In contrast, reports from other stakeholder groups indicate the distribution and abundance of wombats is increasing. The distribution of Bare-nosed Wombats across different land use zones is unknown and worth investigating to properly understand the potential impacts of further development on populations.

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6 Wombat management methods and options

Conflicts with wombats have traditionally been resolved using lethal controls, but there is increasing advocacy for the development of alternative 'non-lethal' management options. Creating policy around alternative 'non-lethal' management options are hindered by a lack of quantitative evidence on their effectiveness and humaneness. Management options perceived as non-lethal can have negative ecological or animal welfare impacts, sometimes resulting in death. For example, translocation often has low survival rates but is perceived as a non-lethal management option because it does not involve the direct killing of animals. The term 'non-lethal' has not been used to classify management options in this review.

Research into damage mitigation techniques has not yielded conclusive results or sustained long-term benefits (Barlow et al., 2010, Koehler AE, 1990, Mason, 1998). Given the nature of conflicts vary greatly, no single management technique will alleviate all conflicts. A variety of damage mitigation techniques are needed that can be tailored to the ecological, social, cultural and economic realities in which conflicts occur (Dubois et al., 2017). Land managers also require data on the distribution and abundance of wombats, as well as the type and extent of damage, to effectively implement a management strategy.

This section reviews current research on wombat management and damage mitigation strategies.

6.1 Fencing

Exclusion fencing is a popular tool for eliminating damage to high value resources. While it is perceived as non-lethal it can have negative impacts on target and non-target species by prohibiting natural movement patterns or inhibiting access to important resources. Prior to installing exclusion fencing, careful consideration needs to be given to the ecological impacts on excluding species from their habitat.

6.1.1 Foot netting

Excluding wombats from areas where they are causing damage such as to high value infrastructure or resources can help to reduce damages and increase landholder tolerance towards wombats. Several wombat exclusion fence designs have been trialled. Attaching foot netting to the bottom of fences has been found to temporarily reduce the number of holes dug in fencing by 35-63% for up to 3 weeks (Marks, 1998b). Borchard et al. (2009b) trialled using hinged joint wire (80 cm wide x 15 cm spacings) attached to the outside of existing fencing and flattened along the ground and secured with tent pegs every 1 m along a 100 m section of fence and silt fencing (770 mm wide) laid out in the same manner and secured every 30 cm. In both designs hinge wire foot netting was placed on the inside of the fence at wombat breach points. The foot netting trial resulted in a mean exclusion rate of 35% for a one month. In the absence of aversive stimuli wombats quickly learned to chew through the silt fence or dig under the wire netting.

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6.1.2 Electric fencing

Electric fencing has been shown to exclude wombats from areas where their behaviour conflicts with human land use (Marks, 1998b, St John and Saunders, 1989). The electrification of the dog fence along the Nullarbor Plain in south east Australia has reduced damage to the fence caused by Southern Hairy-nosed Wombats, which allows dingoes (*Canis lupus dingo*) to pass through (St John and Saunders, 1989). On the outside of the dog fence, an additional two strands of wire 15 and 30 cm above the ground, positioned approximately 30 cm away from the original dog fence were constructed. The fence is patrolled regularly by dog baiters who assess the fence for signs of damage. Most damage occurs from Southern Hairy-nosed Wombats inside the fence attempting to travel north. Electrifying the fence has prevented Southern Hairy-nosed Wombats from travelling north, resulting in them moving south of the highway into crop land where they had not previously been, resulting in conflicts with wombats and crop farmers (Sparrow, 2011). Marks (1998a) found electric fencing produced variable results, for Bare-nosed Wombats with electric fencing reducing the number of holes by 0-92% over 13 weeks. Landholders who used electric fencing to exclude Southern Hairy-nosed Wombats from their properties reported it to be unsuccessful as the electrified strands were often shorted out by vegetation or debris and it was too time intensive to check (O'Brien, 2019). Electric fencing is costly and time consuming to maintain on a small scale. Landholder perceptions of success may not be influenced solely by damage reduction, but also by the time and costs associated with implementing and maintaining control measures.

The use of electric fencing to reduce wombat damage is best suited to protecting small areas with important assets inside wombat free areas. Electric fencing will require regular inspections to ensure the fence hasn't been damaged or shorted out and involves construction costs and ongoing costs to run.

6.2 Wombat gates

Swinging gates have been recommended to reduce fence damage by wombats in Australia (Breckwoldt, 1983, Triggs, 2009) which can allow stock to escape paddocks or other unwanted animals from entering crop fields. Wombats can make numerous breaches in fencing and the installation of gates at every breach point may be impractical. The placement of gates would depend on the density of wombats in the area and the number of access points being used. Gates should be installed at the most well-used breaches and exclusion netting can be used to 'train' wombats to use the gates. Anecdotal evidence suggests Bare-nosed Wombats will use gates placed up to 800 m apart without making new holes (Triggs, 2009). Breckwoldt (1983) recommends gates of a timber construction which is likely to require regular maintenance. Newer fence designs consist of heavy-duty weld mesh gates weighing at least 2-3kg if trying to exclude other animals such as wallabies (Statham and Statham, 2009, Driessen et al., 2020). If Bare-nosed Wombats could not see through gates they would dig a hole next to it rather than use it (Statham and Statham, 2009). Gates weighing between 4.5-16 kg have also been reported to be used by Bare-nosed Wombats (Coates, 2013). Borchard et al. (2009a) found Bare-nosed Wombats continued to breach the foot netting of fencing for the first few months while they learned to use the gates requiring ongoing repairs. Driessen et al. (2020) wired gates open for two weeks to allow Bare-nosed Wombats a habituation period but did not report on fence breaches throughout the study.

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The decision to use wombat gates or a combination of gates and exclusion fencing will depend on the extent of the problem, the cost of the damage and the cost to purchase, erect and maintain the length of fence required. The installation of gates can be laborious and will likely require ongoing maintenance. The installation of gates in fencing may prevent damage to fencing but it does not prevent wombats from accessing areas where their behaviour may cause further damage on the property, thus not all property managers will readily accept the use of swinging gates or view it as a successful damage mitigation strategy (Borchard and Collins, 2001).

6.3 Mapping wombat burrows

There are a variety of methods for surveying and mapping the location of wombat burrows. While it is not a direct damage mitigation method it may prove useful for choosing the most appropriate management action for burrows in unfavourable locations. Mapping the locations of tunnels can help to prevent accidents such as vehicles or machinery falling down tunnels which can collapse under their weight, by avoiding driving over them. However, in areas with a high density of tunnels this may be unavoidable.

6.4 Burrow collapsing

As wombats are known to use multiple burrows within their home range, the opportunity exists to remove problem burrows and moderate their burrowing activity with minimal impact on the wombats. However, widespread burrow destruction is not recommended as it can lead to the displacement of wombats. It is also important to consider the impact of burrow collapsing on young at foot who may not be able to travel long distances. Historically burrow collapsing has been used following fumigation to prevent neighbouring Southern Hairy-nosed Wombats from recolonising the area, however, it was rarely successful as burrows were re-excavated (Marks, 1998a). Burrow collapsing in combination with other methods to exclude wombats from areas where they are causing damage may prove more effective.

The gradual collapsing of burrows over three days in combination with the use of deterrents has been trialled as a management option for Southern Hairy-nosed Wombats (Sparrow et al., 2016, O'Brien, 2018). This method involves collapsing the first 1-2 m of the tunnel on day one, followed by another several meters on day two. The tunnel is left open, providing a clear exit point for wombats. The disturbance of the burrow on over the first two days is 93% effective in getting Southern Hairy-nosed Wombats to exit the burrow before ripping the tunnel on day three (O'Brien, 2018). On day three the tunnel is carefully ripped with a backhoe, stopping every few meters to check the direction of the tunnel and look for signs of occupancy. If a wombat is still within the tunnel, it can be left for another day to see if they will leave. On one occasion a Southern Hairy-nosed Wombat failed to leave on the fourth day and had excavated a further 7 m of tunnel overnight despite the presence of alternate inactive burrows nearby ($\leq 50\text{m}$ away). The failure of burrow disturbance to get the Southern Hairy-nosed Wombat to leave may reflect the importance of the burrow. Although Southern Hairy-nosed Wombats may use up to 10 different warrens within their home range, they usually use 1-2 warrens on most occasions to which they display high site fidelity (Shimmin *et al.* 2002; Finlayson *et al.* 2005).

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Both studies trialled the effectiveness of dingo urine and faeces in deterring Southern Hairy-nosed Wombats from re-excavating collapsed tunnels and produced mixed results. Sparrow et al. (2016) found untreated collapsed burrows on the Nullarbor plain in South Australia were recolonised within 75 days while those treated with dingo scents showed minimal activity. In contrast, in the Murraylands of South Australia 58% of collapsed warrens were recolonised within a month, while others took up to 6 months to be recolonised and deterrents didn't play a significant role in the time taken for recolonisation to occur (O'Brien, 2018). The differences in results between the two studies could be attributed to variances in the methods used or environmental factors such as predator densities at the sites or burrow availability and importance and warrants further investigation. Although burrow collapsing is considered non-lethal its impacts on evicted wombats has not been studied and warrants further investigation. Studying the impact of burrow collapsing on wombats may help to answer questions about the reasons for its success or failure. Burying steel mesh at the location of the collapsed burrow is untested but may prevent wombats from re-excavating.

Alternate methods could trap and relocate wombats or empty burrows using one-way gates placed in burrow entrances prior to collapse. Trapping is more time consuming and costly as traps need to be checked every morning and it requires careful planning and trained personnel to handle and relocate the wombat(s) but removing animals from the area may provide longer term relief from conflict. One-way gates can be installed and left in place until the burrow is empty, though regular assessment of the gate is recommended as wombats have been known to dig around or under them. Motion sensor cameras can be used to determine if a burrow is empty. Low-cost methods such as raking the soil to assess for footprints or the placing of sticks in a burrow entrance can be used to determine if a burrow is empty however, it is not always possible to determine if a wombat has gone into the burrow or exited.

The time and costs of burrow collapsing will vary on a case-by-case basis. Some burrows may be simple single entrance tunnels that take 1.5 hrs to rip while other more complex 5 entrance warrens that are 4 m deep can take up to 10 hours (O'Brien, 2018). Soil type and burrow depth will impact the time and costs associated with burrow destruction. Given the time and costs of collapsing burrows along with the low success rate it is not a viable long-term solution to wombat management, but it may prove useful in certain situations. Given Bare-nosed Wombats within the ACT breed year-round consideration needs to be given to the potential for there to be young at foot that may not be able to travel to the next nearest burrow or move through a wombat gate. Though these studies found burrow collapsing did not result in new burrows being dug in other locations it is always possible that it could transfer the conflict to a new location.

6.5 Deterrents

Designed to capitalise on an animal's mechanisms of threat detection, deterrents aim to discourage the use of human resources with aversive stimuli (Ramp et al., 2005, Apfelbach R, 2005, Schakner and Blumstein, 2013). A wide range of deterrents, such as chemical cues, novel objects, and painful stimuli are increasingly being marketed as non-lethal means of reducing human wildlife conflict (Breitenmoser et al., 2005). Although there are numerous studies on the use of deterrents, many devices have not been quantitatively field-tested, and their

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perceived effectiveness lies in testimonial and anecdotal reports. Controlled lab studies often do not translate to field situations, where numerous uncontrollable environmental factors can influence the way animals detect and respond to threats (Mason, 1998, Koehler AE, 1990, Barlow et al., 2010). Even where devices have been field tested, they often produce conflicting results.

Before deterrents are recommended to mitigate wombat damage, a better understanding of the factors influencing wombat threat perceptions and responses to them is needed. Further research is required to evaluate responses in different environmental conditions such as varying distance to cover, and with different methods of application and placement, to determine the optimal conditions for success. In addition, future studies should consider conducting trials in a closed system with known individuals or capturing and marking individuals prior to commencing trials for ease of identification so individual variation in responses can be taken into consideration.

6.5.1 Olfactory deterrents

Olfaction is known to play an important role in social communication in wombats (Taggart and Temple-Smith, 2008, Triggs, 2009), little is known about its role in threat perception. Anecdotally, fertilisers such as blood and bone, dog and human urine are thought to deter wombats (O'Brien, 2019). Dingo urine and faeces has been trialled with mixed results. Field trials found no difference in Southern Hairy-nosed Wombat activity before and after placing a cup of blood and bone in burrow entrances (O'Brien et al., 2021). Captive Southern Hairy-nosed Wombats increased their exploratory behaviour in response to dingo faeces placed inside burrows, followed by increased use of burrows and concealed locations (Descovich et al., 2012). Sparrow et al. (2016) reported Southern Hairy-nosed Wombats showed greater avoidance and prolonged time to recolonisation of collapsed warrens treated with dingo odours than control warrens on the Nullarbor in South Australia. Conversely, the application of dog urine and dingo faeces had no significant impact on the time taken for Southern Hairy-nosed Wombats to recolonise collapsed warrens in the Murraylands of South Australia (O'Brien, 2018) or deter them from using burrows where dingo urine and faeces were placed at the entrance (O'Brien, 2019). No known research has been conducted on the effects of odour deterrents on Bare-nosed Wombats.

The differing results of these studies indicate Southern Hairy-nosed Wombat responses to predator odours may be context dependent, but disparities in experimental design and analyses make it difficult to determine which factors are influencing threat perceptions. Control–impact studies may lead to a misconception of the effectiveness of treatments as they don't consider differences in pre-existing activity levels at treatment sites (Koehler AE, 1990, Parsons and Bondrup, 1996, Rytwinski et al., 2016). Southern Hairy-nosed Wombats may have responded to blood and bone or dingo odours with increased hiding or reduced ranging behaviour in a manner that was not evident from the camera data, or it could have been perceived as a low risk. The use of a greater volume and repeated or more widespread application of deterrents may elicit greater avoidance responses. The application of odours inside burrows or in open areas further from the safety of a burrow may heighten risk perceptions, resulting in greater avoidance responses (Atkinson et al., 1994).

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6.5.2 Visual deterrents

Anecdotal evidence suggested wombats are fearful of shiny objects and actively avoid them. Stationary CDs have been found to elicit avoidance responses in Southern Hairy-nosed Wombats, with a decrease in the number of visits to burrows following their application (O'Brien et al., 2021). Visual stimuli produced avoidance responses most likely due to an immediate fear response (neophobia) of an unknown object within their environment (Harris and Knowlton, 2001, Davidson-Nelson and Gehring, 2010, Bruggers et al., 1986). Wombats may respond more readily to visual cues as they are easily detected from further away than olfactory cues, which require closer investigation. Though these preliminary investigations are encouraging, habituation to visual stimuli is a major limiting factor to their long-term use, particularly when unaccompanied by negative reinforcement (Koehler AE, 1990, Gilsdorf et al., 2002). Habituation to CDs was not observed in Southern Hairy-nosed Wombats over the 5-night trial, however, it may occur over a longer time frame.

6.5.3 Virtual fencing

Virtual fencing is a term often used for placing deterrents along roadsides that are activated by approaching vehicle headlights. On activation the device emits a sound, flashing lights or both with the aim of scaring away any animals that may be adjacent to the roadside. Virtual fencing is not a physical barrier and allows animals to move through the landscape. Early trials in Tasmania reported a 50% reduction in roadkill over a three-years (Fox et al., 2018), but the trial had many design flaws and likely had little to no effect on possums, wallabies or wombats (Coulson and Bender, 2019). A study on the impacts of virtual fencing on wombats found a small reduction in the number of wombats killed after the virtual fence was installed (Stannard et al., 2021), however the study design was flawed and widely disputed (Coulson and Bender, 2022, Candy and Englefield). Similarly, other deterrent devices mounted to vehicles like the Shuroo have been found ineffective, as the noise the device makes cannot be heard over the vehicle noise from >50 m away (Bender and Coulson, 2022).

6.6 Translocation

Translocation is a widely used “non-lethal” human-wildlife conflict mitigation measure, but its effectiveness is disputed. The survival of translocated animals is often low, and the conflict may not be resolved or could be transferred to the release site (Bradley et al., 2005, Linnell et al., 1997). Translocation has been trialled on Southern Hairy-nosed Wombats to relieve conflicts with agriculturalists. Southern Hairy-nosed Wombats were translocated from areas of conflict to a property where species numbers were low and lots of inactive burrows were available to release them into. Animals were fitted with GPS and/or VHS collars to monitor their survival and behaviour in comparison to resident animals. Though translocated Southern Hairy-nosed Wombats had high survival rates and exhibited release site fidelity conflicts were not resolved. Neighbouring Southern Hairy-nosed Wombats moving into vacated burrows at the source site within a matter of weeks. Landholders using culling as a control measure to reduce conflicts with Southern Hairy-nosed Wombats have reported similar results, with neighbouring animals recolonising vacated warrens (St John and Saunders, 1989). Translocation of a larger number of animals may provide longer relief from conflict. However, Southern Hairy-nosed Wombats evaded traps by remaining underground or digging under fencing, resulting in a low trap rate of 5.95%. Similarly, the

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trapping success of Bare-nosed Wombats was 7.9% and Northern Hairy-nosed Wombats as low as 1-2%, all species avoid capture by remaining underground for extended periods of time (McIlroy, 1977a; Alan Horsup, pers. comm 2018). Thus, large scale translocation could be labour intensive and cost prohibitive. Furthermore, the ongoing translocation of large numbers of Southern Hairy-nosed Wombats would over time lead to shortages of suitable conflict free release sites with low numbers of conspecifics in the species natural range. Translocation could be used as a tool to repopulate areas where numbers are known to have declined, however, it may result in further deaths if the cause of the decline has not been addressed.

Similarly, the critically endangered Northern Hairy-nosed Wombat has been successfully re-introduced into areas they were extirpated from by releasing them into starter burrows (Horsup, 2004). A study on the survival of rescued and rehabilitated Bare-nosed Wombats reported high survival (94.5%) of animals released onto a private property within the first 42 days following release and 77% survival after eight years (Saran et al., 2011). Survival was not found to be related to age, sex, provision of supplemental food, season or time spent in rehabilitation.

Despite its limitations, translocation may prove useful for removing a small number of individuals from areas of conflict, where alternative measures fail or are unsuitable. **When used in combination with burrow collapsing or deterrent use it may yield more promising results in reducing conflict at the source site.** Prior to carrying out a translocation careful planning is needed. Translocation plans should adhere to the Conservator Guidelines for the Translocation of Native Flora and Fauna in the ACT. . Important biological and ecological factors need to be taken into consideration, such as capture stress, disease transmission, habitat suitability, and competition with conspecifics. The availability of burrows at the release site is a key consideration when it comes to translocating wombats, which would require up to date knowledge of wombat distribution and density. Follow up monitoring is imperative to ensure survival of translocated animals.

6.7 Culling

Historically, conflicts with wombats have been managed using lethal controls. In most states, there are provisions to cull wombats causing damage or threatening human safety under permit systems (see section [2.16-1](#)). The lethal control of wombats has become a highly contentious and controversial issue in the last few decades, due to changing public attitudes towards its use and concerns about wombat conservation. Permits to destroy Bare-nosed Wombats have decreased greatly in Tasmania and other states where it is allowed in the last few years due to increasing public pressure. The impacts of culling on wombats populations are poorly understood (Tartowski and Stelmann, 1998, Taggart et al., 2008). If conducted at unsustainable levels it can result in range contractions and population isolation (Powell, 2006, Fuller et al., 1992, Woodroffe et al., 2005). In contrast, killing an insufficient number of animals can fail to reduce damage to an acceptable level (Hone, 2007). In some cases, the removal of animals from a population can encourage population growth and immigration, thereby increasing conflict (Treves et al., 2016). Culling can disrupt social structures that lead to fractured social groups and increases in conflicts (Wallach et al., 2009, Allen et al., 2015). Social instability can result in increased

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reproduction, as multiple subordinate females may breed (Glen et al. 2007). Despite the limitations of culling, there may always be some situations in which it is the best intervention method (Warburton and Norton, 2009).

There is one known study examining the effects of culling on Southern Hairy-nosed Wombats. Changes in the number of active burrows were monitored in an area where culling occurred and an adjacent control zone where no culling took place. Over the two-year term of the study an estimated 12% of the population was culled per year. Despite this there was an estimated 30-40% increase in the number of Southern Hairy-nosed Wombats in the culled area, while in the uncultured area there was an estimated 50-60% increase. The increase in Southern Hairy-nosed Wombat numbers over this time frame could have been a result of increased rainfall and recovery from the 1981-83 drought, the effects are unlikely to be the same on a stable or decreasing population (Tartowski and Stelmann, 1998).

Culling it is often preferred as a conflict reduction tool by landholders, as it is convenient, immediately shows results, satisfies their need for control, and is perceived as cost effective (Horton RR, 1997, Zinn et al., 1998, Treves and Naughton Treves, 2005). Landholders surveyed in South Australia most widely used culling to reduce conflicts with Southern Hairy-nosed Wombats in South Australia and those who were financially dependent on their property or had experienced damage were more likely to cull wombats (O'Brien, 2019). Despite the widespread use of culling, only half of the landholders using it perceived it to be effective. A lack of data on wombat numbers makes it difficult for state agencies to set balanced culling quotas often resulting in ineffective conflict resolution (Taggart et al., 2008). Many landholders feel they are rarely permitted to cull enough wombats to mitigate damage with recolonisation of burrows being an ongoing problem (Stott, 1998, Taggart et al., 2008, St John and Saunders, 1989). Official government registers are considered an underestimate of the true numbers of wombats culled, as some landholders resort to culling outside the permit system (St John and Saunders, 1989, Taggart et al., 2008). The use of lethal controls needs to be carefully evaluated and managed based on scientific evidence, to ensure conflict reduction without threatening species conservation.

6.8 Wombat monitoring and research

There are significant knowledge gaps in our understanding of Bare-nosed Wombat populations in the ACT. Addressing these gaps will require dedicated monitoring and survey effort to collect fit-for-purpose datasets. This section examines a variety of survey options, and their costs and benefits.

6.8.1 Quantify the frequency and occurrence of wombat damage

Perceptions and tolerance of damage caused by wildlife are often shaped by financial dependence on crops or livestock and previous experiences (Naughton-Treves L, 2005, Van Tassell et al., 2000). Perceived damage can sometimes be disproportionate to actual damages (Dickman, 2010, Knight, 2000, Madden, 2004, Wigley and Garner, 1986). Quantifying the frequency and cost of Bare-nosed Wombat-related damage is crucial to distinguish between real and perceived impacts. This data can help identify high-conflict areas and guide wildlife managers in developing targeted management actions. In regions where damage is minimal or misattributed,

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educating stakeholders can be crucial to mitigating conflict. Conversely, where significant damage occurs, targeted management interventions to reduce damages may be necessary to alleviate its effects.

Accurately reporting the prevalence and costs of wombat damage from landholders and other relevant stakeholders will require a consistent approach to data collection. This will require CED to develop a reporting tool for stakeholders to submit information such as: (1) the type of damage; (2) the location of the damage; (3) the financial costs associated with damage; and (4) negative safety outcomes associated with damage. Collecting a consistent set of data in each report will allow for comparison with wombat population data and other key population metrics. This tool will need to be managed by CED or another relevant team within the ACT Government.

6.8.2 Ecological surveys of wombats in the ACT

One of the critical aspects of species management is understanding population dynamics. Currently, Bare-nosed Wombat population monitoring in the ACT is limited, with few systematic surveys to track wombat numbers or distribution. Animal welfare and stakeholder concerns around the prevalence of mange also require systematic surveys that include areas with and without mange treatment applications. High-quality distribution and abundance data paired with standardised impact and mange assessments will provide land managers with the tools for effective management and conflict mitigation.

Current monitoring

CED has commenced a long-term monitoring program at eleven sites within the ACT. The purpose of these surveys is to detect changes in populations over time, and to collect data on mange prevalence and severity. Survey sites were selected based on known presence of Bare-nosed Wombats and ease of accessibility. Surveys are conducted twice annually in winter and consist of walking 1 km transects at a slow pace (45 mins), commencing 30 mins after sunset (Figure 6). Surveys are carried out in teams of at least two people for health and safety reasons. Surveyors use night vision binoculars to reduce disturbance of animals.

When a Bare-nosed Wombat is seen, the surveyor notes their location using a GPS, takes a compass bearing and estimates the distance to the animal. Wombats are given a body condition score (ranked 1-5, with 1 being poor and 5 being excellent) and a mange score using the categories described in Stannard et al. (2020). Observers also record a mange confidence score to reflect how confident the surveyor is in their assessment in the presence or absence of mange, noting that it can be difficult to assess from a distance. Weather variables including temperature, rainfall, wind speed, cloud cover and visibility of the moon are measured at the beginning of each transect. A further two sites in Namadgi National Park are surveyed annually using the same method as above, with the exception that surveys are undertaken from a vehicle.

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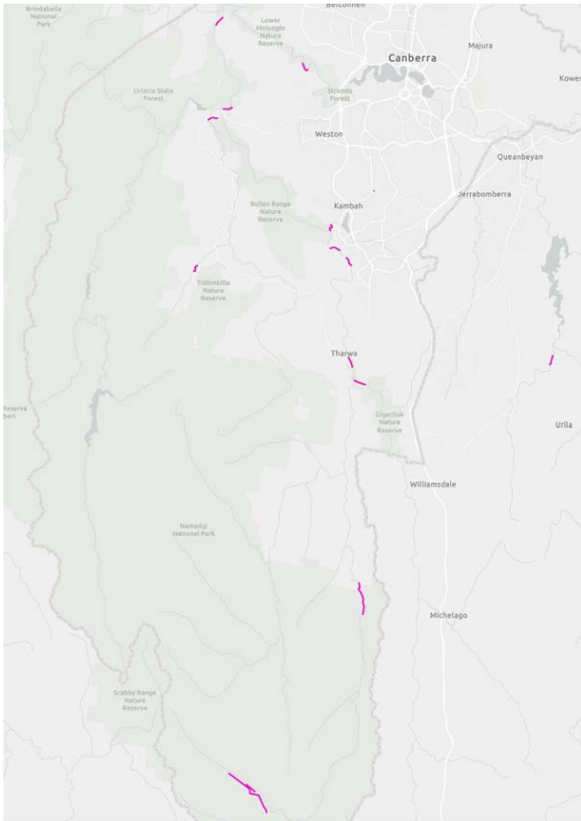


Figure 16: Locations (pink) of the line transect surveys conducted to detect changes in populations over time, and to collect data on mange prevalence and severity

Bare-nosed Wombat records are also collected using applications such as NatureMapr and the Atlas of Living Australia. These are useful tools that enable public reporting of wombat sightings over large areas that would otherwise be infeasible for ecologists to survey. These incidental sightings are typically biased towards areas of high human activity (i.e., roads or trails) and there are caveats around their value in understanding a species distribution or abundance. Without standardised survey effort, it is difficult to determine whether areas with a lower number of records represent a true absence or a low survey effort. Species and signs of their presence, such as faeces, tracks and burrows, can also be misidentified or difficult to detect. Burrows also present a challenging proxy for wombat occupancy as burrows may remain in an area after an individual has moved on (Tartowski and Stelmann, 1998).

Gaps in current methodology

A comprehensive survey program to inform wombat management in the ACT requires data on (1) wombat density or relative activity across areas of suitable habitat; (2) prevalence of mange across existing wombat

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populations; and (3) the effect of mange treatments on the prevalence of mange. The current monitoring program captures relative activity data within the conservation estate but is not representative of all Bare-nosed Wombat habitat in the ACT. A more representative selection of sites would require survey transects to be located across conservation estate, rural lands, and other stakeholder areas (i.e., Icon Water). This would require approval from stakeholders for ecologists to access their land for surveys.

The current site selection does not consider whether sites have been actively or historically treated for mange. This makes it difficult to determine whether the abundance or current health of the local population is affected by these treatments. In future, monitoring sites should be evenly stratified into two groups: treated and untreated. Once these sites are selected, treatment conditions should remain consistent throughout the study period.

The current survey methodology as described above is subject to imperfect detection of both mange prevalence and individual wombats. Vegetation and uneven topography can make it difficult to detect individuals and assess mange severity. For more information on alternative survey methodologies that may be more suitable, refer to the section below.

The current monitoring program is conducted across 26 survey nights annually, with two staff or volunteer members required to conduct each survey. In the past this work has been done by CED ecologists and volunteers from Wombat Rescue. Expanding the survey scope to include transects on rural land and other stakeholder properties would increase the survey time required. For consistency and impartiality, this should be done by trained ecologists and not members of any stakeholder group.

Alternative monitoring methods for consideration

Due to the nocturnal and burrowing nature of Bare-nosed Wombats they are difficult to survey. Direct counting using spotlight surveys are labour intensive and not practical over large areas. Spotlight counts are not representative of population numbers as wombats may remain in their burrows and avoid being counted (McIlroy, 1977b).

Mark recapture studies, requiring individuals to be captured on more than one occasion, are challenging as Bare-nosed Wombats are difficult to capture. They can remain underground for prolonged periods or dig around traps to avoid capture (McIlroy, 1977b, Skerratt et al., 2004). In these surveys, trapping only a portion of burrows can result in imprecise abundance estimates (Banks et al., 2003). Trapping every burrow across a large area is impractical due to the time and labour required.

The number of active burrows has successfully been linked to wombat abundances using mark-recapture methods (McIlroy, 1977a), burrow flap counters (Tiver, 1981) and remote cameras (Swinbourne et al., 2018). A combination of burrow activity levels and the number of active burrows is a relatively low-cost method and has been used to infer population abundances (St John and Saunders, 1989). Burrow activity can be estimated using

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burrow flap counters or remote cameras. Abundance estimates using these measures will allow land managers to track trends in population levels but will not provide an exact density.

Ground penetrating radar has been used successfully to map Southern Hairy-nosed Wombat burrows (Swinbourne* et al., 2015). It can be used to determine the length, depth and direction of wombat tunnels and help determine if a burrow is a main, secondary or starter burrow. There are various ground penetrating radar systems available, simple units can be hired for between \$200-400 a day and can penetrate up to 8 m depth.

Drones have successfully been used to map wombat burrow locations in New South Wales grasslands (Old et al, 2019). In their study, Old et al. (2019) detected a similar number of burrows using desktop analysis of drone imagery and ground-based surveys. In aerial surveys observer errors can result in inaccurate counts, but standardising the results using a transect with a known number of burrows can help develop a correction factor for the dataset (Tiver, 1981). Recording video footage during aerial surveys can also allow for more accurate and repeatable scores of wombat warrens (McGregor and Wells, 1998). Drone surveys can be affected by vegetation, with reduced efficacy in dense vegetation where burrow entries are obscured (Old et al 2019; Taggart et al, 2008). These aerial surveys provide an alternative to manual searching for burrows and can be used to quickly assess range expansion in local wombat populations. Detecting decreases in distribution based on burrow surveys is more difficult, as warrens remain visible long after they have been vacated.

Integrating drones with thermal sensors has been used effectively to directly survey a range of terrestrial and arboreal species (Beaver et al, 2020; Howell et al, 2021; Witt et al, 2020). These methods have not yet been tested on wombats, but they may provide a suitable alternative to ground-based surveys. While thermal drone surveys may reduce labour inputs and reduced detection abilities in dense vegetation, they are still subject to the pitfalls of direct count methodologies. Direct counting will still be subject to imperfect detection if individual wombats remain underground during the surveys.

6.8.3 Furthering research by partnering with scientists

There are lots of knowledge gaps that hinder the effective management of Bare-nosed Wombats in the ACT. While it is not necessarily the role of the ACT Government to conduct the research to fill these knowledge gaps, collaboration with scientists may help to overcome some of these knowledge gaps.

Collaboration between the ACT Government and researchers could help fill the knowledge gaps discussed above. Key research areas include developing a deeper understanding of complex stakeholder views and collecting more robust population-level data for wombats in the ACT. Additional topics could include further research into mange treatment and collaborating with landholders to develop effective damage mitigation strategies. Landholders currently lack reliable options for mitigating conflict with wombats. These options need to be well-tested, and the limitations and benefits of each need to be clearly understood.

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7 Recommendations

Effective wombat management in the ACT requires a pragmatic, balanced approach that recognises both ecological responsibilities and the practical constraints of limited resources. Although Bare-nosed Wombats are not a threatened species, their increasing impact on infrastructure, agriculture, and animal welfare necessitates a coordinated response.

The following recommendations propose practical, evidence-based solutions informed by successful approaches in other jurisdictions. These aim to reduce conflict, improve welfare outcomes, and guide policy development. By strategically adopting proven methods, the ACT can strengthen its policy framework and foster coexistence between wombats and human communities.

Recommendation 1: Policy reform

Assess the suitability of policy that establishes mechanisms for wombat management.

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- Establish a policy position for wombat management in the ACT
 - Assess the suitability of a controlled native species management plan for wombats in the ACT
 - Incorporate guidelines and agreed licensing mechanisms for burrow management, fencing, and deterrents.
 - Explore the option of a pilot permit or licencing system for wombat damage mitigation, limited to high-conflict zones and critical infrastructure (e.g. dams, roads, buildings).
 - Leverage existing licensing infrastructure to minimise administrative burden.
 - Prioritise non-lethal methods of damage mitigation
- Define clear protocols and licensing pathways for mange treatment, including:
 - Restrictions near sensitive environments such as waterways
 - Training requirements for volunteers and wildlife carers implementing mange treatments
- Develop wildlife release guidelines for rehabilitated animals that include:
 - Best practices for the release of rehabilitated wombats.
 - Designated release zones that prioritise ecological compatibility and long-term welfare for rehabilitated wombats.
- Continue implementation of the Conservator Guidelines for the Management of Burrowing Animals During Development (2025) to support management of wombats during construction and development activities.
- Broader community consultation should be undertaken as part of policy development.

Recommendation 2: Stakeholder engagement

Establish a consultative committee to inform wombat policy development and ensure inclusive stakeholder representation.

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- Include leaseholders, Ngannawal representatives, wildlife carers, ecologists, government, industry and other relevant stakeholders.
- Maintain support for a Wombat Mange and Monitoring Group, and encourage broader participation.

Recommendation 3: Public education

Enhance public awareness and transparency around wombat management.

- Increase public awareness of potential human-wildlife conflict where wombats occur in urban and peri-urban areas
- Increase public awareness of wombat impact mitigation strategies
- Maintain public access to the [ACT Wombat Sightings Portal](#) for reporting sightings.
- Deliver targeted media and communications to enable transparency of government strategies and collaborative actions.

Recommendation 4: Provide a framework for volunteer-led mange treatment programs

- Acknowledge community concerns and volunteer efforts to enhance animal welfare for wombats in the ACT. Where appropriate, provide licenses, reserve access, and data tools to enable effective mange treatment.

Recommendation 5: Partner with universities and citizen scientists for research and monitoring

Collaborate with universities and citizen scientists to improve data collection and inform management decisions.

- Ensure leaseholders have access to tools for recording wombat impacts, implementing mitigation strategies and monitoring outcomes.
- Trial drone-based burrow mapping and/or population counts in hotspot areas to support quantitative evaluation of mange treatment programs and monitor population trends.
- Continue support for citizen science platforms such as the ACT Wombat Portal, NatureMapr, and WomSAT for public reporting.

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Glossary

- **City and Environment Department (CED)** – ACT government department responsible for managing conservation estate and public land
- **Closed season** – A defined period during which hunting or capturing was prohibited for listed species.
- **Deterrent** – Something that discourages or prevents someone from taking an action due to the perception of negative consequences.
- **Dry sheep equivalent (DSE)** – A unit of measure used to assess the nutritional needs of livestock and the carrying capacity of a farm. It equates to the amount of feed required daily by a two-year-old, 50 kg Merino wether.
- **Leaseholder** – A person or entity granted a Crown lease by the Territory, giving them the right to occupy and use land according to the terms and conditions of the lease.
- **Noxious pest/pest** – An animal, insect, or plant considered harmful to agriculture, the environment, or human health, and officially declared or classified as such under relevant legislation or regulations.
- **Olfaction** – The sense of smell.
- **Open season** – A specific period during which it is legally permissible to hunt, take, or possess certain wildlife species that are otherwise protected. An open season is officially declared by the relevant authority (e.g., the Minister responsible for wildlife or a delegated agency) and specifies:
 - The dates during which hunting or taking of wildlife is allowed.
 - The species to which it applies.
 - Any conditions or restrictions, such as location, bag limits, or methods of hunting.
- **Pasture Protection Board** – Local government bodies established under the *Pastures Protection Act 1934*. The 59 boards in NSW were responsible for managing grazing, controlling pests like rabbits and feral animals, and promoting sustainable land management.
- **Protected species** – Species protected by law that cannot be taken, harmed, or interfered with without appropriate authorisation.
- **Reintroduction** – The movement of wild animals into part of their former range from which they have been extirpated.
- **Translocation** – The deliberate movement of wild animals from one part of their range to another.
- **Vermin** – Species of animals not protected by law and often considered pests due to their negative impacts on agriculture, native species, or the environment.
 - Declared vermin can usually be destroyed or managed at any time, including outside of open seasons, unless other laws (such as firearms laws) apply.
 - The list of vermin is not fixed and can be updated by regulation or proclamation.

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Executive Summary

This document reviews the status and management of Bare-nosed Wombats (*Vombatus ursinus*) in the Australian Capital Territory (ACT), considering stakeholder views, current legislation and policy, management and monitoring of populations. It draws on past and current practice from across the Australian states and territories to inform a path forward. It also highlights current challenges within the ACT, including the complexities involved in balancing conservation with stakeholder needs.

As native marsupials wombats are integral to the region's ecosystem but present several management issues. These include wildlife-vehicle collisions and conflict with agricultural activities. The species is challenged by threats such as urban expansion, habitat loss and the prevalence of sarcoptic mange.

By adopting a holistic and informed approach to wombat management, the ACT can balance species conservation and protection of infrastructure and agricultural interests, ensuring a sustainable future for both local wildlife and the community.

Key findings from the review include:

- **Legislation and Policy:** Unlike other Australian jurisdictions, the ACT does not allow control permits for mitigating wombat damage. This has led to frustration among leaseholders managing wombat-related damages.
- **Threats to Wombats:** Habitat loss and sarcoptic mange remain the primary threats. Management of sarcoptic mange is complex and is currently conducted by wildlife carers. .
- **Stakeholder Conflicts:** With diverse stakeholders the ACT has conflicting views on how wombats should be managed.
- **Management Tools:** Fencing, burrow modifications, and deterrents are available but are often resource-intensive and may yield inconsistent results. Many have not been trialled in the ACT and stakeholders may not be aware of the available options.

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Key Recommendations

Recommendations are to implement a more coordinated, balanced and evidence-based approach to wombat management in the ACT, involving government agencies, local communities, and wildlife organisations.

Specifically:

1. **Policy**– Assess the suitability of policy that establishes mechanisms for wombat management. This may include provisions for damage mitigation, the development of a controlled native species management plan, wildlife release guidelines, and guidelines for the controlled use of veterinary products for mange in the ACT. Broader community consultation should be undertaken as part of policy development.
2. **Stakeholder Engagement** – Establish a streamlined consultative committee to support policy development and ensure diverse stakeholder input is considered, and needs are balanced.
3. **Public Education** –Increase community awareness of potential human-wildlife conflicts where wombats are present in urban and peri-urban areas, available damage-mitigation strategies and conservation initiatives. Deliver targeted media and communications for transparency of government strategies and collaborative actions.
4. **Community and Volunteers** – Acknowledge community concerns and volunteer efforts to enhance animal welfare for wombats in the ACT. .
5. **Research Partnerships** – Collaborate with universities and citizen scientists to support ongoing research and data collection to inform management decisions. This includes exploring new technology to develop improved and cost-effective options for monitoring wombat populations in the ACT.

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1 Introduction

Wombats are iconic Australian marsupials, deeply embedded in the cultural heritage of First Nations Peoples and the national identity (Garvey et al., 2016). There are three extant species: the Bare-nosed Wombat (*Vombatus ursinus*), the Southern Hairy-nosed Wombat (*Lasiorhinus latifrons*), and the Northern Hairy-nosed Wombat (*Lasiorhinus krefftii*). Although once likely widespread, all three species have experienced significant declines and range contractions since European settlement (Aitken, 1971, Gordon et al., 1985, Buchan A and DC, 1998, Cooke, 1998, McIlroy, 2008). The clearing of land for agriculture and urban development, coupled with the introduction of European rabbits (*Oryctolagus cuniculus*), has had a profound impact on wombat populations (Aitken, 1971, Cooke, 1998). Rabbits provided competition for food and shelter (Cooke, 1998), and wombat warrens were often destroyed during rabbit control efforts (Triggs, 2009). Increasing conflict with livestock (Crossman et al., 1994) also contributed to population pressures. The Northern Hairy-nosed Wombat suffered the greatest decline, reduced to a single known population of approximately 30 individuals by 1982 (Gordon et al., 1985). It is now listed as endangered under the *Nature Conservation Act 1992*. In contrast, the Bare-nosed Wombat was declared vermin as early as 1906 in Victoria, and considered a pest in other states (Temby, 1998).

Historically wombats were widely regarded as pests, particularly because their burrowing behaviour damaged rabbit exclusion fencing (Aitken, 1971, Temby, 1998). This perception contributed to sustained population control efforts and legislative measures in all jurisdictions to reduce their impact. The Australian Capital Territory (ACT) awarded early protection to Bare-nosed Wombats under the *Animals & Birds Protection Ordinance 1918*. Growing public concern over animal welfare, conservation, and sarcoptic mange have pressured other state governments to adopt more protective policies. Though wombats are now protected species in most states, they can be controlled under permit systems where they cause damage. Landholders are required to pursue alternative management methods in almost all states before seeking a culling permit.

The management of wombats has become a highly contentious issue due to the complexities of trying to balance competing interests of stakeholder groups, including but not limited to local government, leaseholders, first peoples and wildlife care groups. Conservation and wildlife care groups are concerned for the welfare of Bare-nosed Wombats and advocate for better protections. Agriculturalists and developers want to manage the species to minimise the damage they can cause to infrastructure, stock and farm personnel. Given the diversity of stakeholder interests, reaching agreement on the best approach to wombat management is a persistent challenge.

This review explores the management of Bare-nosed Wombats (*Vombatus ursinus*) in the Australian Capital Territory, highlighting the legislative, ecological, and stakeholder challenges involved in balancing species conservation with human land use and infrastructure needs. It uses past and current legislation across the Australian states and territories as frameworks to inform the conservation and management of wombats in the ACT.

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2 Legislation, policy and regulation

2.1 Policy and legislation

Following European settlement and the expansion of agriculture in Australia, all three Vombatid species, the Bare-nosed (*Vombatus ursinus*), Northern Hairy-nosed (*Lasiiorhinus krefftii*), and Southern Hairy-nosed Wombats (*Lasiiorhinus latifrons*) have experienced conflicts with humans. Initially, conflicts arose because wombats caused damage to rabbit exclusion fencing and wombat burrows provided refuge for rabbits. As a result, wombats were commonly viewed as pests and were able to be lethally controlled under legislation in most states.

The range of all three species of wombat contracted significantly as a result of large-scale land clearance for agricultural and urban development, and the introduction of European rabbits (*Oryctolagus cuniculus*) (Aitken, 1971, Temby, 1998, Gordon et al., 1985, Buchan and Goldney, 1998, McIlroy, 2008, Cooke, 1998). Over time attitudes towards wombats and concern for their conservation increased and legislation changed to reflect this.

This section provides an overview of the legislative frameworks and policies related to wombat management across various Australian states and territories. These frameworks serve to inform the management approaches in the Australian Capital Territory (ACT) and offer potential insights into improving wombat conservation and management strategies.

2.1.1 Victoria

Legislative history

The Bare-nosed Wombat was declared vermin throughout the state of Victoria in a 1906, under provisions of the *Vermin Destruction Act 1890* (Seebeck 1988). In 1925, a bounty was placed on Bare-nosed Wombats under the *Vermin and Noxious Weed Act 1922*, with more than 60,000 bounties paid up until 1955. The bounty was subsequently suspended in 1966 and officially abolished in 1971. Bare-nosed Wombats remained a pest to many and from 1971 to 1986 government officials fumigated their burrows on crown land.

In 1977, Bare-nosed Wombats were declared protected under the *Wildlife Act 1975* in the region west of the Melbourne to Sydney railway line, where they occurred in low numbers. The vermin status of the species was maintained in eastern Victoria until 1984, when Bare-nosed Wombats were protected under the *Wildlife Act 1975* across all Victoria. Lobbying by farmers led the species to be declared 'unprotected wildlife' in 193 parishes in eastern Victoria under the *Wildlife Act 1975*. The declaration of the species as 'unprotected wildlife' enabled the destruction of Bare-nosed Wombats by landholders, their families, and employees by means of fumigation, trapping or shooting on freehold or leasehold land, and within 1 km of such land on adjoining crown land. In June 1997, the *Wildlife Act 1975* was modified to enable destruction only on the occupier's property with a high-powered, centre-fire rifle of .222 calibre or larger.

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Current Legislation

In February 2020, an amendment to the *Wildlife Act 1975* revoked the unregulated control of Bare-nosed Wombats across 193 parishes in eastern Victoria. It is now an offence to kill, take, control or harm Bare-nosed Wombats across the entire state of Victoria without authorisation. This includes activities such as destroying or disturbing their burrows. To destroy a wombat or their burrows landowners need to apply for an authority to control wildlife permit (ATCW) from the Department of Energy, Environment and Climate Action which can be done [online](#), by post or email (Table 1). Applicants are required to demonstrate damage to their property, crops or pasture, impacts on biodiversity values, or risks to human health or safety. Applicants must also demonstrate that all other reasonable options have been considered. A [wombat management methods factsheet](#) outlines “non-lethal” management options for landholders. Forest and Wildlife Officers review applications and may require a property inspection. This process can take up to six weeks to complete. Each ATCW specifies the species of wildlife that can be controlled and the method of control. Anyone shooting wildlife under the *Wildlife Act 1975* must also comply with the *Firearms Act 1996*. To destroy a wombat without a permit carries a penalty ranging from \$8,261 to \$39, 652 and/or six to twelve months in jail.

Table 1. The number of permits issued to control Bare-nosed Wombats and the number of animals to be harmed in Victoria over the last seven years.

Year	Number of permits	Animals authorised to be culled
2023	222	1902
2022	226	1862
2021	207	1675
2020	273	1478
2019	268	3655
2018	252	3830
2017	270	3374

2.1.2 New South Wales

Legislative History

New South Wales was home to all three species of wombat until the last claimed sighting of Northern Hairy-nosed Wombats in 1909. Bare-nosed and Northern Hairy-nosed Wombats had partial protection under the *Native Animals Protection Act 1903*. Under this act both species were protected from destruction during the declared closed season from August to January each year. Bare-nosed Wombats lost these protections when they were not included on the list of protected species under the *Animals and Birds Protection Act 1918*. Bare-nosed Wombats regained legal protection under the subsequent *Fauna Protection Act 1948*. Landholders were required to obtain permits for wombat destruction, except in areas governed by Pasture Protection Boards. At this time, wombats were also regarded as a noxious pest by the Department of Agriculture under the *Pastures Protection Act 1934*. This created a conflict in areas where landholders were required to destroy wombats under the *Pastures Protection Act 1934*, but could be prosecuted for doing so under the *Fauna Protection Act 1948*. In 1959 the National Parks and Wildlife Service and the Department of Agriculture reached a compromise, leaving

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Bare-nosed Wombats unprotected but no longer declared noxious. As a result, both species of wombat became fair game for sports shooters and landholders. In March 1973, Bare-nosed Wombats were awarded full protection with provision for destruction for damage control purposes by being removed from the First Schedule (list of unprotected animals) of the *Fauna Protection Act 1948-67*. The following *National Parks and Wildlife Act 1974* provided full protection to Northern Hairy-nosed Wombats which were classed as endangered. Bare-nosed Wombats were also given protection with a provision for damage control under a permit system.

Current Legislation

Wombats are protected under the *NSW Biodiversity Conservation Act 2016*. It is an offence to harm a wombat unless a licence is obtained from the Department of Climate Change, Energy, the Environment and Water. To obtain a licence landholders must demonstrate animals are a threat to human safety, damaging property and/or causing economic hardship. Where possible, the department seeks to resolve negative interactions using non-destructive methods and recommends non-lethal methods [on their website](#). However, a licence to harm individual animals may be required to mitigate problems. To apply for a licence, landholders must contact their local National Parks and Wildlife Service (NPWS) office to discuss the nature and severity of the issue and any non-lethal measures that may resolve the problem. They can then [download and fill in an application form](#) and lodge it with their local NPWS. The National Parks and Wildlife Service may grant a licence to the owner or occupier of a property to cull wombats. Records of the number of animals harmed need to be kept on a record sheet provided and lodged with the NPWS office within 7 days of the licence expiry. All people operating under the licence must comply with the *Firearms Act 1996* and the Code of Practice for the Humane Destruction of Wombats by Shooting in NSW. Harming wildlife without a permit may receive a maximum fine of \$330,000 with an additional \$33,000 for each animal harmed or two years in jail.

Within the last seven years a small number of permits have been issued (Table 2). The maximum number of Bare-nosed Wombats to be harmed on any one permit was 50 animals. More commonly permits range from 1 – 20 animals for issues including damage to crops, competition with stock, hazard for vehicles, damage to fencing, causing erosion and disease.

Table 2. The number of permits issued to control Bare-nosed Wombats and the number of animals to be harmed in New South Wales over the last seven years.

Year	Permits issued	Number of wombats to be harmed
2023	34	187
2022	38	219
2021	26	138
2020	42	221
2019	76	501
2018	103	752
2017	40	193

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2.1.3 Queensland

Legislative History

The Northern Hairy-nosed Wombat and Bare-nosed Wombat were protected in Queensland under the *Native Animals Protection Act* 1906. However, this and subsequent Acts provided provisions for damage control. By 1982, the Northern Hairy-nosed Wombat was restricted to a single population of approximately 30 animals (Gordon et al., 1985). The *Fauna Conservation Act* 1974-1989 provided permanent protection for the Northern Hairy-nosed Wombat with no provision for damage control. Northern Hairy-nosed Wombats were declared endangered under the *Nature Conservation Act* 1992. Bare-nosed Wombats remained protected with provision for damage control under a permit system.

Current Legislation

Northern hairy-nosed and Bare-nosed Wombats are protected under the *Nature Conservation Act* 1992, though there are provisions to control Bare-nosed Wombats for damage mitigation purposes. [A damage mitigation permit](#) is required to take wildlife to minimise damage or loss of property (e.g. crops) or to protect human health and wellbeing. Damage mitigation permits may cover the removal and translocation of problem animals or lethal control.

To obtain a three-year permit to remove and relocate wildlife applicants must demonstrate the following:

- Certificate of completion of a training course concerning the keep, relocation, and safe handling of relevant wildlife.
- A current first aid certificate issued by an approved first aid provider.
- Referee reports from two suitably skilled and qualified persons.
- Statements outlining the ability to handle wildlife, including safety procedures to be applied when handling or moving wildlife and access to appropriate equipment.
- Statements outlining wildlife identification skills.
- A resume including details of qualifications provided with the application.

If an applicant does not have any experience, they are recommended to contact a local damage mitigation permit holder for guidance and possible endorsement under this permit type.

To obtain a permit to lethally control wildlife, applicants must demonstrate damages caused and the economic losses incurred, or any threats to human health (e.g. disease or injury risks). Two non-lethal damage mitigation measures to prevent or minimise damage need to have been attempted prior to application for lethal control. There are no specifications about suitable non-lethal methods to be used or the duration of use. A statement outlining the applicant's relevant knowledge and experience in correctly identifying the relevant species is required. Permits are issued for one-year unless the landholder has an approved property management plan, in which case permits can be issued for three years. The Department of Environment Science and Innovation offers a service to guide applicants through the assessment process. The service includes meeting with a departmental project manager to discuss the information needed for the application. Applicants can email a [downloadable](#)

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[form](#) to the permits and licensing department and may take up to 40 business days to process. Once a permit has been granted, permit holders are required to lodge a return of operations form every three months and within 10 days of the permit expiry detailing how many animals were taken under the permit. The maximum penalty for controlling protected wildlife without a permit is \$15,480 (100 penalty units).

2.1.4 Tasmania

Legislative History

Bare-nosed Wombats were not protected in Tasmania until the passing of the *National Parks and Wildlife Act* 1970, which provided partial protection allowing for the declaration of an open season. The Minister by order, could declare the dates and places on which the taking of any partially protected wildlife may start, stop, be prohibited or permitted and impose any conditions on the order. No open seasons were declared, and destruction for damage control purposes was undertaken by permit.

Current Legislation

Bare-nosed Wombats are protected under the *Nature Conservation Act* 2002 with provision for damage control. The Department of Natural Resources and Environment encourages people to use non-lethal management options for mitigating wombat damage and several factsheets can be found on their website for [Living with Wombats](#). A [property protection permit](#) is needed to control protected wildlife, including Bare-nosed Wombats (Table 3). Permits can be applied for by landholders, managers or lessees of land to prevent the destruction of, or injury to any stock, crops and equipment or infrastructure used in crop and/or stock production. Applications must identify the damage caused, the method of control to be used and the number of animals they want to take. The Department of Natural Resources and Environment must be satisfied a financial loss is likely to occur if the crop, stock, equipment or infrastructure is not protected. Applications are assessed on a case-by-case basis, which may include a visit to the applicant's property. The local abundance of Bare-nosed Wombats, the impacts they may have on the property, and whether non-lethal measures will be effective at the site are considered when issuing permits. The Department of Natural Resources and Environment Tasmania assesses population trends using annual spotlight monitoring of 190 10-km transects across the state. Issued permits specify the number of Bare-nosed Wombats that may be taken and a timeframe of up to 12 months. Permit holders are required to maintain accurate records of animals destroyed and report them within 28 days of the permit expiry. Persons controlling wildlife without a permit or who do not comply with the terms of their permit can receive a penalty of up to \$19,500 (100 penalty units).

Table 3. The number of permits issued to control Bare-nosed Wombats and the number of animals to be harmed in Tasmania from 2016 to 2022. Blank cells indicate a lack of data.

Year	Number of permits	Total quota issued	Wombats culled
2022	9	165	29
2021	6		17
2020	5	51	20
2019	4		107
2018	6	110	
2017	22	160	

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Year	Number of permits	Total quota issued	Wombats culled
2016	52	2171	

2.1.5 Western Australia

Legislative History

Southern Hairy-nosed Wombats were not provided protection under early game acts in Western Australia. The *Game Act 1912* provided protection to all “non harmful” native fauna, but it is unclear whether this extended to Southern Hairy-nosed Wombats. The *Fauna Protection Act 1950* was the first to provide blanket protection to all native fauna in the state, including Southern Hairy-nosed Wombats. In 1975 it was re-named the *Wildlife Conservation Act 1950* and included new provisions for damage control permits.

To prevent Southern Hairy-nosed Wombats from becoming an agricultural threat across the state, the Agricultural Protection Board declared them as vermin in areas of WA outside their known range. In 1973, the declaration was amended to include Southern Hairy-nosed Wombats as a pest species under the *Vermin Control Act 1918-1970*. When the *Vermin Control Act* was replaced by the *Agriculture and Related Resources Protection Act 1976*, the Southern Hairy-nosed Wombat was included as a category seven declared animal. As a category seven species, the Minister had the authority to recommend and approve a species management plan that included management by lethal control.

Current legislation

In 2019 the *Wildlife Conservation Act 1950* was replaced by the *Biodiversity and Conservation Act 2016* and the Biodiversity Conservation Regulations 2018. Under the Biodiversity Conservation Regulations 2018, there are provisions for controlling fauna that have been listed as managed species. Fauna may be listed as a managed species if they are determined to be impacting public safety or biosecurity, or causing economic or ecological damage. The Southern Hairy-nosed Wombat is not currently listed as a managed species. There are no records of licence applications or grants for Southern Hairy-nosed Wombat control in Western Australia.

When fauna cause damage to agriculture, native animals may be declared pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Under the BAM Act, every organism except a human being has a legal status assigned through a declaration made by the Minister. If the Minister has not made a declaration, the status automatically remains unlisted. BAM status determines whether a permit is required to import the organism into Western Australia. The Southern Hairy-nosed Wombat is listed as a Permitted species S11 (exempt) on the Western Australian organism [list](#) under the BAM Act. This means they are not a declared pest and can be imported into the state without a permit provided they satisfy import permits and can be kept without a permit.

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2.1.6 South Australia

Legislative History

Wombats gained their first legal recognition under the *Animals protection Act* 1912 on the schedule of unprotected animals. Partial protection was achieved under the provision of *Animals and Birds Protection Act* 1919 with the declaration of a closed season on wombats from July to December. During the closed season landholders were only permitted to cull wombats for damage control purposes. The Fauna Conservation Act 1964 provided full protection with a provision for controlling wombats for damage mitigation. Under the *National Parks & Wildlife Act* 1972, the Bare-nosed Wombat was listed as 'Vulnerable' with full protection. The Southern Hairy-nosed Wombat was permitted to be controlled for damage mitigation purposes.

Current legislation

The Bare-nosed Wombat and Southern Hairy-nosed Wombat are protected under the National Parks and Wildlife Act 1972 (NPW Act). It is an offence to catch, interfere with, harass, or kill both species without a permit. The Department for Environment and Water recommends using non-lethal means for managing wombats prior to resorting to culling and has a "Living with Wombats" [factsheet](#). The Department of Environment Water can issue destruction permits in circumstances where wombats cause damage or threaten human safety (*section 53.1c of the SA National Parks and Wildlife Act 1972*). Permit application forms are available [online](#) and can be emailed, posted or dropped off at the nearest regional office. Applications are considered by National Parks and Wildlife rangers on an individual basis. Consideration is given to whether non-lethal means may resolve the problem, the extent of the damage and threats to safety. There is a [code of practice for the humane destruction of wombats](#) which permit holders must abide by. The penalty for killing a wombat without a permit is a \$2,500 fine or six months in prison.

An amendment was made to the National Parks and Wildlife Act in 2023 prohibiting the destruction, damage or disturbance of wombat burrows without a permit, with a maximum penalty of \$5 000 or imprisonment for 12 months. Permits are not required if:

- you are the owner of the land where the burrow is located,
- you are authorised to destroy, damage or disturb the burrow by the owner of the land where the burrow is located; and
 - the burrow is located outside of a Wombat Burrow Protection Zone; and
 - the burrow is causing, or is likely to cause, damage to crops, stock, machinery or infrastructure (including tracks and built structures) or may constitute a safety risk or hazard to people.

If a burrow is located within a declared Wombat Burrow Protection Zone a person must not, without a permit, destroy, damage or disturb the burrow. No Wombat Burrow Protection Zones currently exist so a permit is not presently needed to destroy a wombat burrow. There is a protection for wombat burrows [factsheet](#) outlining the new changes.

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2.1.7 Australian Capital Territory

Legislative History

The Bare-nosed Wombat was protected early in the Australian Capital Territory (ACT) in comparison with most other states. There has been full protection without provision for destruction in the ACT since the *Animals & Birds Protection Ordinance* 1918. Successive Commonwealth ordinances and the *Nature Conservation Act* 1980 kept full protection in place, making no provisions for destruction permits to be issued for damage control purposes.

Current legislation

Under the *Nature Conservation Act 2014*, Bare-nosed Wombats remain protected without provisions for damage control. To kill a protected animal will result in a maximum penalty of \$16,000 (100 penalty units) and/or imprisonment of up to 1 year. Under part 6.1 of the Act, it is an offence to conduct any activity that interferes with a nest (or burrow), endangers progeny or breeding, kills, injures, or endangers a native animal. However, some activities, such as nest destruction, may be carried out under a licence issued by the [Conservator of Flora and Fauna](#). The maximum penalty for a damage land offence is \$2,025,000 for a corporation or 7 years imprisonment and/or \$400,000 for an individual. It is the responsibility of the applicant to apply for a licence for any proposed activity that may otherwise be an offence under the Act. The Parks and Conservation Service administers the Act and conservation officers are responsible for conducting compliance activities. These include public education, inspections, audits, and investigations to promote and support compliance.

In 2025, the ACT Government strengthened its regulatory framework for wildlife protection during development by introducing the Nature Conservation ([Protection of Burrowing Animals During Development](#)) Conservator Guidelines. These guidelines, issued by the ACT Conservator of Flora and Fauna, are a notifiable instrument under the *Nature Conservation Act 2014*, giving them legal force and requiring compliance from developers operating in areas with suitable habitat. The guidelines aim to minimise harm to native burrowing animals, such as Bare-nosed Wombats, by requiring site assessments, avoidance of active burrows, and consultation with the Conservator where disturbance is unavoidable.

2.1.8 Legislative differences between the ACT and other jurisdictions

Apart from the ACT, all jurisdictions have a provision under legislation to enable wombat control for the purpose of damage mitigation. Control is regulated by a permit system, and applicants may be required to prove alternative methods of damage mitigation were unsuccessful. Tasmania is the only state which considers trends in wombat populations when setting permit allocations. Understanding baseline population data is critical to assessing a program's efficacy and impacts. Controlling too few individuals can be ineffective at reducing damages, while removing too many can have negative conservation outcomes (Taggart et al. 2008).

Most states have an online permit application system or provide a form that can be submitted to the relevant department. Applications typically take 4-6 weeks to process, and landholders may be frustrated by these

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timeframes (Sparrow, 2011, Stott, 1998, Bunn, 2019). When landholders are faced with wombats burrowing under dams and other infrastructure, they feel prompt action is required to prevent further damage. Most states require the applicant to have tried 'non-lethal' damage mitigation strategies before applying for a permit, but guidance on 'non-lethal interventions' may not be provided. Further research into the efficacy and animal welfare considerations of common 'non-lethal interventions' is also required.

There has been a substantial reduction in the number of permits and the number of wombats permitted to be culled within the last decade across all states. This is in response to mounting public pressure on government agencies from conservationists and animal welfare advocates. As a result, landholders feel they are unable to reduce the damage caused by wombats on their property. For many farmers, the lengthy application process is not worth the time it takes to apply for a permit if they are only permitted to cull 10-25 wombats. As such some landholders act outside of permit systems and official government registers are considered an underestimate of the true numbers of wombats culled (St John and Saunders, 1989, Taggart et al., 2008).

3 Wombats in the ACT

3.1 Distribution and abundance

Prior to European settlement Bare-nosed Wombats were thought have a continuous distribution across much of their range including the ACT. Following European settlement, the establishment of farming along with the introduction of rabbits is thought to have had a significant reduction on the distribution and abundance of all three species of wombats (Buchan A and DC, 1998, Cooke, 1998). Current occurrence records from the ACT Wildlife Atlas show Bare-nosed Wombats are widespread across the ACT, particularly along the Murrumbidgee and Molonglo River (Figure 1). Wombats are also known to occur across Namadgi National Park (CED survey data).

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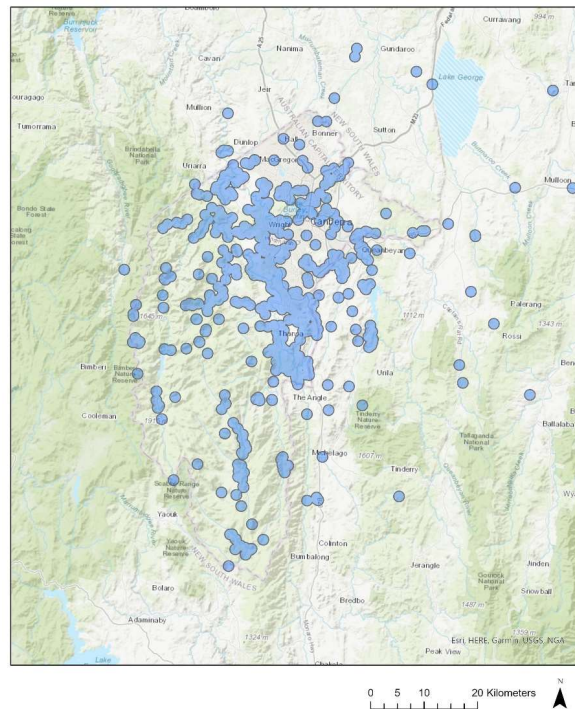


Figure 1. The known distribution of Bare-nosed Wombats (blue) in the Australian Capital Territory, taken from ACT Wildlife Atlas records, CED survey data and the [ACT Wombat Mange Portal Map](#).

Abundance is likely to vary locally and regionally, depending on a range of factors, such as habitat type, soil type and climatic conditions. Competition from rabbits and kangaroos for food resources also limits Bare-nosed Wombat numbers in many areas (Tamura et al., 2021, Bird et al., 2012, Cooke, 1998).

There are currently no reliable estimates of abundance for Bare-nosed Wombats in the ACT. After an initial likely decline from habitat loss, following the expansion of agriculture and urbanisation, anecdotal reports from leaseholders suggest the distribution and abundance of Bare-nosed Wombats have increased over the last 10-20 years. Anecdotal evidence from park rangers also support an increase in distribution. Reports dating back to 1975 indicate Bare-nosed Wombats were not present on the Canberra plains or in Canberra Nature Park at the time, though they were present in Tidbinbilla and Namadgi National Park. Rabbit control officers were known to target Bare-nosed Wombats because of the holes they made in rabbit proof fencing (Don Fletcher Pers comm) (Higgins, 1991).

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3.2 ACT Government Stakeholder engagement

The Office of Nature Conservation (CED) initiated a Wombat Working Group in 2021 to bring together stakeholders with interests in Bare-nosed Wombat management in the ACT to share knowledge and discuss management issues. The group consisted of wildlife carers, ACT government, agriculturalists and researchers. The group initially met via zoom, but a lack of attendance by rural lessees meant that it was disbanded. A mange management sub-group also commenced in 2021. The subgroup met quarterly until it was scaled back and eventually suspended in 2024. For more information on relevant stakeholders in the ACT see Section 4.

3.3 Monitoring and management

The Office of Nature Conservation (CED) currently conducts line transect surveys across 13 sites to monitor wombat populations in the ACT, but these methods are currently insufficient to robustly estimate abundance. For more information on monitoring wombat populations see Section 6.8.

Mange is treated by wildlife care groups under a CED permit (27378) for use of moxidectin on public land in the ACT, with strict conditions of its use around waterways due to its toxicity to aquatic species. For more information on the prevalence and treatment of sarcoptic mange in the ACT see Section 5.2.1.

3.4 Rescue and rehabilitation

There are two wildlife rescue organisations within the ACT that care for and rehabilitate sick and injured Bare-nosed Wombats. Wombat Rescue is solely dedicated to Bare-nosed Wombats, and ACT Wildlife cares for all injured wildlife. Wombat Rescue operates under a licence to take, rehabilitate and release wildlife in the ACT-LT202224 issued under Section 273 of the *Nature Conservation Act 2014*. Both groups work closely with each other and NSW care groups to coordinate resources for the care of Bare-nosed Wombats.

Wombat Rescue report responding to several call outs a day. In the last 6 months Wombat Rescue have taken 19 Bare-nosed Wombats into care. Records indicate up to 50 wombats are taken into care annually by Wombat Rescue and ACT Wildlife cares for 20-30. What most individuals take into care are pouch young orphaned as a result of road vehicle collisions. To a lesser extent Bare-nosed Wombats with severe mange are taken into care for treatment, with carers preferring to treat mange in situ where possible.

Of the approximately 50-60 Bare-nosed Wombats taken into care each year fewer than 10 animals are released in the ACT. In 2024, 28 wombats from the ACT were taken into care and only five were released into the ACT. Animals that come into care from New South Wales must be released in NSW. Release sites are resource intensive to find and must meet strict criteria, designed to improve an individuals' chances of survival. These criteria include a large enough area that is free from mange, away from roads, have available food and water, and have a low density of resident wombats. ACT Wildlife procure empty burrows to release animals by evicting resident Bare-nosed Wombats with the use of one-way gates. Wombat Rescue create artificial starter burrows to release animals by digging a 70 cm deep L-shaped tunnel in flat ground. They place a 45 cm diameter trench liner half pipe over the hole before filling it back in to make a tunnel. When creating tunnels on private land they

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use soft release techniques, fencing the burrow and providing supplemental food. Animals released into parks and reserves are not provided supplemental food or fenced burrows. Carers monitor released individuals for a few weeks using wildlife cameras, but released animals rarely stay in the release area.

More recently, there has been request from Wombat Rescue that ACT Government provide land for a pre-release wombat sanctuary or haven to prepare rehabilitated wombats for wild release. Areas would need to be designated and fenced for this purpose, and policy or guidelines developed around effective and safe release of wombats. The feasibility and need for a wombat sanctuary, and the role of the ACT Government in providing such a facility, is still in discussion.

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4 Stakeholder consultation and interviews

This section lists the primary stakeholders invested in Bare-nosed Wombat management in the ACT, and their interests in this issue (Table 4). It is important to note this is not a comprehensive review of stakeholder opinions on Bare-nosed Wombat management in the ACT and only expresses the views and opinions of a small number of people from each stakeholder group. Views and opinions are likely to vary within stakeholder groups. A formal review of stakeholder views is recommended.

Table 4. Identified stakeholders within the ACT with an interest in Bare-nosed Wombat management.

Group	Organisation/name	Role in relation to Bare-nosed Wombats
ACT Government	Office of the Conservator of Flora and Fauna, City and Environment Directorate	Acts on issues that affect the conservation matters embodied in the <i>Nature Conservation Act 2014</i> , particularly protecting native plants and animals
	Office of Nature Conservation Policy, City and Environment Directorate	Updates policy and legislation under the <i>Nature Conservation Act 2014</i>
	Office of Nature Conservation, City and Environment Directorate	Undertake a range of nature conservation programs in the ACT, including research on local flora and fauna, preparing scientific advice on ecological and natural resource management, conducting ecological surveys, biodiversity monitoring
	Transport Canberra and City Services	Deliver a range of services, including shop and playground upgrades, road and path maintenance, domestic animal services, and the management of urban open spaces including tree planting and grass mowing that may be impacted by Bare-nosed Wombat behaviour
	Natural Resource Management ACT, City and Environment Directorate	Integrated management of ACT's natural resources, including biodiversity, sustainable agriculture and cultural history
	ACT Parks and Conservation Service, City and Environment Directorate	Land management of the conservation estate, licensing and compliance under the <i>Nature Conservation Act 2014</i> , vertebrate pest and weed control, and managing visitor experiences.
	Urban Wildlife, ACT Parks and Conservation Service, City and Environment Directorate	Manage the outcomes of human-wildlife conflict, including nuisance animals, vehicle strikes and sick and injured animals
	Veterinarians, City and Environment Directorate	Administering treatment and care of animals including wildlife within the ACT
Industry	Icon Water	Responsible for maintaining supply of water and sewage services in the ACT. These services may be impacted by Bare-nosed Wombat activity on occasion and require management
	Developers	Construction of new developments within the ACT in compliance with Conservator Guidelines for Burrowing Animals.
Agriculturalists	Rural leaseholders	Land management and agricultural production which may be impacted by Bare-nosed Wombat behaviour
	ACT Rural Landholders Association	Advocacy for farmers and best practice farming within the ACT
Wildlife carers	Wombat Rescue	

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Group	Organisation/name	Role in relation to Bare-nosed Wombats
	ACT Wildlife	Caring for injured wombats and treating mange infected populations within the ACT. Advocate for wombat conservation.
Researchers	Prof Scott Carver	Conducting research on wombat ecology, biology and management
	[REDACTED]	
	[REDACTED]	
Ngunnawal	Dhawura-Ngunnawal Caring for Country Committee (DNCCC)	Traditional custodians of the Country in and around the ACT

4.1 Rural leaseholders

Rural leaseholders are frustrated by their current ability, or lack thereof, to manage Bare-nosed Wombats on their properties. Burrows and tunnels are becoming a big safety concern, with some paddocks described as 'Swiss cheese'. Staff and stock are frequently injured by falling into burrows (see section 9.2.1). Rabbits have become difficult to control, as they shelter in Bare-nosed Wombat burrows and cannot be treated. Landholders have expressed interest in the development of an authorised control program like the kangaroo management program in the ACT.

The management of mange on private properties is a cause of concern for rural leaseholders. Some leaseholders reported their dogs had contracted mange from the burrows of infected animals. This has resulted in expensive vet bills and distress to both dogs and their owners. Wildlife carers have also been caught trespassing on private property to treat mange. Landholders are concerned carers may be applying toxic chemicals without their knowledge. Furthermore, some leaseholders have experienced pressure from lobby groups in relation to kangaroo management and are apprehensive of similar dynamics with wombat carer groups.

Rural landholders within the ACT are frustrated by the current level of engagement with ACT Government on wombat management issues. Those involved in the wombat working group expressed concern that the group was heavily focused on conservation and mange treatment and did not adequately address the difficulties of managing wombats on rural properties. Rural landholders should be engaged directly to better understand the management issues they are facing, and to develop damage mitigation strategies to improve co-existence with wombats. For these strategies to be successfully implemented, they must be accepted by landholders as feasible and effective options. Additionally, continuing discussions between researchers, ecologists and landholders on the ecological value of wombats may improve landholder tolerance of wombats and facilitate effective management (Schumann et al, 2012).

It is important to note, there are 381 farmers within the ACT, only three rural leaseholders were consulted in the writing of this review. The views presented here do not necessarily represent the views of all rural leaseholders within the ACT.

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4.2 Wildlife carers

ACT Wildlife and Wombat Rescue are two groups rehabilitating Bare-nosed Wombats in the ACT. Wombat Rescue are often called out to assess the condition of injured or mange-affected animals by the ACT Parks and Conservation Service (PCS) and the public. Wombat Rescue has approximately 20 active members who respond to calls and their resources are strained. They are concerned about the level of awareness and training rangers have in assessing mange cases and determining if treatment or euthanasia is needed. While carers acknowledge assessing the severity of mange is subjective, they would like mange training courses to be mandatory for all rangers to attend. To address this issue in part, the ACT Chief Veterinary Officer developed the 'Assessment of sarcoptic mange in wombats: A guide for rangers' as a decision sheet for PCS rangers assessing mange severity and the need for humane euthanasia. Additionally, carers are concerned about the lack of suitable release sites for rehabilitated animals in the ACT, leading to most releases occurring in NSW. Both groups worry about post-release survival and are exploring GPS tracking to monitor outcomes.

Wombat Rescue leads efforts to treat mange across populations, while ACT Wildlife limits treatment to intended release areas (see section 9.3.1). Despite ongoing efforts, carers lack the resources to eliminate mange from populations and believe more needs to be done to control the disease. Wombat Rescue also notes that some leaseholders are reluctant to allow property access to wildlife carers to treat mange affected Bare-nosed Wombats, increasing tension between the stakeholder groups.

Urban development in the ACT is encroaching on Bare-nosed Wombat habitats, forcing them into river corridors and increasing population density (see section 9.3.2). While carers have positive relationships with some developers, they are concerned others neglect proper wombat management. Carers fear Bare-nosed Wombats are being pushed into narrow river corridors which will place a strain on resources and result in more aggressive territorial behaviour. They would like to see buffer zones placed around new developments to minimise impacts to Bare-nosed Wombats.

4.3 Community

Bare-nosed Wombats frequently interact with areas used by the broader community. As urban sprawl encroaches on Bare-nosed Wombat habitat there will likely be increases in human-wombat interactions and potential conflicts in urban areas. The broader community was not consulted as part of this review, and their opinions remain unknown.

Many people who do not live with wombats on their properties are often unaware of the issues these animals can cause, which contributes to resistance toward their management. Increasing public education about Bare-nosed Wombat biology, ecology, and the challenges they present can improve acceptance of species management strategies (Reiter et al., 1999). Including educational material on wombat ecology, impacts and management options on the CED website would be a valuable resource for the community. This could be similar to the information that is currently provided for other managed species (e.g. kangaroos). Public awareness

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campaigns should focus on the ecological role of Bare-nosed Wombats, the potential damage they can cause, and how to responsibly co-exist with them. Educational materials such as pamphlets, online resources, and community workshops can offer practical advice. This may include information such as what management is permitted under law, guidelines for effectively securing property, and safely driving in areas with high Bare-nosed Wombat activity. Additionally, encouraging the public to report wombat sightings and burrows would support monitoring and conservation efforts. Conducting surveys to assess public knowledge and attitudes toward wombats would help identify disparities between stakeholder groups and inform more inclusive management strategies. By fostering understanding through a well-structured information campaign, communities can better support responsible Bare-nosed Wombat conservation and reduce human-wombat conflicts across urban and rural settings.

4.4 Ngunnawal

Bare-nosed Wombats were widely used by First Nations people in many parts of southeast Australia. Much of the traditional knowledge has been disrupted due to the impacts of colonisation. Unfortunately, limited access to relevant contacts has constrained our ability to assess the importance of Bare-nosed Wombats to the Ngunnawal community at this stage. Reviving and incorporating First Nations perspectives into contemporary conservation efforts can help honour cultural importance and provide holistic approaches to managing Bare-nosed Wombat populations in the ACT.

4.5 Office of Nature Conservation (ONC)

The management of Bare-nosed Wombats is becoming an emerging and complex issue for ONC. ONC initiated a Wombat Working Group to work with stakeholders and better understand the complexities and conflicting viewpoints in this space, but reported they had trouble engaging leaseholders within the working group. The working group came to an end when there was no new information to guide decision-making. ONC faces pressure from wildlife groups to manage mange and has worked with researchers and wildlife carers to mitigate mange impacts. This includes the creation of the Wombat Mange and Monitoring Group, a subgroup of the Wombat Working Group focused on monitoring wombat populations and assessing mange. While there is a desire within ONC to effectively manage this species, a range of knowledge gaps and resource allocation has proven to be a significant hurdle.

4.6 ACT Parks and Conservation Service

Rangers find it challenging to manage community frustrations surrounding wombat burrow management in ACT parks and reserves. Walking and cycling trails are often re-routed along sub-optimal routes due to the presence of Bare-nosed Wombat burrows. As conservation officers, rangers are permitted to interfere with wombat burrows where necessary and are required to adhere to the Conservator Guidelines for the Protection of Burrowing Animals. Rangers would like support to manage burrows, particularly short starter burrows that are not used as a primary refuge.

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4.7 Natural Resource Management

The primary issues Natural Resource Management (NRM) encountered with Bare-nosed Wombat management were a result of conflicts with farmers. Anecdotally Bare-nosed Wombat numbers have increased in the last 15-20 years, and subsequently the number of conflicts has increased. Among landholders there is an appetite to declare Bare-nosed Wombats overabundant and allow lethal controls as a management tool. NRM would be reluctant to implement lethal control as there are multiple knowledge gaps around current population levels and minimum viable populations. NRM also highlighted the lack of resourcing for non-lethal options for managing conflict between landholders and Bare-nosed Wombats. Subsidising exclusion fencing in hotspot areas may be a feasible option for conflict resolution. One-way gates, another management option, may remove conflict in one area but relocate wombats and conflict to another area.

4.8 Icon Water

Bare-nosed Wombats have damaged Icon water essential services infrastructure (see section 9.2.1). Icon Water sought advice from ecologists on damage mitigation strategies but had difficulties finding skilled ecologists with capacity to assess the problem and implement recommendations. As a result, Icon Water now manages wombat damage independently based on online consultation with ecologists. They have adopted a variety of management strategies, but they require monitoring and management investments. Icon Water currently has sufficient resources to continue implementing their management program.

4.9 Licensing and Compliance

Lethal control of Bare-nosed Wombats in the ACT is not permitted, however there is pressure from rural communities for it to be permitted. If the ACT government was to permit lethal control of Bare-nosed Wombats it would need to be part of an evidence-based controlled native species management plan (CNSMP), similar to macropods. A CNSMP would require clear guidelines around when control is appropriate, and the criteria that must be met for control to occur. For example, the existing CNSMP for Eastern Grey Kangaroos clearly defines when control occurs, the number of animals to be removed, and benchmarks for shooter proficiency. A CNSMP for wombats would also require a new code under the Animal Welfare Act that defines how wombats are to be controlled humanely. The PCS licensing department is supportive of developing a CNSMP for wombats and indicated that this is preferable to issuing licenses for control. Currently there have been no formal complaints to the licencing department about Bare-nosed Wombats.

In recent years, wildlife carers have been concerned about the impacts of new development on Bare-nosed Wombats. In response, the Office of the Conservator for Flora and Fauna developed the Conservator Guidelines for the Protection of Burrowing Animals during development (Protection of Burrowing Animals During Development) Conservator Guidelines 2025 notified under the [Legislation Act 2001](#). There are currently two licences issued to interfere with Bare-nosed Wombat burrows.

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4.10 Scientists

The only scientist consulted during this review was Dr. Scott Carver, who specialises in researching wildlife disease ecology. Dr. Carver was a member of CED's Wombat Working Group and has worked with the ACT and Tasmanian governments on mange-related projects. He felt the Wombat Working Group effectively achieved its intended purpose. Similar to the Tasmanian wombat working group, the CED-led group came to a natural end when participants ran out of new information to bring to the table.

Dr. Carver has worked extensively with wildlife carers on mange treatment. He noted that within the stakeholder group there is disagreement over best practice treatment methods and determining when euthanasia is appropriate. He noted that conversations in this space can escalate quickly, and more research is necessary. A recent study by the Wombat Protection Society and associated researchers trialled increasing the dose of moxidectin from 20 ml to 100 ml to treat mange in wombats. Dr. Carver noted that this is a large increase in dosage, and studies gradually increasing the treatment dose to determine the lowest effective amount would be key to preventing excessive use of moxidectin.

Dr. Carver acknowledged leaseholders had conflicts with Bare-nosed Wombats and more research was necessary in this space, but it was outside his area of expertise.

4.11 Chief Veterinary Officer

The ACT Government Chief Veterinary Officer (CVO) was primarily concerned Bare-nosed Wombats treated for mange *in situ* are not getting the proper care they need. Ideally animals would be diagnosed by a qualified veterinarian prior to being given treatment, although the CVO did acknowledge that this was not possible when treating wild animals *in situ*. They raised concern that the indiscriminate application of moxidectin at all burrows within an area can lead to accidental overdosing of individual Bare-nosed Wombats. Conversely, some wombats may not receive a full dose if the chemical splashes as they are exiting a burrow or they move away from the treatment area. Healthy animals within the population will also unnecessarily receive treatments, which could lead to the development of chemical-resistant mites.

The drugs being used to treat Bare-nosed Wombats have the potential to cause harmful side effects in other species. Dogs that ingest moxidectin can experience neurotoxic effects and possible mortality. Faecal matter from treated animals contains traces of moxidectin, which can wash into waterways and affect aquatic systems. Responsible use of mange treatment drugs is critical to ensuring the negative impacts on ecological function are minimised.

4.12 Developers

The ACT population is projected to grow to 696,000 by 2050. Over the next few decades urban expansion is likely to encroach on areas where Bare-nosed Wombats reside resulting in management issues for urban developers. No developers were spoken to during this review. Consultation with developers is recommended to ensure urban expansion can be managed with minimal impacts on Bare-nosed Wombats.

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5 Complexities of wombat management

The management of wombats is highly contentious, with challenges arising from the need to balance the competing interests of diverse stakeholder groups, including local government, leaseholders, First Nations, and wildlife care organisations (see Table 4). Conservation and wildlife care groups advocate for stronger protections for Bare-nosed Wombats, while agriculturalists and developers seek to manage the species to reduce damage to infrastructure, livestock, and personnel.

It is unlikely that all stakeholder groups will agree on a single approach to wombat management. However, participatory planning can improve communication and foster mutual understanding. Involving stakeholders in decision-making processes can lead to greater ownership of outcomes, enhance program credibility and transparency, and support the achievement of long-term goals (Hewitt and Messmer, 1997). Stakeholders are less likely to adopt or support management practices if they feel their opinions have not been taken into consideration and may take management actions into their own hands.

To date, there is no known research specifically examining the complexities of stakeholder relationships in wombat management. However, studies have explored landholder relationships with Southern Hairy-nosed Wombats (O'Brien, 2019, Sparrow, 2011, St John and Saunders, 1989, Stott, 1998) and Bare-nosed Wombats (Marks, 1998c). Additionally, the 5th IUCN World Parks Congress in 2004 brought together conservation experts to discuss human-wildlife conflict. Insights from this workshop, summarised by Madden (2004) provide a useful guiding resource for managing human-wildlife conflict.

5.1 Common causes of damage

5.1.1 Burrowing behaviour

Wombats are one of the largest burrowing herbivores in the world and create warren complexes that vary in complexity from single entrance burrows to a collection of interconnected burrows (warren). Burrows can vary in depth (0.4-2.8 m) and length (0.5-20 m), as such the spoil mound can be anywhere from 2.5-8 m² (Triggs, 2009, McIlroy, 1973). A Bare-nosed Wombat can use up to 11 burrows within their home range, though they typically favour the use of 1-2 burrows (Evans, 2008). Though their burrowing provides essential ecosystem services it often leads to conflicts with people. Bare-nosed Wombat burrows can undermine infrastructure such as roads, buildings, water tanks, fencing, dams which can result in substantial damage, financial costs and safety concerns.

One of the main points of contention for rural leaseholders with Bare-nosed Wombats on their properties in the ACT is the damage and occupational health and safety risks burrows can cause. This includes damage to fencing, dams, roads, buildings and erosion. Wombat damage to fencing can result in stock escaping from paddocks, posing a safety risk to both stock and people. Livestock may become injured or lost once they escape from the safety of a property resulting in financial losses to the rural leaseholders. Where properties adjoin parks and

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reserves there is a risk escaped stock may damage parks and reserves and incur fines for the landholder. Furthermore, rural leaseholders have a legal responsibility to ensure their stock does not stray from their property and can be held liable for any damages if they escape. Fence damage can also allow access to properties from undesirable pest species such as pigs.

Rural leaseholders and Icon Water have reported issues with Bare-nosed Wombats burrowing into the sides of dams or reservoirs. This is not only a safety concern for people but also the Bare-nosed Wombat. If a dam wall breaks it has the potential to release large volumes of water, threatening farm water supplies and downstream properties. In addition, it could cause increased erosion and sediment washing into the Murrumbidgee River and other major waterways. This places a significant financial burden on the rural leaseholders who are responsible for appropriately maintaining their dams. Icon Water have been managing Bare-nosed Wombats burrowing around dams by using one-way gates to force animals to leave the burrow and filling the hole with cement once they have been evicted.

Icon Water, rural landholders and PCS rangers have reported safety concerns with Bare-nosed Wombats burrowing under roads and tracks and within paddocks. The weight of a vehicle driving over a tunnel can cause the tunnel to collapse, causing damage to vehicles and necessitating vehicle and road maintenance. For rural leaseholders, burrows pose a significant safety risk to people and stock. Landholders using quadbikes and buggies can incur significant injuries if their vehicle falls into a burrow, which can lead to lengthy recovery times and a loss of income. Rural leaseholders have reported vehicles falling in tunnels as frequently as once a month with estimated damages costing ~\$1,000. This risk is increased in summer when grasses and other vegetation obscure burrow entrances. Landholders can also be liable for injuries to contractors and other staff working on their property, and landholders have been sued by injured contractors. Stock falling into wombat burrows can negatively affect animal welfare and lead to financial losses. One rural leaseholder has had to remove high value stock from a paddock with high levels of Bare-nosed Wombat activity. When wombat burrows limit accessibility of paddocks landholders may not be able to carry out other management tasks such as weed control. While burrow entrances can be mapped to reduce the risk, it would need to be updated regularly to account for new burrows. This is not feasible for rural landholders at a large scale.

Bare-nosed Wombats burrow under other infrastructure, such as buildings, water tanks and wastewater treatment drying beds. They can be removed with the use of one-way gates and burrows can be backfilled, but it is possible wombats will re-excavate the site. Rural leaseholders have tried using mesh to prevent re-excavation, but this treatment only lasts up to six months. Icon Water use a range of methods to prevent Bare-nosed Wombats re-excavating under infrastructure including the installation of cement skirts, placement of large rocks or mesh skirting. This requires ongoing maintenance and monitoring to keep animals out of undesirable areas. Burrows can also harbour rabbits, which creates an added layer of complexity in rabbit control. If rabbits are found using Bare-nosed Wombat warrens, Icon Water install one-way gates to remove the wombat before fumigating the burrow.

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5.1.2 Grazing competition/Crop damage

Within the ACT there are 20,869 ha of agricultural land, the majority of which is stock grazing land, with a small amount of cropping. Though competition for food resources between wombats and livestock has been reported as an issue of concern in other states (O'Brien, 2019, Stott, 1998, Marks, 1998c). Rural leaseholders in the ACT have not reported it as an issue. The density of wombats on properties can vary at local and regional scales and may influence reports of grazing competition. For example, within the Murraylands of South Australia, Southern Hairy-nosed Wombats have an estimated DSE (dry sheep equivalent) of 0.5, comparatively sheep have a 1.2 DSE. Dry sheep equivalent is a unit of measure used to assess the nutritional needs of livestock and assess the carrying capacity of a farm. It equates to the amount of feed required by a two-year-old 50 kg Merino wether per day. Landholders have had to reduce their stocking rate by 20%, to account for the impacts of growing Southern Hairy-nosed Wombat populations, threatening the viability of some farms. Due to the differing climatic conditions in the ACT Bare-nosed Wombats might not have a substantial grazing impact. However, only three rural leaseholders were consulted in the writing of this document. Further consultation with rural leaseholders is recommended to understand the extent of the problems they are facing within the ACT before ruling grazing competition or crop damage out as a potential cause of conflict.

5.1.3 Erosion

Wombat burrows are often perceived to cause erosion in creeks and gullies (O'Brien, 2019); however, the extent of damage has not been quantified. Past land clearance may have resulted in increased soil instability, facilitating wind and water erosion of creek lines over time. When Bare-nosed Wombats burrow into steep banks, they undercut and destabilise them, the effects of which are exacerbated in unstable soils where there is a lack of vegetation. Eroding soils get washed into the Murrumbidgee River which has environmental implications for aquatic systems. Assessment of erosion damage is needed to determine the underlying cause and quantify the damage so the most appropriate management actions can be implemented.

Rural leaseholders have used fencing to prevent stock from accessing creek lines and contributing to erosion risks. They are unable to prevent Bare-nosed Wombats from digging into creek banks and damaging the stock exclusion fencing. One rural leaseholder remediated the creek line of his property to reduce the erosion and subsequent damage to the surrounding aquatic environment with the help of ACT NRM and community groups (Figure 3). It took significant effort getting the necessary approvals on top of the time and costs of the work itself, totalling over \$50,000. This work was undertaken as part of a grant program and would otherwise have been infeasible for the rural leaseholder. The rural leaseholder reported difficulty in dealing with 'red tape' associated with the project and would not have completed it without the help of the ACT NRM.

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Figure 3. Top – the eroding creek line on a leaseholder's property prior to remediation works. Bottom – the creek line after remediation works.

5.1.4 Land clearance for urban development

Recent expansion of urban development has caused concern among wildlife groups for wombats. Though Bare-nosed Wombats are a protected species they are not threatened and thus do not need to be considered when assessing a site for development approval. As such, developments have been planned, approved and construction commenced in areas where Bare-nosed Wombats occur without considering the impacts. Though it is an offence to kill or interfere with a Bare-nosed Wombat under the Nature Conservation Act 2014, burrows have reportedly been destroyed during earthworks by developers, potentially burying Bare-nosed Wombats alive (pers. comm wildlife carers 2024). Wildlife carers have reported increased numbers of call outs in areas where urban development has or is occurring. This has highlighted the need for a greater understanding of the impacts of development on Bare-nosed Wombats.

As a response to potential impacts from development on Bare-nosed Wombats and other burrowing animals, the Conservator of Flora and Fauna has developed Conservator Guidelines for Burrowing Animals. The purpose of the guidelines is to improve consideration of burrowing animals during development and provide direction to developers on best practice methods to minimise harm. The guidelines will apply to any new developments within the ACT. During planning stages, developers will need a suitably qualified ecologist to identify burrow and

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shelter sites, monitor them for activity and ensure they are vacant or avoid developing over them wherever practicable. Wombat Rescue and ICON Water have highlighted the difficulties of conducting appropriate assessments due to the lack of capacity among suitably skilled ecologists in the ACT. Wombat Rescue are often called by ecologists seeking advice on how to manage wombats (pers. comms Wombat Rescue 2024). Where avoidance of burrows is not possible developers can apply for a licence to destroy burrows and must follow the guidelines to ensure this is done with minimal disturbance to animals.

The guidelines don't take into consideration the potential for new developments to fragment and isolate populations, limiting dispersal and resulting in genetic differentiation over time. Prior to any new land use zoning, consideration should be given to whether wildlife populations will be disconnected resulting in small and isolated populations that over time could result in inbreeding. There is concern development is pushing Bare-nosed Wombats into narrow river corridors where increased densities could result in increased competition for resources and creating stressful conditions for animals. Without a more detailed understanding of the abundance of Bare-nosed Wombats and carrying capacity in the ACT it is difficult to determine the impacts of increasing development and expansion. Furthermore, the carrying capacity of Bare-nosed Wombats is unknown and likely to vary from region to region based on habitat and resource availability.

If Bare-nosed Wombat densities are reaching a critical limit with food resources it can increase stress, competition and ultimately population declines. Increased stress and high Bare-nosed Wombat densities are often associated with increased mange prevalence (Sengupta, 2019). Areas closer to fresh water are also predicted to have the highest suitability for mange (Ringwaldt *et al.*, 2023). Urban areas abutting river corridors where Bare-nosed Wombats occur could result in increased human-wombat interactions. Dispersing Bare-nosed Wombats may wander into urban areas where conflicts can occur (e.g. burrow damage) and be more susceptible to road vehicle collisions. There could also be increased interactions between wombats and pets, resulting in injuries to domestic dogs and wombats. Dogs have been known to enter burrows where they may contract mange, get stuck or become injured. Increased public education on the implications of living near Bare-nosed Wombats will be essential.

It is important to note no developers were consulted in the preparation of this report. Consultation with developers is recommended to improve Bare-nosed Wombat management in areas under development.

5.2 Conservation concerns

5.2.1 Mange

Sarcoptic mange is a skin condition caused by the *Sarcoptes scabiei* mite. Mange initially presents as skin reddening and hair thinning. As the disease progresses, visible signs of itching, alopecia and epidermal crusting appear (Pence and Ueckermann, 2002). Mange has strong animal welfare implications as affected individuals can suffer a slow and agonising death, usually through secondary infection, blindness and/or starvation (WHA, 2021). Prevention of mange in Australia is considered almost impossible, as all disease transmission pathways would need to be interrupted, including transmission from host species such as foxes (WHA, 2021).

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Ideally mange should be diagnosed and treated by qualified veterinarians so the condition is correctly identified, and animals can receive appropriate treatment. This is not feasible for wildlife populations. Mange in wombats is typically diagnosed and treated by wildlife carers and volunteer groups with varied levels of training, experience and coordination. Diagnosing the disease in its early stages can be difficult without catching and examining animals. The same symptoms can be caused by malnourishment from low quality feed, creating the potential for misdiagnosis (Fraser et al., 2018).

The distribution of mange and its impacts on wombat populations is poorly understood. Bare-nosed Wombat populations often persist in the presence of mange, and prevalence is usually $\leq 15\%$ (Carver et al., 2021). During outbreaks, mange prevalence can rise to $> 50\%$, with near 100% mortality of infected individuals (WHA, 2021). In some cases, mange outbreaks have resulted in $> 90\%$ decline in local Bare-nosed Wombat abundance (Skerratt 2005; Martin et al. 2018a). Research suggests population decline and range retraction can occur when mange prevalence is $> 25\%$ (Carver et al., 2023). Additional research is needed to understand which environmental variables may lead to mange outbreaks.

Increased rates of mange are often associated with high wombat densities and periods of drought or high stress (e.g. seasonal stress in winter) (Sengupta, 2019). Burrows are thought to be the predominant mode of sarcoptic mange transmission in wombats (Evans, 2008, Martin et al., 2019, Beeton et al., 2019). The humid and cool microclimate within wombat burrows provides favourable conditions to maximise mites off-host survival, particularly in cooler months (16.4 days in winter and 5.96 days in summer). Mites can survive in burrows longer than the minimum known frequency of wombat burrow switching 4- 10 days. Transmission is exacerbated by patterns of burrow use and sharing (Evans, 2008; Martin et al., 2019b).

Regulation of veterinary chemicals used to treat mange in Australia

The Australian Pesticides and Veterinary Medicines Authority (APVMA) is responsible for the regulation and control of agricultural and veterinary chemicals in Australia. Under legislation, the APVMA can evaluate, approve and register agricultural and veterinary chemicals, regulate supply, undertake compliance and issue permits for use. There are currently four active permits (valid in all states and territories of Australia) and three active permit holders approved for veterinary chemicals use for the treatment of mange in wombats.

The Wombat Protection Society holds two permits for the use of a Cydectin (active constituent Moxidectin). One permit allows for a dose 4 ml per kg of body weight with a maximum single dose of 100 ml on an adult wombat (>15 kg) with five days between doses and no more than five doses. The efficacy and toxicity associated with this dose rate has not been fully evaluated and users must observe wombats for any signs of toxicity. Any wombats that die after treatment must be reported to a veterinarian and a detailed postmortem carried out.

A second permit held for the use of Cydectin allows 0.8 ml dosage per kg of body weight with a maximum dose of 20 ml applied once weekly for 15 weeks. This permit is also held by Mange Management Incorporated. Cydectin can be delivered directly or by topical application using a pole and scoop to pour a dose onto the wombat's back, or indirectly by using a burrow flap that doses the wombat when passing underneath.

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Intervet Australia holds a permit for use of Bravecto (active constituent Fluralaner) for mange treatment. The dose is 25 mg/kg with a maximum of three doses one month apart on wombats > 5 kg. Bravecto must be applied by topical application directly or by using a pole and scoop to pour a dose onto the wombat's back.

A condition of all these permits is that 'the product must only be used by persons who have appropriate experience in identifying mange infection and toxicity signs in wombats'. It is the permit holder's responsibility to ensure people operating under the permit are trained in the identification and treatment of mange in wombats. This is particularly relevant for care groups, where mange treatments may be administered by a range of volunteers. The permit holder must record any adverse experience associated with the use of the product and report them to the APVMA as soon as possible.

While there are no conditions on any of the APVMA permits with regards to Cydectin use near waterways, an environmental protection warning on the product states 'Moxidectin is extremely toxic to aquatic species. Do not contaminate dams, rivers, streams or other waterways with the chemical or used container.' This statement applies to use of the product under all APVMA permits.

Applying moxidectin indiscriminately across all burrows in an area may lead to unintentional overdosing of individual wombats over time, either from inaccurate dosage or from wombats relocating to treated burrows. Some wombats may not receive a full dose if the chemical splashes as they are exiting a burrow or they move away from the treatment area. Healthy animals within the population will also unnecessarily receive treatments. This could lead to the development of mite resistance arising from inappropriate chemical concentrations being administered.

There is also a risk non-target animals are treated, as wombat burrows are known to be used by a range of other native species (Linley et al., 2024, Thornett et al., 2016) and the impacts of moxidectin on these species is unknown. The broadscale use of these chemicals can result in chemical residues within the environment which can have negative impacts on native fauna, including invertebrates and aquatic species. Application with a pole and scoop though more time consuming can specifically target wombats with mange and promotes good chemical stewardship.

Some carers believe other products are safer or more effective and use a range of alternative treatments or supplementary products to relieve itching and treat secondary infection. Less invasive approaches include the one-off or repeated administration of a topical acaricide. However, topical treatments may not reach mites due to a failure to penetrate parakeratotic scale crust or be adequately absorbed systemically due to a thickened epidermis. Even among experienced carers there is wide disagreement about how best to treat mange (O'Sullivan, 2018).

Current treatment of mange in the ACT

In the ACT, Bare-nosed Wombats are primarily treated for mange by Wombat Rescue volunteers, and to a lesser extent ACT Wildlife carers. Volunteers operate under APVMA permits PER89982 and PER90837 issued under section 112 of the Agricultural and Veterinary Chemicals Code 1994. The first permit allows for the treatment of

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Bare-nosed Wombats with mange using up to 20 ml of Cydectin via burrow flap or pour on/pole and scoop application methods. The second permit allows for the treatment of Bare-nosed Wombats with Bravecto using pour on methods only. Volunteer groups must also apply for a licence under the *Nature Conservation Act 2014* to use a vehicle within a reserve.

In addition, Wombat Rescue has a TCCS permit for use of Cydectin on public lands to undertake population treatments, with strict conditions of its use around waterways due to its toxicity to aquatic species. Cydectin must not be used when there is a medium chance or greater (>40 %) of heavy rain (>10 mm) forecast and all treatments within 5-15 m of a permanent waterway must be removed within 24 hours in the catchment area. A treatment area cannot exceed 1km of river reach, can only be treated at the population level once annually and no more than 6 treatment areas can be treated annually along the Murrumbidgee and Molonglo Rivers. Population level treatment by burrow flap application must not be used within 15 m of permanent waterways but is permitted for treating a maximum of 5 individuals at any one time. Cydectin cannot be used within 5 m of the water's edge or within 5 m from the centre of drainage lines and intermittent gullies, including unnamed drainages at any time. No treatments are to be applied in the Cotter Catchment above Cotter Dam, Namadgi National Park or Tidbinbilla Nature Reserve. The location and dosage details of all treatments, particularly those within 5-15 m of a permanent waterway, must be entered into a shared spatial layer once treatment has commenced.

Mange-affected Bare-nosed Wombats are treated both individually and at a population level. Population level treatments are conducted by Wombat Rescue and occur mainly in riparian areas along river corridors. Due to the substantial time it takes to install burrow flaps on every burrow, and permit restrictions, volunteers are only able to treat burrows along a 1 km stretch of the river at a time. Mange can be successfully eliminated in isolated areas, but where connected populations of Bare-nosed Wombats occur along river corridors, it is difficult to eradicate mange as infected individuals from outside the treatment zone can wander in following the course of treatment. ACT Wildlife only administers mange treatments in areas where rehabilitated Bare-nosed Wombats are to be released if there has been isolated incidence of mange to maximise their chances of survival.

Wombat Rescue regularly responds to call outs to treat and rescue mangy Bare-nosed Wombats from concerned members of the public and ACT Parks and Conservation Service.

Mange distribution

To gain a better understanding of the distribution of mange in the ACT, CED have developed an online portal to enable the community to report sightings of mange-affected Bare-nosed Wombats. Sightings are also reported on WomSAT, an online application developed by researchers at the University of New South Wales. This data helps inform the national distribution and prevalence of mange in wombats. Users of WomSAT create an account and sightings must include a photo for verification. While applications of this nature enable capture of data across broad regions, reporting is typically skewed towards areas of high human activity and therefore may not accurately represent the presence/absence of mange (Figure 3).

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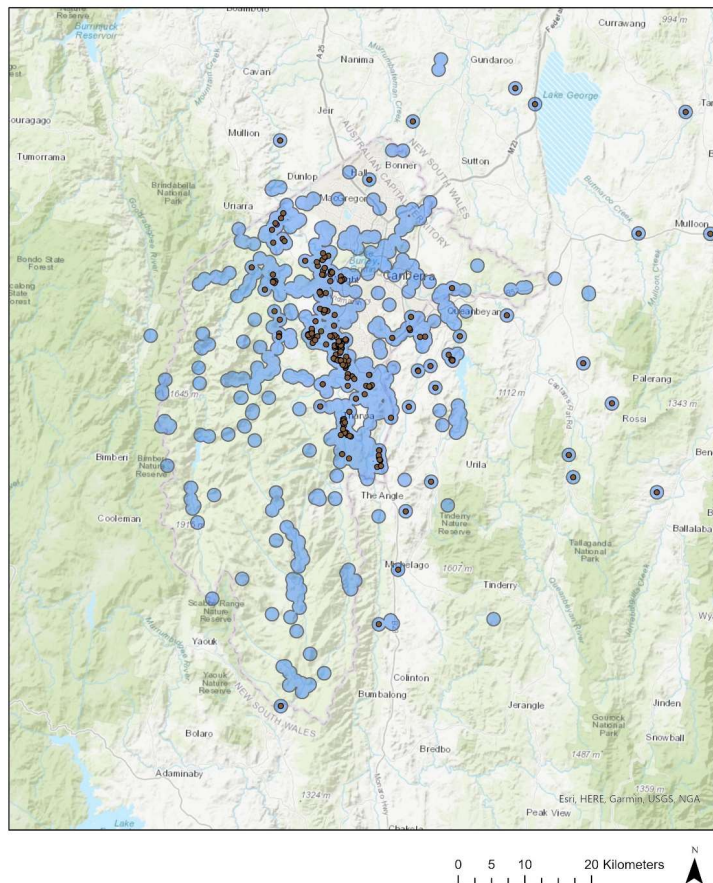


Figure 4. The known records of mange in Bare-nosed Wombats (red dots) in the ACT taken from CED survey data and ACT Wildlife Atlas wombat records and mange portal data.

Wombat Mange and Monitoring Group

To progress treatment of mange and improve monitoring of Bare-nosed Wombats in the ACT, CED convened the Wombat Mange and Monitoring Group (initiated March 2021). This group was formed as a subgroup of the Wombat Working Group. Members included two community wildlife care groups (Wombat Rescue and ACT Wildlife), Prof. Scott Carver of the University of Georgia USA (formerly of the University of Tasmania) and CED staff. The group took a collaborative approach to addressing mange and coordinates activities of the community and ACT Government. Previous activities of the Wombat Mange and Monitoring Group include:

- Trialling the use of Bravecto, as a potentially longer-lasting, more effective, and target-specific treatment for mange.

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- Developing a collaborative monitoring program to provide data on wombat populations, distribution, and mange prevalence across the ACT.
- Support mange treatment in public reserves while minimising risks associated with using Cydectin near waterways.
- Undertake collaborative research on the impacts of mange treatment chemicals on aquatic ecosystems.
- Develop and promote a publicly accessible web-based communication portal to enable community members to report Bare-nosed Wombat sightings and incidences of mange.

5.2.2 Road vehicle collisions

Collisions with vehicles are a source of mortality or injury for Bare-nosed Wombats and a safety concern for people. Roadkill records reported in the WomSAT app between 2015-2019 are relatively low in the ACT in comparison to other states (Figure 4, Mayadunnage et al., 2024). WomSAT relies on citizen scientists to report sightings and thus data may not be representative of all road kills occurring in the ACT. Roadkill records are collected by the Urban Wildlife Team, and it is worth reviewing them to gain a better understanding of the frequency of collisions and identify hotspot areas where intervention may help to reduce collisions.

The frequency of vehicle collisions is likely to vary depending on traffic levels, vehicle speed, Bare-nosed Wombat population density, climate and season (Mayadunnage et al., 2024, Ramp et al., 2005). Bare-nosed Wombat road mortalities are higher in winter and early spring (Roger et al., 2011, Mayadunnage et al., 2024, Nguyen et al., 2022). This could be linked to seasonal changes in the activity periods of Bare-nosed Wombats or more cars being on the road at dawn and dusk due to shorter winter days. High Bare-nosed Wombat road mortalities have been linked to areas of dense forest cover and the greenest ground cover in areas where wombat burrows are present (Roger and Ramp, 2009).

Within the ACT, most Bare-nosed Wombats (approximately 50 a year) come into care because of injuries from road vehicle collisions or being orphaned due to a vehicle collision. The relatively small number of Bare-nosed Wombats taken into care does not represent the total number of wombats killed.

Wombats can cause substantial damage to vehicles, the cost of which is unknown. Analysis of 17,000 animal collision claims between 1 January – 31 December 2023 by Suncorp Group revealed the most common animals drivers collide with are kangaroos, wallabies, wombats, deer, dogs, cows and emus (AAMI, 2024). The average cost of an animal collision insurance claim is greater than \$5,000 and 16% of vehicles were written off in claims that involved wildlife. The study revealed 76% of Australians believe kangaroos would cause the most damage to a car if involved in a collision, followed by wombats (16%).

Even if roadkill is not causing widespread declines of Bare-nosed Wombats, wildlife-vehicle collisions should be reduced where possible. Measures to reduce wildlife vehicle collisions include installing wildlife warning signs, installing underpasses or overpasses, and using deterrent devices (see section 10.5 for more information).

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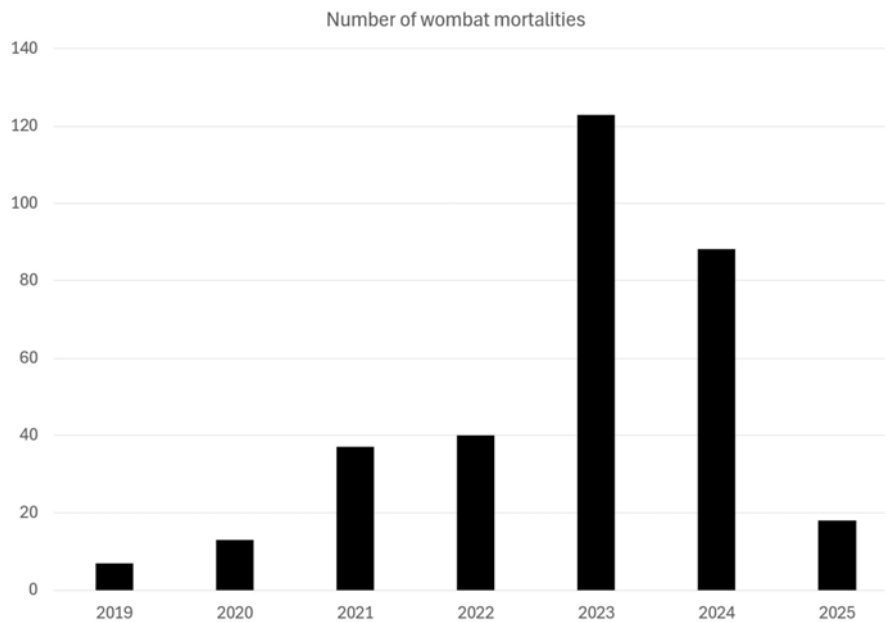


Figure 5. Temporal distribution of wombat roadkill records reported by the ACT Urban Wildlife Team between July 2019 and July 2025. For 2019, data is limited to July-December of that year; for 2025, data is limited to January-July of that year.

5.2.3 Habitat loss

The expansion of urban development has caused concern for the safety of Bare-nosed Wombats. The ACT is around 236,000 hectares, which is roughly 43.6 conservation estate, 10% highly modified urban land, and 15% highly modified rural and broadacre lands. The exact division of land may be different as land zoned for urban areas may still be undeveloped or rezoned to another land use prior to development. Between 2006 and 2022, the ACT's urban area grew by 9% (2,760 ha). Most development has been in Gungahlin (Taylor, Throsby, Jacka and Moncrieff), West Belconnen (Ginninderry) and the Molonglo Valley (Whitlam and Denman Prospect). The increase in urban land has been driven by strong and sustained population growth over the last decade. The ACT population is projected to grow to 696,000 by 2050. The *ACT Planning Strategy 2018* aims to accommodate this growth while limiting urban spread by setting a target of 70% of new housing being built within existing urban areas. The impact of urban expansion of Bare-nosed Wombat populations is poorly understood. Urban development is thought to be pushing Bare-nosed Wombats into river corridors where their densities are high, resulting in increased stress from resource competition and territoriality (pers. comm wildlife carers 2024). In contrast, reports from other stakeholder groups indicate the distribution and abundance of wombats is increasing. The distribution of Bare-nosed Wombats across different land use zones is unknown and worth investigating to properly understand the potential impacts of further development on populations.

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6 Wombat management methods and options

Conflicts with wombats have traditionally been resolved using lethal controls, but there is increasing advocacy for the development of alternative 'non-lethal' management options. Creating policy around alternative 'non-lethal' management options are hindered by a lack of quantitative evidence on their effectiveness and humaneness. Management options perceived as non-lethal can have negative ecological or animal welfare impacts, sometimes resulting in death. For example, translocation often has low survival rates but is perceived as a non-lethal management option because it does not involve the direct killing of animals. The term 'non-lethal' has not been used to classify management options in this review.

Research into damage mitigation techniques has not yielded conclusive results or sustained long-term benefits (Barlow et al., 2010, Koehler AE, 1990, Mason, 1998). Given the nature of conflicts vary greatly, no single management technique will alleviate all conflicts. A variety of damage mitigation techniques are needed that can be tailored to the ecological, social, cultural and economic realities in which conflicts occur (Dubois et al., 2017). Land managers also require data on the distribution and abundance of wombats, as well as the type and extent of damage, to effectively implement a management strategy.

This section reviews current research on wombat management and damage mitigation strategies.

6.1 Fencing

Exclusion fencing is a popular tool for eliminating damage to high value resources. While it is perceived as non-lethal it can have negative impacts on target and non-target species by prohibiting natural movement patterns or inhibiting access to important resources. Prior to installing exclusion fencing, careful consideration needs to be given to the ecological impacts on excluding species from their habitat.

6.1.1 Foot netting

Excluding wombats from areas where they are causing damage such as to high value infrastructure or resources can help to reduce damages and increase landholder tolerance towards wombats. Several wombat exclusion fence designs have been trialled. Attaching foot netting to the bottom of fences has been found to temporarily reduce the number of holes dug in fencing by 35-63% for up to 3 weeks (Marks, 1998b). Borchard et al. (2009b) trialled using hinged joint wire (80 cm wide x 15 cm spacings) attached to the outside of existing fencing and flattened along the ground and secured with tent pegs every 1 m along a 100 m section of fence and silt fencing (770 mm wide) laid out in the same manner and secured every 30 cm. In both designs hinge wire foot netting was placed on the inside of the fence at wombat breach points. The foot netting trial resulted in a mean exclusion rate of 35% for a one month. In the absence of aversive stimuli wombats quickly learned to chew through the silt fence or dig under the wire netting.

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6.1.2 Electric fencing

Electric fencing has been shown to exclude wombats from areas where their behaviour conflicts with human land use (Marks, 1998b, St John and Saunders, 1989). The electrification of the dog fence along the Nullarbor Plain in south east Australia has reduced damage to the fence caused by Southern Hairy-nosed Wombats, which allows dingoes (*Canis lupus dingo*) to pass through (St John and Saunders, 1989). On the outside of the dog fence, an additional two strands of wire 15 and 30 cm above the ground, positioned approximately 30 cm away from the original dog fence were constructed. The fence is patrolled regularly by dog baiters who assess the fence for signs of damage. Most damage occurs from Southern Hairy-nosed Wombats inside the fence attempting to travel north. Electrifying the fence has prevented Southern Hairy-nosed Wombats from travelling north, resulting in them moving south of the highway into crop land where they had not previously been, resulting in conflicts with wombats and crop farmers (Sparrow, 2011). Marks (1998a) found electric fencing produced variable results, for Bare-nosed Wombats with electric fencing reducing the number of holes by 0-92% over 13 weeks. Landholders who used electric fencing to exclude Southern Hairy-nosed Wombats from their properties reported it to be unsuccessful as the electrified strands were often shorted out by vegetation or debris and it was too time intensive to check (O'Brien, 2019). Electric fencing is costly and time consuming to maintain on a small scale. Landholder perceptions of success may not be influenced solely by damage reduction, but also by the time and costs associated with implementing and maintaining control measures.

The use of electric fencing to reduce wombat damage is best suited to protecting small areas with important assets inside wombat free areas. Electric fencing will require regular inspections to ensure the fence hasn't been damaged or shorted out and involves construction costs and ongoing costs to run.

6.2 Wombat gates

Swinging gates have been recommended to reduce fence damage by wombats in Australia (Breckwoldt, 1983, Triggs, 2009) which can allow stock to escape paddocks or other unwanted animals from entering crop fields. Wombats can make numerous breaches in fencing and the installation of gates at every breach point may be impractical. The placement of gates would depend on the density of wombats in the area and the number of access points being used. Gates should be installed at the most well-used breaches and exclusion netting can be used to 'train' wombats to use the gates. Anecdotal evidence suggests Bare-nosed Wombats will use gates placed up to 800 m apart without making new holes (Triggs, 2009). Breckwoldt (1983) recommends gates of a timber construction which is likely to require regular maintenance. Newer fence designs consist of heavy-duty weld mesh gates weighing at least 2-3kg if trying to exclude other animals such as wallabies (Statham and Statham, 2009, Driessen et al., 2020). If Bare-nosed Wombats could not see through gates they would dig a hole next to it rather than use it (Statham and Statham, 2009). Gates weighing between 4.5-16 kg have also been reported to be used by Bare-nosed Wombats (Coates, 2013). Borchard et al. (2009a) found Bare-nosed Wombats continued to breach the foot netting of fencing for the first few months while they learned to use the gates requiring ongoing repairs. Driessen et al. (2020) wired gates open for two weeks to allow Bare-nosed Wombats a habituation period but did not report on fence breaches throughout the study.

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The decision to use wombat gates or a combination of gates and exclusion fencing will depend on the extent of the problem, the cost of the damage and the cost to purchase, erect and maintain the length of fence required. The installation of gates can be laborious and will likely require ongoing maintenance. The installation of gates in fencing may prevent damage to fencing but it does not prevent wombats from accessing areas where their behaviour may cause further damage on the property, thus not all property managers will readily accept the use of swinging gates or view it as a successful damage mitigation strategy (Borchard and Collins, 2001).

6.3 Mapping wombat burrows

There are a variety of methods for surveying and mapping the location of wombat burrows. While it is not a direct damage mitigation method it may prove useful for choosing the most appropriate management action for burrows in unfavourable locations. Mapping the locations of tunnels can help to prevent accidents such as vehicles or machinery falling down tunnels which can collapse under their weight, by avoiding driving over them. However, in areas with a high density of tunnels this may be unavoidable.

6.4 Burrow collapsing

As wombats are known to use multiple burrows within their home range, the opportunity exists to remove problem burrows and moderate their burrowing activity with minimal impact on the wombats. However, widespread burrow destruction is not recommended as it can lead to the displacement of wombats. It is also important to consider the impact of burrow collapsing on young at foot who may not be able to travel long distances. Historically burrow collapsing has been used following fumigation to prevent neighbouring Southern Hairy-nosed Wombats from recolonising the area, however, it was rarely successful as burrows were re-excavated (Marks, 1998a). Burrow collapsing in combination with other methods to exclude wombats from areas where they are causing damage may prove more effective.

The gradual collapsing of burrows over three days in combination with the use of deterrents has been trialled as a management option for Southern Hairy-nosed Wombats (Sparrow et al., 2016, O'Brien, 2018). This method involves collapsing the first 1-2 m of the tunnel on day one, followed by another several meters on day two. The tunnel is left open, providing a clear exit point for wombats. The disturbance of the burrow on over the first two days is 93% effective in getting Southern Hairy-nosed Wombats to exit the burrow before ripping the tunnel on day three (O'Brien, 2018). On day three the tunnel is carefully ripped with a backhoe, stopping every few meters to check the direction of the tunnel and look for signs of occupancy. If a wombat is still within the tunnel, it can be left for another day to see if they will leave. On one occasion a Southern Hairy-nosed Wombat failed to leave on the fourth day and had excavated a further 7 m of tunnel overnight despite the presence of alternate inactive burrows nearby ($\leq 50\text{m}$ away). The failure of burrow disturbance to get the Southern Hairy-nosed Wombat to leave may reflect the importance of the burrow. Although Southern Hairy-nosed Wombats may use up to 10 different warrens within their home range, they usually use 1-2 warrens on most occasions to which they display high site fidelity (Shimmin *et al.* 2002; Finlayson *et al.* 2005).

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Both studies trialled the effectiveness of dingo urine and faeces in deterring Southern Hairy-nosed Wombats from re-excavating collapsed tunnels and produced mixed results. Sparrow et al. (2016) found untreated collapsed burrows on the Nullarbor plain in South Australia were recolonised within 75 days while those treated with dingo scents showed minimal activity. In contrast, in the Murraylands of South Australia 58% of collapsed warrens were recolonised within a month, while others took up to 6 months to be recolonised and deterrents didn't play a significant role in the time taken for recolonisation to occur (O'Brien, 2018). The differences in results between the two studies could be attributed to variances in the methods used or environmental factors such as predator densities at the sites or burrow availability and importance and warrants further investigation. Although burrow collapsing is considered non-lethal its impacts on evicted wombats has not been studied and warrants further investigation. Studying the impact of burrow collapsing on wombats may help to answer questions about the reasons for its success or failure. Burying steel mesh at the location of the collapsed burrow is untested but may prevent wombats from re-excavating.

Alternate methods could trap and relocate wombats or empty burrows using one-way gates placed in burrow entrances prior to collapse. Trapping is more time consuming and costly as traps need to be checked every morning and it requires careful planning and trained personnel to handle and relocate the wombat(s) but removing animals from the area may provide longer term relief from conflict. One-way gates can be installed and left in place until the burrow is empty, though regular assessment of the gate is recommended as wombats have been known to dig around or under them. Motion sensor cameras can be used to determine if a burrow is empty. Low-cost methods such as raking the soil to assess for footprints or the placing of sticks in a burrow entrance can be used to determine if a burrow is empty however, it is not always possible to determine if a wombat has gone into the burrow or exited.

The time and costs of burrow collapsing will vary on a case-by-case basis. Some burrows may be simple single entrance tunnels that take 1.5 hrs to rip while other more complex 5 entrance warrens that are 4 m deep can take up to 10 hours (O'Brien, 2018). Soil type and burrow depth will impact the time and costs associated with burrow destruction. Given the time and costs of collapsing burrows along with the low success rate it is not a viable long-term solution to wombat management, but it may prove useful in certain situations. Given Bare-nosed Wombats within the ACT breed year-round consideration needs to be given to the potential for there to be young at foot that may not be able to travel to the next nearest burrow or move through a wombat gate. Though these studies found burrow collapsing did not result in new burrows being dug in other locations it is always possible that it could transfer the conflict to a new location.

6.5 Deterrents

Designed to capitalise on an animal's mechanisms of threat detection, deterrents aim to discourage the use of human resources with aversive stimuli (Ramp et al., 2005, Apfelbach R, 2005, Schakner and Blumstein, 2013). A wide range of deterrents, such as chemical cues, novel objects, and painful stimuli are increasingly being marketed as non-lethal means of reducing human wildlife conflict (Breitenmoser et al., 2005). Although there are numerous studies on the use of deterrents, many devices have not been quantitatively field-tested, and their

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perceived effectiveness lies in testimonial and anecdotal reports. Controlled lab studies often do not translate to field situations, where numerous uncontrollable environmental factors can influence the way animals detect and respond to threats (Mason, 1998, Koehler AE, 1990, Barlow et al., 2010). Even where devices have been field tested, they often produce conflicting results.

Before deterrents are recommended to mitigate wombat damage, a better understanding of the factors influencing wombat threat perceptions and responses to them is needed. Further research is required to evaluate responses in different environmental conditions such as varying distance to cover, and with different methods of application and placement, to determine the optimal conditions for success. In addition, future studies should consider conducting trials in a closed system with known individuals or capturing and marking individuals prior to commencing trials for ease of identification so individual variation in responses can be taken into consideration.

6.5.1 Olfactory deterrents

Olfaction is known to play an important role in social communication in wombats (Taggart and Temple-Smith, 2008, Triggs, 2009), little is known about its role in threat perception. Anecdotally, fertilisers such as blood and bone, dog and human urine are thought to deter wombats (O'Brien, 2019). Dingo urine and faeces has been trialled with mixed results. Field trials found no difference in Southern Hairy-nosed Wombat activity before and after placing a cup of blood and bone in burrow entrances (O'Brien et al., 2021). Captive Southern Hairy-nosed Wombats increased their exploratory behaviour in response to dingo faeces placed inside burrows, followed by increased use of burrows and concealed locations (Descovich et al., 2012). Sparrow et al. (2016) reported Southern Hairy-nosed Wombats showed greater avoidance and prolonged time to recolonisation of collapsed warrens treated with dingo odours than control warrens on the Nullarbor in South Australia. Conversely, the application of dog urine and dingo faeces had no significant impact on the time taken for Southern Hairy-nosed Wombats to recolonise collapsed warrens in the Murraylands of South Australia (O'Brien, 2018) or deter them from using burrows where dingo urine and faeces were placed at the entrance (O'Brien, 2019). No known research has been conducted on the effects of odour deterrents on Bare-nosed Wombats.

The differing results of these studies indicate Southern Hairy-nosed Wombat responses to predator odours may be context dependent, but disparities in experimental design and analyses make it difficult to determine which factors are influencing threat perceptions. Control–impact studies may lead to a misconception of the effectiveness of treatments as they don't consider differences in pre-existing activity levels at treatment sites (Koehler AE, 1990, Parsons and Bondrup, 1996, Rytwinski et al., 2016). Southern Hairy-nosed Wombats may have responded to blood and bone or dingo odours with increased hiding or reduced ranging behaviour in a manner that was not evident from the camera data, or it could have been perceived as a low risk. The use of a greater volume and repeated or more widespread application of deterrents may elicit greater avoidance responses. The application of odours inside burrows or in open areas further from the safety of a burrow may heighten risk perceptions, resulting in greater avoidance responses (Atkinson et al., 1994).

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6.5.2 Visual deterrents

Anecdotal evidence suggested wombats are fearful of shiny objects and actively avoid them. Stationary CDs have been found to elicit avoidance responses in Southern Hairy-nosed Wombats, with a decrease in the number of visits to burrows following their application (O'Brien et al., 2021). Visual stimuli produced avoidance responses most likely due to an immediate fear response (neophobia) of an unknown object within their environment (Harris and Knowlton, 2001, Davidson-Nelson and Gehring, 2010, Bruggers et al., 1986). Wombats may respond more readily to visual cues as they are easily detected from further away than olfactory cues, which require closer investigation. Though these preliminary investigations are encouraging, habituation to visual stimuli is a major limiting factor to their long-term use, particularly when unaccompanied by negative reinforcement (Koehler AE, 1990, Gilsdorf et al., 2002). Habituation to CDs was not observed in Southern Hairy-nosed Wombats over the 5-night trial, however, it may occur over a longer time frame.

6.5.3 Virtual fencing

Virtual fencing is a term often used for placing deterrents along roadsides that are activated by approaching vehicle headlights. On activation the device emits a sound, flashing lights or both with the aim of scaring away any animals that may be adjacent to the roadside. Virtual fencing is not a physical barrier and allows animals to move through the landscape. Early trials in Tasmania reported a 50% reduction in roadkill over a three-years (Fox et al., 2018), but the trial had many design flaws and likely had little to no effect on possums, wallabies or wombats (Coulson and Bender, 2019). A study on the impacts of virtual fencing on wombats found a small reduction in the number of wombats killed after the virtual fence was installed (Stannard et al., 2021), however the study design was flawed and widely disputed (Coulson and Bender, 2022, Candy and Englefield). Similarly, other deterrent devices mounted to vehicles like the Shuroo have been found ineffective, as the noise the device makes cannot be heard over the vehicle noise from >50 m away (Bender and Coulson, 2022).

6.6 Translocation

Translocation is a widely used “non-lethal” human-wildlife conflict mitigation measure, but its effectiveness is disputed. The survival of translocated animals is often low, and the conflict may not be resolved or could be transferred to the release site (Bradley et al., 2005, Linnell et al., 1997). Translocation has been trialled on Southern Hairy-nosed Wombats to relieve conflicts with agriculturalists. Southern Hairy-nosed Wombats were translocated from areas of conflict to a property where species numbers were low and lots of inactive burrows were available to release them into. Animals were fitted with GPS and/or VHS collars to monitor their survival and behaviour in comparison to resident animals. Though translocated Southern Hairy-nosed Wombats had high survival rates and exhibited release site fidelity conflicts were not resolved. Neighbouring Southern Hairy-nosed Wombats moving into vacated burrows at the source site within a matter of weeks. Landholders using culling as a control measure to reduce conflicts with Southern Hairy-nosed Wombats have reported similar results, with neighbouring animals recolonising vacated warrens (St John and Saunders, 1989). Translocation of a larger number of animals may provide longer relief from conflict. However, Southern Hairy-nosed Wombats evaded traps by remaining underground or digging under fencing, resulting in a low trap rate of 5.95%. Similarly, the

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trapping success of Bare-nosed Wombats was 7.9% and Northern Hairy-nosed Wombats as low as 1-2%, all species avoid capture by remaining underground for extended periods of time (McIlroy, 1977a; Alan Horsup, pers. comm 2018). Thus, large scale translocation could be labour intensive and cost prohibitive. Furthermore, the ongoing translocation of large numbers of Southern Hairy-nosed Wombats would over time lead to shortages of suitable conflict free release sites with low numbers of conspecifics in the species natural range. Translocation could be used as a tool to repopulate areas where numbers are known to have declined, however, it may result in further deaths if the cause of the decline has not been addressed.

Similarly, the critically endangered Northern Hairy-nosed Wombat has been successfully re-introduced into areas they were extirpated from by releasing them into starter burrows (Horsup, 2004). A study on the survival of rescued and rehabilitated Bare-nosed Wombats reported high survival (94.5%) of animals released onto a private property within the first 42 days following release and 77% survival after eight years (Saran et al., 2011). Survival was not found to be related to age, sex, provision of supplemental food, season or time spent in rehabilitation.

Despite its limitations, translocation may prove useful for removing a small number of individuals from areas of conflict, where alternative measures fail or are unsuitable. **When used in combination with burrow collapsing or deterrent use it may yield more promising results in reducing conflict at the source site.** Prior to carrying out a translocation careful planning is needed. Translocation plans should adhere to the Conservator Guidelines for the Translocation of Native Flora and Fauna in the ACT. . Important biological and ecological factors need to be taken into consideration, such as capture stress, disease transmission, habitat suitability, and competition with conspecifics. The availability of burrows at the release site is a key consideration when it comes to translocating wombats, which would require up to date knowledge of wombat distribution and density. Follow up monitoring is imperative to ensure survival of translocated animals.

6.7 Culling

Historically, conflicts with wombats have been managed using lethal controls. In most states, there are provisions to cull wombats causing damage or threatening human safety under permit systems (see section 2.1). The lethal control of wombats has become a highly contentious and controversial issue in the last few decades, due to changing public attitudes towards its use and concerns about wombat conservation. Permits to destroy Bare-nosed Wombats have decreased greatly in Tasmania and other states where it is allowed in the last few years due to increasing public pressure. The impacts of culling on wombats populations are poorly understood (Tartowski and Stelmann, 1998, Taggart et al., 2008). If conducted at unsustainable levels it can result in range contractions and population isolation (Powell, 2006, Fuller et al., 1992, Woodroffe et al., 2005). In contrast, killing an insufficient number of animals can fail to reduce damage to an acceptable level (Hone, 2007). In some cases, the removal of animals from a population can encourage population growth and immigration, thereby increasing conflict (Treves et al., 2016). Culling can disrupt social structures that lead to fractured social groups and increases in conflicts (Wallach et al., 2009, Allen et al., 2015). Social instability can result in increased

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reproduction, as multiple subordinate females may breed (Glen et al. 2007). Despite the limitations of culling, there may always be some situations in which it is the best intervention method (Warburton and Norton, 2009).

There is one known study examining the effects of culling on Southern Hairy-nosed Wombats. Changes in the number of active burrows were monitored in an area where culling occurred and an adjacent control zone where no culling took place. Over the two-year term of the study an estimated 12% of the population was culled per year. Despite this there was an estimated 30-40% increase in the number of Southern Hairy-nosed Wombats in the culled area, while in the uncultured area there was an estimated 50-60% increase. The increase in Southern Hairy-nosed Wombat numbers over this time frame could have been a result of increased rainfall and recovery from the 1981-83 drought, the effects are unlikely to be the same on a stable or decreasing population (Tartowski and Stelmann, 1998).

Culling it is often preferred as a conflict reduction tool by landholders, as it is convenient, immediately shows results, satisfies their need for control, and is perceived as cost effective (Horton RR, 1997, Zinn et al., 1998, Treves and Naughton Treves, 2005). Landholders surveyed in South Australia most widely used culling to reduce conflicts with Southern Hairy-nosed Wombats in South Australia and those who were financially dependent on their property or had experienced damage were more likely to cull wombats (O'Brien, 2019). Despite the widespread use of culling, only half of the landholders using it perceived it to be effective. A lack of data on wombat numbers makes it difficult for state agencies to set balanced culling quotas often resulting in ineffective conflict resolution (Taggart et al., 2008). Many landholders feel they are rarely permitted to cull enough wombats to mitigate damage with recolonisation of burrows being an ongoing problem (Stott, 1998, Taggart et al., 2008, St John and Saunders, 1989). Official government registers are considered an underestimate of the true numbers of wombats culled, as some landholders resort to culling outside the permit system (St John and Saunders, 1989, Taggart et al., 2008). The use of lethal controls needs to be carefully evaluated and managed based on scientific evidence, to ensure conflict reduction without threatening species conservation.

6.8 Wombat monitoring and research

There are significant knowledge gaps in our understanding of Bare-nosed Wombat populations in the ACT. Addressing these gaps will require dedicated monitoring and survey effort to collect fit-for-purpose datasets. This section examines a variety of survey options, and their costs and benefits.

6.8.1 Quantify the frequency and occurrence of wombat damage

Perceptions and tolerance of damage caused by wildlife are often shaped by financial dependence on crops or livestock and previous experiences (Naughton-Treves L, 2005, Van Tassell et al., 2000). Perceived damage can sometimes be disproportionate to actual damages (Dickman, 2010, Knight, 2000, Madden, 2004, Wigley and Garner, 1986). Quantifying the frequency and cost of Bare-nosed Wombat-related damage is crucial to distinguish between real and perceived impacts. This data can help identify high-conflict areas and guide wildlife managers in developing targeted management actions. In regions where damage is minimal or misattributed,

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educating stakeholders can be crucial to mitigating conflict. Conversely, where significant damage occurs, targeted management interventions to reduce damages may be necessary to alleviate its effects.

Accurately reporting the prevalence and costs of wombat damage from landholders and other relevant stakeholders will require a consistent approach to data collection. This will require CED to develop a reporting tool for stakeholders to submit information such as: (1) the type of damage; (2) the location of the damage; (3) the financial costs associated with damage; and (4) negative safety outcomes associated with damage. Collecting a consistent set of data in each report will allow for comparison with wombat population data and other key population metrics. This tool will need to be managed by CED or another relevant team within the ACT Government.

6.8.2 Ecological surveys of wombats in the ACT

One of the critical aspects of species management is understanding population dynamics. Currently, Bare-nosed Wombat population monitoring in the ACT is limited, with few systematic surveys to track wombat numbers or distribution. Animal welfare and stakeholder concerns around the prevalence of mange also require systematic surveys that include areas with and without mange treatment applications. High-quality distribution and abundance data paired with standardised impact and mange assessments will provide land managers with the tools for effective management and conflict mitigation.

Current monitoring

CED has commenced a long-term monitoring program at eleven sites within the ACT. The purpose of these surveys is to detect changes in populations over time, and to collect data on mange prevalence and severity. Survey sites were selected based on known presence of Bare-nosed Wombats and ease of accessibility. Surveys are conducted twice annually in winter and consist of walking 1 km transects at a slow pace (45 mins), commencing 30 mins after sunset (Figure 6). Surveys are carried out in teams of at least two people for health and safety reasons. Surveyors use night vision binoculars to reduce disturbance of animals.

When a Bare-nosed Wombat is seen, the surveyor notes their location using a GPS, takes a compass bearing and estimates the distance to the animal. Wombats are given a body condition score (ranked 1-5, with 1 being poor and 5 being excellent) and a mange score using the categories described in Stannard et al. (2020). Observers also record a mange confidence score to reflect how confident the surveyor is in their assessment in the presence or absence of mange, noting that it can be difficult to assess from a distance. Weather variables including temperature, rainfall, wind speed, cloud cover and visibility of the moon are measured at the beginning of each transect. A further two sites in Namadgi National Park are surveyed annually using the same method as above, with the exception that surveys are undertaken from a vehicle.

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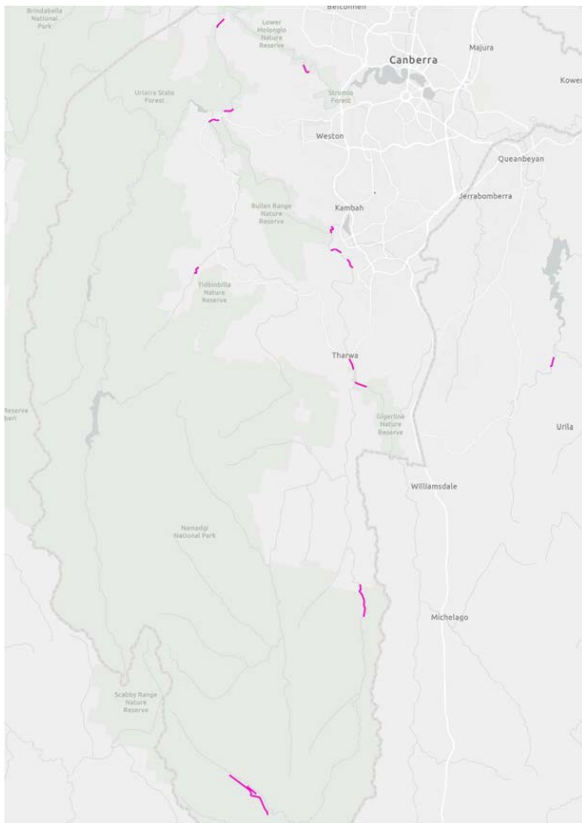


Figure 1: Locations (pink) of the line transect surveys conducted to detect changes in populations over time, and to collect data on mange prevalence and severity

Bare-nosed Wombat records are also collected using applications such as NatureMapr and the Atlas of Living Australia. These are useful tools that enable public reporting of wombat sightings over large areas that would otherwise be infeasible for ecologists to survey. These incidental sightings are typically biased towards areas of high human activity (i.e., roads or trails) and there are caveats around their value in understanding a species distribution or abundance. Without standardised survey effort, it is difficult to determine whether areas with a lower number of records represent a true absence or a low survey effort. Species and signs of their presence, such as faeces, tracks and burrows, can also be misidentified or difficult to detect. Burrows also present a challenging proxy for wombat occupancy as burrows may remain in an area after an individual has moved on (Tartowski and Stelmann, 1998).

Gaps in current methodology

A comprehensive survey program to inform wombat management in the ACT requires data on (1) wombat density or relative activity across areas of suitable habitat; (2) prevalence of mange across existing wombat

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populations; and (3) the effect of mange treatments on the prevalence of mange. The current monitoring program captures relative activity data within the conservation estate but is not representative of all Bare-nosed Wombat habitat in the ACT. A more representative selection of sites would require survey transects to be located across conservation estate, rural lands, and other stakeholder areas (i.e., Icon Water). This would require approval from stakeholders for ecologists to access their land for surveys.

The current site selection does not consider whether sites have been actively or historically treated for mange. This makes it difficult to determine whether the abundance or current health of the local population is affected by these treatments. In future, monitoring sites should be evenly stratified into two groups: treated and untreated. Once these sites are selected, treatment conditions should remain consistent throughout the study period.

The current survey methodology as described above is subject to imperfect detection of both mange prevalence and individual wombats. Vegetation and uneven topography can make it difficult to detect individuals and assess mange severity. For more information on alternative survey methodologies that may be more suitable, refer to the section below.

The current monitoring program is conducted across 26 survey nights annually, with two staff or volunteer members required to conduct each survey. In the past this work has been done by CED ecologists and volunteers from Wombat Rescue. Expanding the survey scope to include transects on rural land and other stakeholder properties would increase the survey time required. For consistency and impartiality, this should be done by trained ecologists and not members of any stakeholder group.

Alternative monitoring methods for consideration

Due to the nocturnal and burrowing nature of Bare-nosed Wombats they are difficult to survey. Direct counting using spotlight surveys are labour intensive and not practical over large areas. Spotlight counts are not representative of population numbers as wombats may remain in their burrows and avoid being counted (McIlroy, 1977b).

Mark recapture studies, requiring individuals to be captured on more than one occasion, are challenging as Bare-nosed Wombats are difficult to capture. They can remain underground for prolonged periods or dig around traps to avoid capture (McIlroy, 1977b, Skerratt et al., 2004). In these surveys, trapping only a portion of burrows can result in imprecise abundance estimates (Banks et al., 2003). Trapping every burrow across a large area is impractical due to the time and labour required.

The number of active burrows has successfully been linked to wombat abundances using mark-recapture methods (McIlroy, 1977a), burrow flap counters (Tiver, 1981) and remote cameras (Swinbourne et al., 2018). A combination of burrow activity levels and the number of active burrows is a relatively low-cost method and has been used to infer population abundances (St John and Saunders, 1989). Burrow activity can be estimated using

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burrow flap counters or remote cameras. Abundance estimates using these measures will allow land managers to track trends in population levels but will not provide an exact density.

Ground penetrating radar has been used successfully to map Southern Hairy-nosed Wombat burrows (Swinbourne* et al., 2015). It can be used to determine the length, depth and direction of wombat tunnels and help determine if a burrow is a main, secondary or starter burrow. There are various ground penetrating radar systems available, simple units can be hired for between \$200-400 a day and can penetrate up to 8 m depth.

Drones have successfully been used to map wombat burrow locations in New South Wales grasslands (Old et al, 2019). In their study, Old et al. (2019) detected a similar number of burrows using desktop analysis of drone imagery and ground-based surveys. In aerial surveys observer errors can result in inaccurate counts, but standardising the results using a transect with a known number of burrows can help develop a correction factor for the dataset (Tiver, 1981). Recording video footage during aerial surveys can also allow for more accurate and repeatable scores of wombat warrens (McGregor and Wells, 1998). Drone surveys can be affected by vegetation, with reduced efficacy in dense vegetation where burrow entries are obscured (Old et al 2019; Taggart et al, 2008). These aerial surveys provide an alternative to manual searching for burrows and can be used to quickly assess range expansion in local wombat populations. Detecting decreases in distribution based on burrow surveys is more difficult, as warrens remain visible long after they have been vacated.

Integrating drones with thermal sensors has been used effectively to directly survey a range of terrestrial and arboreal species (Beaver et al, 2020; Howell et al, 2021; Witt et al, 2020). These methods have not yet been tested on wombats, but they may provide a suitable alternative to ground-based surveys. While thermal drone surveys may reduce labour inputs and reduced detection abilities in dense vegetation, they are still subject to the pitfalls of direct count methodologies. Direct counting will still be subject to imperfect detection if individual wombats remain underground during the surveys.

6.8.3 Furthering research by partnering with scientists

There are lots of knowledge gaps that hinder the effective management of Bare-nosed Wombats in the ACT. While it is not necessarily the role of the ACT Government to conduct the research to fill these knowledge gaps, collaboration with scientists may help to overcome some of these knowledge gaps.

Collaboration between the ACT Government and researchers could help fill the knowledge gaps discussed above. Key research areas include developing a deeper understanding of complex stakeholder views and collecting more robust population-level data for wombats in the ACT. Additional topics could include further research into mange treatment and collaborating with landholders to develop effective damage mitigation strategies. Landholders currently lack reliable options for mitigating conflict with wombats. These options need to be well-tested, and the limitations and benefits of each need to be clearly understood.

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7 Recommendations

Effective wombat management in the ACT requires a pragmatic, balanced approach that recognises both ecological responsibilities and the practical constraints of limited resources. Although Bare-nosed Wombats are not a threatened species, their increasing impact on infrastructure, agriculture, and animal welfare necessitates a coordinated response.

The following recommendations propose practical, evidence-based solutions informed by successful approaches in other jurisdictions. These aim to reduce conflict, improve welfare outcomes, and guide policy development. By strategically adopting proven methods, the ACT can strengthen its policy framework and foster coexistence between wombats and human communities.

Recommendation 1: Policy reform

Assess the suitability of policy that establishes mechanisms for wombat management.

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- Establish a policy position for wombat management in the ACT
 - Assess the suitability of a controlled native species management plan for wombats in the ACT
 - Incorporate guidelines and agreed licensing mechanisms for burrow management, fencing, and deterrents.
 - Explore the option of a pilot permit or licencing system for wombat damage mitigation, limited to high-conflict zones and critical infrastructure (e.g. dams, roads, buildings).
 - Leverage existing licensing infrastructure to minimise administrative burden.
 - Prioritise non-lethal methods of damage mitigation
- Define clear protocols and licensing pathways for mange treatment, including:
 - Restrictions near sensitive environments such as waterways
 - Training requirements for volunteers and wildlife carers implementing mange treatments
- Develop wildlife release guidelines for rehabilitated animals that include:
 - Best practices for the release of rehabilitated wombats.
 - Designated release zones that prioritise ecological compatibility and long-term welfare for rehabilitated wombats.
- Continue implementation of the Conservator Guidelines for the Management of Burrowing Animals During Development (2025) to support management of wombats during construction and development activities.
- Broader community consultation should be undertaken as part of policy development.

Recommendation 2: Stakeholder engagement

Establish a consultative committee to inform wombat policy development and ensure inclusive stakeholder representation.

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- Include leaseholders, Ngannawal representatives, wildlife carers, ecologists, government, industry and other relevant stakeholders.
- Maintain support for a Wombat Mange and Monitoring Group, and encourage broader participation.

Recommendation 3: Public education

Enhance public awareness and transparency around wombat management.

- Increase public awareness of potential human-wildlife conflict where wombats occur in urban and peri-urban areas
- Increase public awareness of wombat impact mitigation strategies
- Maintain public access to the [ACT Wombat Sightings Portal](#) for reporting sightings.
- Deliver targeted media and communications to enable transparency of government strategies and collaborative actions.

Recommendation 4: Provide a framework for volunteer-led mange treatment programs

- Acknowledge community concerns and volunteer efforts to enhance animal welfare for wombats in the ACT. Where appropriate, provide licenses, reserve access, and data tools to enable effective mange treatment.

Recommendation 5: Partner with universities and citizen scientists for research and monitoring

Collaborate with universities and citizen scientists to improve data collection and inform management decisions.

- Ensure leaseholders have access to tools for recording wombat impacts, implementing mitigation strategies and monitoring outcomes.
- Trial drone-based burrow mapping and/or population counts in hotspot areas to support quantitative evaluation of mange treatment programs and monitor population trends.
- Continue support for citizen science platforms such as the ACT Wombat Portal, NatureMapr, and WomSAT for public reporting.

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Managing wombats

A review of current practice, issues and
challenges to inform wombat management
in the ACT

Acknowledgement of Country

The City and Environment Directorate acknowledges the Ngunnawal people as traditional custodians of the ACT and recognise any other people or families with connection to the lands of the ACT and region.

We respect the Aboriginal and Torres Strait Islander people, particularly our Aboriginal and Torres Strait Islander staff, and their continuing culture and contribution they make to the Canberra region and the life of our city.

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Glossary

- **City and Environment Directorate (CED)** – ACT government department responsible for managing conservation estate and public land
- **Closed season** – A defined period during which hunting or capturing was prohibited for listed species.
- **Deterrent** – Something that discourages or prevents someone from taking an action due to the perception of negative consequences.
- **Dry sheep equivalent (DSE)** – A unit of measure used to assess the nutritional needs of livestock and the carrying capacity of a farm. It equates to the amount of feed required daily by a two-year-old, 50 kg Merino wether.
- **Leaseholder** – A person or entity granted a Crown lease by the Territory, giving them the right to occupy and use land according to the terms and conditions of the lease.
- **Noxious pest/pest** – An animal, insect, or plant considered harmful to agriculture, the environment, or human health, and officially declared or classified as such under relevant legislation or regulations.
- **Olfaction** – The sense of smell.
- **Open season** – A specific period during which it is legally permissible to hunt, take, or possess certain wildlife species that are otherwise protected. An open season is officially declared by the relevant authority (e.g., the Minister responsible for wildlife or a delegated agency) and specifies:
 - The dates during which hunting or taking of wildlife is allowed.
 - The species to which it applies.
 - Any conditions or restrictions, such as location, bag limits, or methods of hunting.
- **Pasture Protection Board** – Local government bodies established under the *Pastures Protection Act 1934*. The 59 boards in NSW were responsible for managing grazing, controlling pests like rabbits and feral animals, and promoting sustainable land management.
- **Protected species** – Species protected by law that cannot be taken, harmed, or interfered with without appropriate authorisation.
- **Reintroduction** – The movement of wild animals into part of their former range from which they have been extirpated.

- **Translocation** – The deliberate movement of wild animals from one part of their range to another.
- **Vermin** – Species of animals not protected by law and often considered pests due to their negative impacts on agriculture, native species, or the environment.
 - Declared vermin can usually be destroyed or managed at any time, including outside of open seasons, unless other laws (such as firearms laws) apply.
 - The list of vermin is not fixed and can be updated by regulation or proclamation.

Executive summary

The ACT seeks to adopt a holistic and informed approach to wombat management, balancing species conservation with protection of landholder and industry assets. This document reviews relevant information to inform best-practice wombat management and to ensure populations persist in the ACT.

The scope encompasses cross-jurisdictional legislation, stakeholder views, management methods and monitoring approaches. The document also highlights current challenges within the ACT, including the complexities involved in balancing conservation with stakeholder needs.

As native marsupials wombats are integral to the region's ecosystem but present several management issues. These include wildlife-vehicle collisions and conflict with agricultural activities. Wombats may face challenges including urban expansion, habitat loss and the prevalence of sarcoptic mange.

Key findings from the review include:

- **Legislation and Policy:** Unlike other Australian jurisdictions, the ACT does not allow specific provisions for the control of wombats nor provide guidance on non-lethal conflict mitigation. This has led to frustration among leaseholders managing wombat-related damages.
- **Threats to Wombats:** Habitat loss and sarcoptic mange remain the primary threats. Management of sarcoptic mange is complex and is currently conducted by wildlife carers. There is no clear mechanism for the government to limit the application of mange treatments in areas where chemicals may have negative ecological consequences. There are currently no guidelines around the release of rehabilitated wombats, including identified release zones that are ecologically suitable.
- **Stakeholder Conflicts:** The ACT has diverse stakeholders who hold conflicting views on how wombats should be managed. Consultation with stakeholder groups on policy changes is a possible method for reducing tension and increasing stakeholder support. Working groups, such as the Wombat Mange and Monitoring Group, also provide forums for stakeholders to engage on topics relevant to their concerns and interests.
- **Public education:** Development of housing near areas of wombat activity can increase incidences of human-wildlife conflict. Providing informative material and engaging in public communication are strategies to increase awareness in the community.
- **Management Tools:** Fencing, burrow modifications, and deterrents are available to manage wombat damage, but are often resource-intensive and may yield inconsistent

results. Many have not been trialled in the ACT and stakeholders may not be aware of the available options. Burrow modification interventions would require additional approvals, and there is currently no streamlined application process to make this available to landholders.

- **Research and collaboration:** The ACT partners with citizen scientists to collect data on wombats through the ACT Wombat Portal, NatureMapr, and WomSAT. These data can inform management decisions but should be paired with systematic surveys to reduce inherent biases in the data. Leaseholders currently do not have a method of reporting wombat impacts on their property.

1. Introduction

Wombats are iconic Australian marsupials, deeply embedded in the cultural heritage of First Nations Peoples and the national identity (Garvey et al., 2016). There are three extant species: the Bare-nosed Wombat (*Vombatus ursinus*), the Southern Hairy-nosed Wombat (*Lasiorhinus latifrons*), and the Northern Hairy-nosed Wombat (*Lasiorhinus krefftii*). Although once likely widespread, all three species have experienced significant declines and range contractions since European settlement (Aitken, 1971, Gordon et al., 1985, Buchan A and DC, 1998, Cooke, 1998, McIlroy, 2008). The clearing of land for agriculture and urban development, coupled with the introduction of European rabbits (*Oryctolagus cuniculus*), has had a profound impact on wombat populations (Aitken, 1971, Cooke, 1998). Rabbits provided competition for food and shelter (Cooke, 1998), and wombat warrens were often destroyed during rabbit control efforts (Triggs, 2009). Increasing conflict with livestock (Crossman et al., 1994) also contributed to population pressures. The Northern Hairy-nosed Wombat suffered the greatest decline, reduced to a single known population of approximately 30 individuals by 1982 (Gordon et al., 1985). It is now listed as endangered under the *Nature Conservation Act 1992*. In contrast, the Bare-nosed Wombat was declared vermin as early as 1906 in Victoria, and considered a pest in other states (Temby, 1998).

Historically wombats were widely regarded as pests, particularly because their burrowing behaviour damaged rabbit exclusion fencing (Aitken, 1971, Temby, 1998). This view contributed to sustained population control efforts and legislative measures in all jurisdictions to reduce their impact. The Australian Capital Territory (ACT) awarded early protection to Bare-nosed Wombats under the *Animals & Birds Protection Ordinance 1918*. Growing public concern over animal welfare, conservation, and sarcoptic mange has pressured other state governments to adopt more protective policies. Though wombats are now protected species in most states, they can be controlled under permit systems where they cause damage.

The management of wombats has become a highly contentious issue due to the complexities of trying to balance competing interests of stakeholder groups, including but not limited to local government, rural leaseholders, First Peoples and wildlife care groups. Conservation and wildlife care groups are concerned for the welfare of Bare-nosed Wombats and advocate for better protections. Agriculturalists want to manage the species to minimise the damage it can cause to infrastructure, stock and farm personnel. Given the diversity of stakeholder interests, reaching agreement on the best approach to wombat management is a persistent challenge.

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This review highlights the legislative, ecological, and stakeholder challenges involved in balancing species conservation with human land use and infrastructure needs. It reviews past and current legislation across the Australian states and territories to inform the conservation and management of wombats in the ACT.

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2. Legislation, policy and regulation

2.1 Policy and legislation

Following European settlement and the expansion of agriculture in Australia, all three wombat species have experienced conflicts with humans. Initially, conflicts arose because wombats caused damage to rabbit exclusion fencing and wombat burrows provided refuge for rabbits. As a result, wombats were commonly viewed as pests and were able to be lethally controlled under legislation in most states.

The range of all three species of wombat contracted significantly as a result of large-scale land clearance for agricultural and urban development, and the introduction of European rabbits (*Oryctolagus cuniculus*) (Aitken, 1971, Temby, 1998, Gordon et al., 1985, Buchan and Goldney, 1998, McIlroy, 2008, Cooke, 1998). Over time attitudes towards wombats and concern for their conservation increased and legislation changed to reflect this.

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This section provides an overview of the legislative frameworks and policies related to wombat management across various Australian states and territories. These frameworks serve to inform the management approaches in the Australian Capital Territory (ACT) and offer potential insights into improving wombat conservation and management strategies.

2.1.1 Victoria

Legislative history

The Bare-nosed Wombat was declared vermin throughout the state of Victoria in 1906, under provisions of the *Vermin Destruction Act 1890* (Seebeck 1988). In 1925, a bounty was placed on Bare-nosed Wombats under the *Vermin and Noxious Weed Act 1922*, with more than 60,000 bounties paid up until 1955. The bounty was subsequently suspended in 1966 and officially abolished in 1971. Bare-nosed Wombats remained a pest to many and from 1971 to 1986 government officials fumigated their burrows on Crown land.

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In 1977, Bare-nosed Wombats were declared protected under the *Wildlife Act 1975* in the region west of the Melbourne to Sydney railway line, where they occurred in low numbers. The vermin status of the species was maintained in eastern Victoria until 1984, when Bare-nosed Wombats were protected under the *Wildlife Act 1975* across all Victoria. Lobbying by farmers led the species to be declared 'unprotected wildlife' in 193 parishes in eastern Victoria under the *Wildlife Act 1975*. The declaration of the species as 'unprotected wildlife' enabled the destruction of Bare-nosed Wombats by landholders, their families, and employees by means of fumigation, trapping or shooting on freehold or leasehold land, and within 1 km of such land on adjoining Crown land. In June 1997, the *Wildlife Act 1975* was modified to enable destruction only on the occupier's property with a high-powered, centre-fire rifle of .222 calibre or larger.

Current ~~legislation~~ and process

In February 2020, an amendment to the *Wildlife Act 1975* revoked the unregulated control of Bare-nosed Wombats across 193 parishes in eastern Victoria. It is now an offence to kill, take, control or harm Bare-nosed Wombats across the entire state of Victoria without authorisation. This includes activities such as destroying or disturbing their burrows. ~~To destroy a wombat without a permit carries a penalty ranging from \$8,261 to \$39,652 and/or six to twelve months in jail.~~ On March 19, 2025 the Victorian Legislative Council voted to review the state's lethal control program for wombats and explore alternative control measures. The review was still underway at the time of writing and no formal legislative changes had been announced.

~~To destroy a wombat or their burrows~~ landowners need to apply for an authority to control wildlife permit (ATCW) from the Department of Energy, Environment and Climate Action which can be done online, by post or email (Table 1). Applicants are required to demonstrate damage to their property, crops or pasture, impacts on biodiversity values, or risks to human health or safety. Applicants must also demonstrate that all other reasonable options have been considered. A wombat management methods factsheet outlines "non-lethal" management options for landholders. Forest and Wildlife Officers review applications and may require a property inspection. This process can take up to six weeks to complete.

Each ATCW specifies the species of wildlife that can be controlled and the method of control. Anyone shooting wildlife under the *Wildlife Act 1975* must also comply with the Firearms Act 1996.

Commented [REDACTED]: This goes well beyond legislation to process - suggest heading is "Current legislation and process"

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Table 1. The number of permits issued to control Bare-nosed Wombats and the number of animals to be harmed in Victoria over the last seven years

Year	Number of permits	Animals authorised to be culled
2023	222	1902
2022	226	1862
2021	207	1675
2020	273	1478
2019	268	3655
2018	252	3830
2017	270	3374

2.1.2 New South Wales

Legislative history

New South Wales was home to all three species of wombat until the last claimed sighting of Northern Hairy-nosed Wombats in 1909. Bare-nosed and Northern Hairy-nosed Wombats had partial protection under the *Native Animals Protection Act 1903*. Under this act both species were protected from destruction during the declared closed season from August to January each year. Bare-nosed Wombats lost these protections when they were not included on the list of protected species under the *Animals and Birds Protection Act 1918*. Bare-nosed Wombats regained legal protection under the subsequent *Fauna Protection Act 1948*. Landholders were required to obtain permits for wombat destruction, except in areas governed by Pasture Protection Boards. At this time, wombats were also regarded as a noxious pest by the Department of Agriculture under the *Pastures Protection Act 1934*. This created a conflict in areas where landholders were required to destroy wombats under the *Pastures Protection Act 1934*, but could be prosecuted for doing so under the *Fauna Protection Act 1948*.

In 1959 the National Parks and Wildlife Service and the Department of Agriculture reached a compromise, leaving Bare-nosed Wombats unprotected but no longer declared noxious. As a result, both species of wombat became fair game for sports shooters and landholders. In March 1973, Bare-nosed Wombats were awarded full protection with provision for destruction for damage control purposes by being removed from the First Schedule (list of unprotected animals) of the *Fauna Protection Act 1948-67*. The following *National Parks and Wildlife Act 1974* provided full protection to Northern Hairy-nosed Wombats, which were classed as endangered. Bare-nosed Wombats were also given protection with a provision for damage control under a permit system.

Current legislation

Wombats are protected under the *NSW Biodiversity Conservation Act 2016*. It is an offence to harm a wombat unless a licence is obtained from the Department of Climate Change, Energy, the Environment and Water.

To obtain a licence landholders must demonstrate animals are a threat to human safety, damaging property and/or causing economic hardship. Where possible, the department seeks to resolve negative interactions using non-destructive methods and recommends non-lethal methods [on their website](#). However, a licence to harm individual animals may be required to mitigate problems. To apply for a licence, landholders must contact their local National Parks and Wildlife Service (NPWS) office to discuss the nature and severity of the issue and any non-lethal measures that may resolve the problem. They can then [download and fill in an application form](#) and lodge it with their local NPWS. The National Parks and Wildlife Service may grant a licence to the owner or occupier of a property to cull wombats. Records of the number of animals harmed need to be kept on a record sheet provided and lodged with the NPWS office within 7 days of the licence expiry. All people operating under the licence must comply with the *Firearms Act 1996* and the Code of Practice for the Humane Destruction of Wombats by Shooting in NSW. Harming wildlife without a permit may receive a maximum fine of \$330,000 with an additional \$33,000 for each animal harmed or two years in jail.

Within the last seven years a small number of permits have been issued (Table 2). The maximum number of Bare-nosed Wombats to be harmed on any one permit was 50 animals. More commonly permits range from 1 – 20 animals for issues including damage to crops, competition with stock, hazard for vehicles, damage to fencing, and causing erosion and disease.

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Table 2. The number of permits issued to control Bare-nosed Wombats and the number of animals to be harmed in New South Wales over the last seven years.

Year	Permits issued	Number of wombats to be harmed
2023	34	187
2022	38	219
2021	26	138
2020	42	221
2019	76	501
2018	103	752
2017	40	193

2.1.3 Queensland

Legislative history

The Northern Hairy-nosed Wombat and Bare-nosed Wombat were protected in Queensland under the *Native Animals Protection Act 1906*. However, this and subsequent Acts provided provisions for damage control. By 1982, the Northern Hairy-nosed Wombat was restricted to a single population of approximately 30 animals (Gordon et al., 1985). The *Fauna Conservation Act 1974-1989* provided permanent protection for the Northern Hairy-nosed Wombat with no provision for damage control. Northern Hairy-nosed Wombats were declared endangered under the *Nature Conservation Act 1992*. Bare-nosed Wombats remained protected with provision for damage control under a permit system.

Current legislation

Northern hairy-nosed and Bare-nosed Wombats are protected under the *Nature Conservation Act 1992*, though there are provisions to control Bare-nosed Wombats for damage mitigation purposes. A damage mitigation permit is required to take wildlife to minimise damage or loss of property (e.g. crops) or to protect human health and wellbeing. Damage mitigation permits may cover the removal and translocation of problem animals or lethal control.

To obtain a three-year permit to remove and relocate wildlife applicants must demonstrate the following:

- Certificate of completion of a training course concerning the keep, relocation, and safe handling of relevant wildlife.
- A current first aid certificate issued by an approved first aid provider.
- Referee reports from two suitably skilled and qualified persons.
- Statements outlining the ability to handle wildlife, including safety procedures to be applied when handling or moving wildlife and access to appropriate equipment.
- Statements outlining wildlife identification skills.
- A resume including details of qualifications provided with the application.

If an applicant does not have any experience, they are recommended to contact a local damage mitigation permit holder for guidance and possible endorsement under this permit type.

To obtain a permit to lethally control wildlife, applicants must demonstrate damages caused and the economic losses incurred, or any threats to human health (e.g. disease or injury risks). Two non-lethal damage mitigation measures to prevent or minimise damage need to have been attempted prior to application for lethal control. There are no specifications about suitable non-lethal methods to be used or the duration of use. A statement outlining the applicant's relevant knowledge and experience in correctly identifying the relevant species is required. Permits are issued for one-year unless the landholder has an approved property management plan, in which case permits can be issued for three years. The Department of Environment Science and Innovation offers a service to guide applicants through the assessment process. The service includes meeting with a departmental project manager to discuss the information needed for the application. Applicants can email a [downloadable form](#) to the permits and licensing department and may take up to 40 business days to process. Once a permit has been granted, permit holders are required to lodge a return of operations form every three months and within 10 days of the permit expiry detailing how many animals were taken under the permit. The maximum penalty for *controlling protected wildlife without a permit* is \$15,480 (100 penalty units).

2.1.4 Tasmania

Legislative history

Bare-nosed Wombats were not protected in Tasmania until the passing of the *National Parks and Wildlife Act 1970*, which provided partial protection allowing for the declaration of an

open season. The Minister by order, could declare the dates and places on which the taking of any partially protected wildlife may start, stop, be prohibited or permitted and impose any conditions on the order. No open seasons were declared, and destruction for damage control purposes was undertaken by permit.

Current legislation

Bare-nosed Wombats are protected under the *Nature Conservation Act 2002* with provision for damage control.

The Department of Natural Resources and Environment encourages people to use non-lethal management options for mitigating wombat damage and several factsheets can be found on their website for [Living with Wombats](#). A [property protection permit](#) is needed to control protected wildlife, including Bare-nosed Wombats (Table 3). Permits can be applied for by landholders, managers or lessees of land to prevent the destruction of, or injury to any stock, crops and equipment or infrastructure used in crop and/or stock production. Applications must identify the damage caused, the method of control to be used and the number of animals they want to take. The Department of Natural Resources and Environment must be satisfied a financial loss is likely to occur if the crop, stock, equipment or infrastructure is not protected. Applications are assessed on a case-by-case basis, which may include a visit to the applicant's property. The local abundance of Bare-nosed Wombats, the impacts they may have on the property, and whether non-lethal measures will be effective at the site are considered when issuing permits.

The Department of Natural Resources and Environment Tasmania assesses population trends using annual spotlight monitoring of 190 10-km transects across the state. Issued permits specify the number of Bare-nosed Wombats that may be taken and a timeframe of up to 12 months Permit holders are required to maintain accurate records of animals destroyed and report them within 28 days of the permit expiry. Persons controlling wildlife without a permit or who do not comply with the terms of their permit can receive a penalty of up to \$19,500 (100 penalty units).

Table 3. The number of permits issued to control Bare-nosed Wombats and the number of animals to be harmed in Tasmania from 2016 to 2022. Blank cells indicate a lack of data.

Year	Permits issued	Total quota issued	Wombats culled
2022	9	165	29

Commented [REDACTED]: For other states can we say whether they do monitoring or not?

2021	6		17
2020	5	51	20
2019	4		107
2018	6	110	
2017	22	160	
2016	52	2171	

2.1.5 Western Australia

Legislative history

Southern Hairy-nosed Wombats were not provided protection under early game acts in Western Australia. The *Game Act 1912* provided protection to all “non harmful” native fauna, but it is unclear whether this extended to Southern Hairy-nosed Wombats. The *Fauna Protection Act 1950* was the first to provide blanket protection to all native fauna in the state, including Southern Hairy-nosed Wombats. In 1975 it was re-named the *Wildlife Conservation Act 1950* and included new provisions for damage control permits.

To prevent Southern Hairy-nosed Wombats from becoming an agricultural threat across the state, the Agricultural Protection Board declared them as vermin in areas of WA outside their known range. In 1973, the declaration was amended to include Southern Hairy-nosed Wombats as a pest species under the *Vermin Control Act 1918-1970*. When the *Vermin Control Act* was replaced by the *Agriculture and Related Resources Protection Act 1976*, the Southern Hairy-nosed Wombat was included as a category seven declared animal. As a category seven species, the Minister had the authority to recommend and approve a species management plan that included management by lethal control.

Current legislation

In 2019 the *Wildlife Conservation Act 1950* was replaced by the *Biodiversity and Conservation Act 2016* and the *Biodiversity Conservation Regulations 2018*. Under the *Biodiversity Conservation Regulations 2018*, there are provisions for controlling fauna that have been listed as managed species. Fauna may be listed as a managed species if they are determined to be impacting public safety or biosecurity or causing economic or ecological damage. The Southern

Hairy-nosed Wombat is not currently listed as a managed species. There are no records of licence applications or grants for Southern Hairy-nosed Wombat control in Western Australia.

When fauna cause damage to agriculture, native animals may be declared pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Under the BAM Act, every organism except a human being has a legal status assigned through a declaration made by the Minister. If the Minister has not made a declaration, the status automatically remains unlisted. BAM status determines whether a permit is required to import the organism into Western Australia. The Southern Hairy-nosed Wombat is listed as a Permitted species S11 (exempt) on the Western Australian organism [list](#) under the BAM Act. This means they are not a declared pest and can be imported into the state without a permit provided they satisfy import permits and can be kept without a permit.

2.1.6 South Australia

Legislative history

Wombats gained their first legal recognition under the *Animals Protection Act 1912* on the schedule of unprotected animals. Partial protection was achieved under the provision of *Animals and Birds Protection Act 1919* with the declaration of a closed season on wombats from July to December. During the closed season landholders were only permitted to cull wombats for damage control purposes. The Fauna Conservation Act 1964 provided full protection with a provision for controlling wombats for damage mitigation. Under the *National Parks & Wildlife Act 1972*, the Bare-nosed Wombat was listed as 'Vulnerable' with full protection. The Southern Hairy-nosed Wombat was permitted to be controlled for damage mitigation purposes.

Current legislation

The Bare-nosed Wombat and Southern Hairy-nosed Wombat are protected under the National Parks and Wildlife Act 1972 (NPW Act). It is an offence to catch, interfere with, harass, or kill both species without a permit. The Department for Environment and Water recommends using non-lethal means for managing wombats prior to resorting to culling and has a "Living with Wombats" [factsheet](#). The Department of Environment Water can issue destruction permits in circumstances where wombats cause damage or threaten human safety (*section 53.1c of the SA National Parks and Wildlife Act 1972*). Permit application forms are available [online](#) and can be emailed, posted or dropped off at the nearest regional office. Applications are considered by National Parks and Wildlife rangers on an individual basis. Consideration is

given to whether non-lethal means may resolve the problem, the extent of the damage and threats to safety. There is a [code of practice for the humane destruction of wombats](#) which permit holders must abide by. The penalty for killing a wombat without a permit is a \$2,500 fine or six months in prison.

An amendment was made to the National Parks and Wildlife Act in 2023 prohibiting the destruction, damage or disturbance of wombat burrows without a permit, with a maximum penalty of \$5 000 or imprisonment for 12 months. Permits are not required if:

- you are the owner of the land where the burrow is located,
- you are authorised to destroy, damage or disturb the burrow by the owner of the land where the burrow is located; and
 - the burrow is located outside of a Wombat Burrow Protection Zone; and
 - the burrow is causing, or is likely to cause, damage to crops, stock, machinery or infrastructure (including tracks and built structures) or may constitute a safety risk or hazard to people.

If a burrow is located within a declared Wombat Burrow Protection Zone a person must not, without a permit, destroy, damage or disturb the burrow. No Wombat Burrow Protection Zones currently exist so a permit is not presently needed to destroy a wombat burrow. There is a protection for wombat burrows [factsheet outlining the new changes](#).

2.1.7 Australian Capital Territory

Legislative history

The Bare-nosed Wombat was protected early in the Australian Capital Territory (ACT) in comparison with most other states. There has been full protection without provision for destruction in the ACT since the *Animals & Birds Protection Ordinance* 1918. Successive Commonwealth ordinances and the *Nature Conservation Act* 1980 kept full protection in place, making no provisions for destruction permits to be issued for damage control purposes.

Current legislation

Under the *Nature Conservation Act 2014*, Bare-nosed Wombats remain protected without specific provisions or policy that enables destruction for damage control. To kill a protected animal will result in a maximum penalty of \$16,000 (100 penalty units) and/or imprisonment of up to 1 year. Under part 6.1 of the Act, it is an offence to conduct any activity that interferes with a nest (or burrow), endangers progeny or breeding, kills, injures, or endangers a native

Commented [REDACTED]: This section has been sent to [REDACTED] for fact checking

Commented [REDACTED]: Is this really true? Licences/permits to harm wildlife can be issued by the Conservator under Chapter 11, and I can't see anything that would prevent him issuing one to control wombats. This is what used to happen for control of kangaroos, for example, before CNSMPs.

Commented [REDACTED]: As above. My interpretation would be that no one has asked and no one has offered licences for this. But should check with [REDACTED] or Legal.

animal. However, some activities, such as nest destruction, may be carried out under a licence issued by the Conservator of Flora and Fauna. The maximum penalty for a damage land offence is \$2,025,000 for a corporation or 7 years imprisonment and/or \$400,000 for an individual. It is the responsibility of the applicant to apply for a licence for any proposed activity that may otherwise be an offence under the Act. The Parks and Conservation Service administers the Act and conservation officers are responsible for conducting compliance activities. These include public education, inspections, audits, and investigations to promote and support compliance.

Commented []: Right - and the scope of this isn't very limited in the legislation as far as I can see - certain things need to be considered, but it leaves it very open.

Commented []: I don't think this is correct. It assists the Conservator in exercise of their functions and is the land custodian

In 2025, the ACT Government strengthened its regulatory framework for wildlife protection during development by introducing the Nature Conservation (Protection of Burrowing Animals During Development) Conservator Guidelines. These guidelines, issued by the ACT Conservator of Flora and Fauna, are a notifiable instrument under the *Nature Conservation Act 2014*, giving them legal force and requiring compliance from developers operating in areas with suitable habitat. The guidelines aim to minimise harm to native burrowing animals, such as Bare-nosed Wombats, by requiring site assessments, avoidance of active burrows, and consultation with the Conservator where disturbance is unavoidable.

2.1.8 Differences between the ACT and other jurisdictions on wombat control

Apart from the ACT, all jurisdictions currently have a specific provision under legislation to enable wombat control for the purpose of damage mitigation. Victoria is currently conducting a review of their lethal control policies for wombats, but this review is still in progress and there have been no legislative changes. Control is regulated by a permit system, and landholders are required to pursue alternative management methods in almost all states before seeking a culling permit.

Commented []: Can we be 100% sure please that all other jurisdictions have an actual provision for wombats (e.g. a list of spp that can be controlled that wombats are on, or some other mechanism), in contrast to the ACT?

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Tasmania is the only state which considers trends in wombat populations when setting permit allocations. Understanding baseline population data is critical to assessing a program's efficacy and impacts. Controlling too few individuals can be ineffective at reducing damages, while removing too many can have negative conservation outcomes (Taggart et al. 2008).

Commented []: This assessment of Tassie's approach to monitoring seems out of place here, in a section on legislative diffs between ACT and other jurisdictions. And actually reading on this section does not really seem it has the right heading. What is the best summary of the overall intent of this section?

Most states have an online permit application system or provide a form that can be submitted to the relevant department. Applications typically take 4-6 weeks to process, and landholders may be frustrated by these timeframes (Sparrow, 2011, Stott, 1998, Bunn, 2019). When landholders are faced with wombats burrowing under dams and other infrastructure, they feel

prompt action is required to prevent further damage. Most states require the applicant to have tried 'non-lethal' damage mitigation strategies before applying for a permit, but guidance on 'non-lethal interventions' may not be provided. Further research into the efficacy and animal welfare considerations of common 'non-lethal interventions' is also required.

There has been a substantial reduction in the number of permits and the number of wombats permitted to be culled within the last decade across all states. This is in response to mounting public pressure on government agencies from conservationists and animal welfare advocates. As a result, landholders feel they are unable to reduce the damage caused by wombats on their property. For many farmers, the lengthy application process is not worth the time it takes to apply for a permit if they are only permitted to cull 10-25 wombats. As such some landholders act outside of permit systems and official government registers are considered an underestimate of the true numbers of wombats culled (St John and Saunders, 1989, Taggart et al., 2008).

3. Wombats in the ACT

3.1 Distribution and abundance

Prior to European settlement Bare-nosed Wombats were thought to have a continuous distribution across much of their range including the ACT. Following European settlement, the establishment of farming along with the introduction of rabbits is thought to have had a significant reduction on the distribution and abundance of all three species of wombats (Buchan A and DC, 1998, Cooke, 1998). Dingoes (*Canis familiaris dingo*) have been known to predate on wombats where the two species co-occur, but their effects on overall population numbers is unclear (Thorley and Old, 2020). Current occurrence records from the ACT Wildlife Atlas show Bare-nosed Wombats are widespread across the ACT, particularly along the Murrumbidgee and Molonglo River (Figure 1). Wombats are also known to occur across Namadgi National Park (CED survey data).

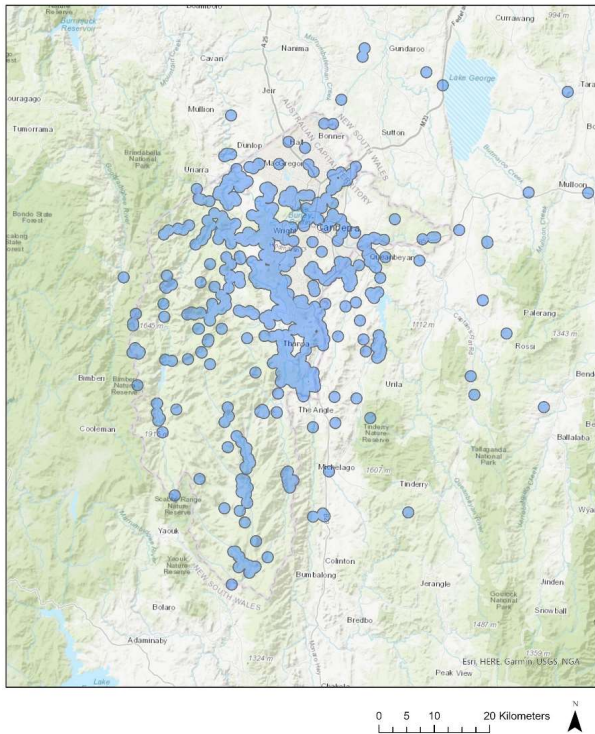


Figure 1. The known distribution of Bare-nosed Wombats (blue) in the Australian Capital Territory, taken from ACT Wildlife Atlas records, CED survey data and the ACT Wombat Manage Portal Map. This data collection system is designed to capture data within the ACT and is likely an underrepresentation of wombat distributions in NSW.

Commented [REDACTED]: This shows NSW too, but records are sparse - I'm assuming that these come mainly from ACT observers recording things when they're outside the ACT. But the reader might assume though that effort is constant across this whole area, and therefore that the ACT is a wombat hotspot. So suggest cropping the records to ACT only.

Abundance is likely to vary locally and regionally, depending on a range of factors, such as habitat type, soil type and climatic conditions. Competition from rabbits and kangaroos for food resources also limits Bare-nosed Wombat numbers in many areas (Tamura et al., 2021, Bird et al., 2012, Cooke, 1998).

There are currently no reliable estimates of abundance for Bare-nosed Wombats in the ACT. After an initial likely decline from habitat loss, following the expansion of agriculture and urbanisation, anecdotal reports from leaseholders suggest the distribution and abundance of Bare-nosed Wombats have increased over the last 10-20 years. Anecdotal evidence from park rangers also support an increase in distribution. Reports dating back to 1975 indicate Bare-nosed Wombats were not present on the Canberra plains or in Canberra Nature Park at the time, though they were present in Tidbinbilla and Namadgi National Park. Rabbit control

officers were known to target Bare-nosed Wombats because of the holes they made in rabbit proof fencing (Don Fletcher, pers. comm.; Higgins, 1991).

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3.2 ACT Government stakeholder engagement

The Office of Nature Conservation (in CED) initiated a Wombat Working Group in 2021 to bring together stakeholders with interests in Bare-nosed Wombat management in the ACT to share knowledge and discuss management issues. The group consisted of wildlife carers, ACT Government, agriculturalists and researchers. The group met several times virtually, but lack of attendance meant that it was disbanded. A Wombat Mange Management Sub-group also commenced in 2021. The subgroup met quarterly until it was scaled back and eventually paused in 2024. For more information on relevant stakeholders in the ACT see Section 4.

Commented [REDACTED]: Was it formally suspended, or has it just been that we haven't needed meetings because everything was fine?

3.3 Monitoring and management

The Office of Nature Conservation conducted line transect surveys across 13 sites to monitor wombat populations in the ACT, but these methods have now been judged insufficient to robustly estimate abundance. For more information on monitoring wombat populations see Section 6.8.

Commented [REDACTED]: Do we? I thought we had now stopped?

Mange is treated by wildlife care groups under a CED permit for use of moxidectin on public land in the ACT, with strict conditions of its use around waterways due to its toxicity to aquatic species. For more information on the prevalence and treatment of sarcoptic mange in the ACT see Section 5.2.1.

3.4 Rescue and rehabilitation

There are two wildlife rescue organisations within the ACT that care for and rehabilitate sick and injured Bare-nosed Wombats. Wombat Rescue is solely dedicated to Bare-nosed Wombats, and ACT Wildlife cares for all injured wildlife. Wombat Rescue operates under a licence to take, rehabilitate and release wildlife in the ACT issued under Section 273 of the *Nature Conservation Act 2014*. Both groups work closely with each other and NSW care groups to coordinate resources for the care of Bare-nosed Wombats.

Commented [REDACTED]: Is this confidential at all?

Wombat Rescue reports responding to several call outs a day. In the last 6 months Wombat Rescue have taken 19 Bare-nosed Wombats into care. Records indicate up to 50 wombats are taken into care annually by Wombat Rescue and ACT Wildlife cares for 20-30. What most individuals take into care are pouch young orphaned as a result of road vehicle collisions. To a

lesser extent Bare-nosed Wombats with severe mange are taken into care for treatment, with carers preferring to treat mange in situ where possible.

Of the approximately 50-60 Bare-nosed Wombats taken into care each year fewer than 10 animals are released in the ACT. In 2024, 28 wombats from the ACT were taken into care and only five were released into the ACT. Animals that come into care from New South Wales must be released in NSW. Release sites are resource intensive to find. For wombats these may include a large enough area that is free from mange, away from roads, has available food and water, and a low density of resident wombats. ACT Wildlife procures empty burrows to release animals by evicting resident Bare-nosed Wombats with the use of one-way gates. Wombat Rescue creates artificial starter burrows to release animals by digging a 70 cm deep L-shaped tunnel in flat ground. They place a 45 cm diameter trench liner half pipe over the hole before filling it back in to make a tunnel. When creating tunnels on private land they use soft release techniques, fencing the burrow and providing supplemental food. Animals released into parks and reserves are not provided supplemental food or fenced burrows. Carers monitor released individuals for a few weeks using wildlife cameras, but released animals rarely stay in the release area.

More recently, there has been request from Wombat Rescue that ACT Government provide land for a pre-release wombat sanctuary or haven to prepare rehabilitated wombats for wild release. Areas would need to be designated and fenced for this purpose, and policy or guidelines developed around effective and safe release of wombats. The feasibility and need for a wombat sanctuary, and the role of the ACT Government in providing such a facility, is still in discussion.

4. Stakeholder consultation and interviews

This section lists the primary stakeholders invested in Bare-nosed Wombat management in the ACT, and their interests in this issue (Table 4). It is important to note this is not a comprehensive review of stakeholder opinions on Bare-nosed Wombat management in the ACT and only expresses the views and opinions of a small number of people from each stakeholder group. Views and opinions are likely to vary within stakeholder groups. A formal review of stakeholder views is recommended.

Commented [REDACTED]: Is this really true? This comes across as wildly inappropriate.

Commented [REDACTED]: Need to lay the groundwork for the stakeholder views presented below by saying that all of these were consulted, giving some details as to how (e.g. phone, survey, conversations, which dates etc)

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Table 4. Identified stakeholders within the ACT with an interest in Bare-nosed Wombat management

Group	Organisation/name	Role in relation to Bare-nosed Wombats
ACT Government	Office of the Conservator of Flora and Fauna, City and Environment Directorate	Acts on issues that affect the conservation matters covered in the <i>Nature Conservation Act 2014</i> , particularly protecting native plants and animals
	Office of Nature Conservation Policy, City and Environment Directorate	Updates policy and legislation under the <i>Nature Conservation Act 2014</i>
	Office of Nature Conservation, City and Environment Directorate	Undertake a range of nature conservation programs in the ACT, including research on local flora and fauna, preparing scientific advice on ecological and natural resource management, conducting ecological surveys, biodiversity monitoring
	Transport Canberra and City Services	Deliver a range of services, including shop and playground upgrades, road and path maintenance, domestic animal services, and the management of urban open spaces including tree planting and grass mowing that may be impacted by Bare-nosed Wombat behaviour
	ACT Natural Resource Management, City and Environment Directorate	Integrated management of ACT's natural resources, including biodiversity, sustainable agriculture and cultural history
	ACT Parks and Conservation Service, City and Environment Directorate	Land management of the conservation estate, licensing and compliance under the <i>Nature Conservation Act 2014</i> , vertebrate pest and weed control, and managing visitor experiences.
	Urban Wildlife, ACT Parks and Conservation Service, City and Environment Directorate	Manage the outcomes of human-wildlife conflict, including nuisance animals, vehicle strikes and sick and injured animals
	Veterinarians, City and Environment Directorate	Administering treatment and care of animals including wildlife within the ACT

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Industry	Icon Water	Responsible for maintaining supply of water and sewage services in the ACT. These services may be impacted by Bare-nosed Wombat activity on occasion and require management
	Developers	Construction of new developments within the ACT in compliance with Conservator Guidelines for Burrowing Animals
Agriculturalists	Rural leaseholders	Land management and agricultural production which may be impacted by Bare-nosed Wombat behaviour
	ACT Rural Landholders Association	Advocacy for farmers and best practice farming within the ACT
Wildlife carers	Wombat Rescue	Caring for injured wombats and treating mange infected populations within the ACT. Advocate for wombat conservation and welfare
	ACT Wildlife	
Researchers	Prof Scott Carver	Conducting research on wombat ecology, biology and management
Ngunnawal	Dhawura-Ngunnawal Caring for Country Committee (DNCCC)	The representative body for ACT Government for traditional custodians of the Country in and around the ACT

4.1 Rural leaseholders

Rural leaseholders are frustrated by their current ability, or lack thereof, to manage Bare-nosed Wombats on their properties. Streambank erosion and reduced water quality as a result of wombat burrowing near waterways have been raised as a concern by landholders in correspondence with the ACT Government. Burrows and tunnels are becoming a big safety concern, with some paddocks described as ‘Swiss cheese’. Staff and stock are frequently injured by falling into burrows (see section 9.2.1). Rabbits have become difficult to control, as they shelter in Bare-nosed Wombat burrows and cannot be treated. Landholders have expressed interest in the development of an authorised control program like the kangaroo management program in the ACT.

The management of mange on private properties is a cause of concern for rural leaseholders. Some leaseholders have reported their dogs have contracted mange from the burrows of

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infected animals. This has resulted in expensive vet bills and distress to both dogs and their owners. Wildlife carers have also been caught trespassing on private property to treat mange. Landholders are concerned carers may be applying toxic chemicals without their knowledge. Furthermore, some leaseholders have experienced pressure from lobby groups in relation to kangaroo management and are apprehensive of similar dynamics with wombat carer groups.

Rural landholders within the ACT are frustrated by the current level of engagement with ACT Government on wombat management issues. Those involved in the Wombat Working Group have expressed concern that the group was heavily focused on conservation and mange treatment and did not adequately address the difficulties of managing wombats on rural properties. Their view is that rural landholders should be engaged directly to better understand the management issues they are facing, and to develop damage mitigation strategies to improve co-existence with wombats. For these strategies to be successfully implemented, they must be accepted by landholders as feasible and effective options. Additionally, continuing discussions between researchers, ecologists and landholders on the ecological value of wombats may improve landholder tolerance of wombats and facilitate effective management (Schumann et al, 2012).

It is important to note, there are 381 farmers within the ACT and only three rural leaseholders were consulted in the writing of this review. The views presented here do not necessarily represent the views of all rural leaseholders within the ACT.

4.2 Wildlife carers

ACT Wildlife and Wombat Rescue are two groups rehabilitating Bare-nosed Wombats in the ACT. Wombat Rescue are often called out to assess the condition of injured or mange-affected animals by the ACT Parks and Conservation Service (PCS) and the public. Wombat Rescue has approximately 20 active members who respond to calls and their resources are strained. They are concerned about the level of awareness and training rangers have in assessing mange cases and determining if treatment or euthanasia is needed. While carers acknowledge assessing the severity of mange is subjective, they would like mange training courses to be mandatory for all rangers to attend. To address this issue in part, the ACT Chief Veterinary Officer developed the 'Assessment of sarcoptic mange in wombats: A guide for rangers' as a decision sheet for PCS rangers assessing mange severity and the need for humane euthanasia. Additionally, carers are concerned about the lack of suitable release sites for rehabilitated animals in the ACT, leading to most releases occurring in NSW. Both care groups worry about post-release survival and are exploring GPS tracking to monitor outcomes.

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Wombat Rescue leads efforts to treat mange across populations, while ACT Wildlife limits treatment to intended release areas (see section 9.3.1). Despite ongoing efforts, carers lack the resources to eliminate mange from populations and believe more needs to be done to control the disease. Wombat Rescue also notes that some leaseholders are reluctant to allow property access to wildlife carers to treat mange affected Bare-nosed Wombats, increasing tension between the stakeholder groups.

Urban development in the ACT is encroaching on Bare-nosed Wombat habitats, likely forcing them into river corridors and increasing population density (see section 9.3.2). While carers have positive relationships with some developers, they are concerned others neglect proper wombat management. Carers fear Bare-nosed Wombats are being pushed into narrow river corridors which will place a strain on resources and result in more aggressive territorial behaviour. They would like to see buffer zones placed around new developments to minimise impacts to Bare-nosed Wombats, but no context was provided.

4.3 Community

Bare-nosed Wombats frequently interact with areas used by the broader community. As urban sprawl encroaches on Bare-nosed Wombat habitat there will likely be increases in human-wombat interactions and potential conflicts in urban areas. The broader community was not consulted as part of this review, and their opinions remain unknown.

Many people who do not live with wombats on their properties are often unaware of the issues these animals can cause, which contributes to resistance toward their management. Increasing public education about Bare-nosed Wombat biology, ecology, and the challenges they present can improve acceptance of species management strategies (Reiter et al., 1999). Including educational material on wombat ecology, impacts and management options on the CED website could be a valuable resource for the community. This would be similar to the information that is currently provided for other managed species (e.g. kangaroos). By fostering understanding through a well-structured information campaign, communities can better support responsible Bare-nosed Wombat conservation and reduce human-wombat conflicts across urban and rural settings.

4.4 Ngunnawal

Bare-nosed Wombats were widely used by First Nations people in many parts of southeast Australia. Much of the traditional knowledge has been disrupted due to the impacts of colonisation. Unfortunately, limited access to relevant contacts has constrained our ability to

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assess the importance of Bare-nosed Wombats to the Ngunnawal community at this stage. Reviving and incorporating First Nations perspectives into contemporary conservation efforts can help honour cultural importance and provide holistic approaches to managing Bare-nosed Wombat populations in the ACT.

4.5 Office of Nature Conservation (ONC)

The management of Bare-nosed Wombats is becoming an emerging and complex issue for ONC. ONC initiated a Wombat Working Group to work with stakeholders and better understand the complexities and conflicting viewpoints in this space, but reported they had trouble engaging leaseholders within the working group. The working group came to an end when there was no new information to guide decision-making. ONC faces pressure from wildlife groups to manage mangle and has worked with researchers and wildlife carers to mitigate mangle impacts. This includes the creation of the Wombat Mangle and Monitoring Group, a subgroup of the Wombat Working Group focused on monitoring wombat populations and assessing mangle. While there is a desire within ONC to effectively manage this species, a range of knowledge gaps and resource allocation has proven to be a significant hurdle.

Ecologists in ONC are also responsible for the monitoring and conservation of a range of threatened riparian and aquatic species in the ACT. There are concerns that mangle treatments such as moxidectin are highly toxic to aquatic life, and the negative consequences this may have on threatened aquatic species.

4.6 ACT Parks and Conservation Service (PCS)

Rangers find it challenging to manage community frustrations surrounding wombat burrow management in ACT parks and reserves. Walking and cycling trails are often re-routed along sub-optimal routes due to the presence of Bare-nosed Wombat burrows. As conservation officers, rangers are permitted to interfere with wombat burrows where necessary and are required to adhere to the Conservator Guidelines for the Protection of Burrowing Animals. Rangers would like support to manage burrows, particularly short starter burrows that are not used as a primary refuge.

Rangers have also raised concerns around streambank erosion and damage caused by wombats burrowing near waterways, particularly along the Murrumbidgee River.

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4.7 ACT Natural Resource Management

The primary issues ACT Natural Resource Management (ACT NRM) encountered with Bare-nosed Wombat management were a result of conflicts with farmers. Anecdotally Bare-nosed Wombat numbers have increased in the last 15-20 years, and subsequently the number of conflicts has increased. Among landholders there is an appetite to declare Bare-nosed Wombats overabundant and allow lethal controls as a management tool. ACT NRM would be reluctant to implement lethal control as there are multiple knowledge gaps around current population levels and minimum viable populations. ACT NRM also highlighted the lack of resourcing for non-lethal options for managing conflict between landholders and Bare-nosed Wombats. Subsidising exclusion fencing in hotspot areas may be a feasible option for conflict resolution. One-way gates, another management option, may remove conflict in one area but relocate wombats and conflict to another area.

4.8 Icon Water

Bare-nosed Wombats have damaged Icon water essential services infrastructure (see section 9.2.1). Icon Water sought advice from ecologists on damage mitigation strategies but had difficulties finding skilled ecologists with capacity to assess the problem and implement recommendations. As a result, Icon Water now manages wombat damage independently based on online consultation with ecologists. They have adopted a variety of management strategies, but they require monitoring and management investments. Icon Water currently has sufficient resources to continue implementing their management program.

4.9 Licensing and Compliance

The Licensing and Compliance team is supportive of developing a CNSMP for wombats and indicated that this is preferable to issuing licenses for control. They recommended that if the ACT government was to permit lethal control of Bare-nosed Wombats it should be part of an evidence-based controlled native species management plan (CNSMP), similar to macropods. Additionally, the Licensing and Compliance team noted that a CNSMP should include clear guidelines around when control is appropriate, and the criteria that must be met for control to occur. For example, the existing CNSMP for Eastern Grey Kangaroos clearly defines when control occurs, the number of animals to be removed, and benchmarks for shooter proficiency. A CNSMP for wombats should also be paired with a new code under the *Animal Welfare Act* that defines how wombats are to be controlled humanely. Currently there have been no formal complaints to the licencing department about Bare-nosed Wombats.

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4.10 Office of the Conservator for Flora and Fauna

In recent years, wildlife carers have been concerned about the impacts of new development on Bare-nosed Wombats. In response, the Office of the Conservator for Flora and Fauna developed the Conservator Guidelines for the Protection of Burrowing Animals during development (Protection of Burrowing Animals During Development) Conservator Guidelines 2025 notified under the [Legislation Act 2001](#)). There are currently two licences issued to interfere with Bare-nosed Wombat burrows.

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4.11 Scientists

The only scientist consulted during this review was Dr. Scott Carver, who specialises in researching wildlife disease ecology. Dr. Carver was a member of CED's Wombat Working Group and has worked with the ACT and Tasmanian governments on mange-related projects. He felt the Wombat Working Group effectively achieved its intended purpose. Similar to the Tasmanian wombat working group, the CED-led group came to a natural end when participants ran out of new information to bring to the table.

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Dr. Carver has worked extensively with wildlife carers on mange treatment. He noted that within the stakeholder group there is disagreement over best practice treatment methods and determining when euthanasia is appropriate. He noted that conversations in this space can escalate quickly, and more research is necessary. A recent study by the Wombat Protection Society and associated researchers trialled increasing the dose of moxidectin from 20 ml to 100 ml to treat mange in wombats. Dr. Carver noted that this is a large increase in dosage, and studies gradually increasing the treatment dose to determine the lowest effective amount would be key to preventing excessive use of moxidectin.

Dr. Carver acknowledged leaseholders had conflicts with Bare-nosed Wombats and more research was necessary in this space, but it was outside his area of expertise.

4.12 Chief Veterinary Officer

The ACT Government Chief Veterinary Officer (CVO) was primarily concerned Bare-nosed Wombats treated for mange *in situ* are not getting the proper care they need. Ideally animals would be diagnosed by a qualified veterinarian prior to being given treatment, although the CVO did acknowledge that this was not possible when treating wild animals *in situ*. They raised concern that the indiscriminate application of moxidectin at all burrows within an area can

lead to accidental overdosing of individual Bare-nosed Wombats. Conversely, some wombats may not receive a full dose if the chemical splashes as they are exiting a burrow or they move away from the treatment area. Healthy animals within the population will also unnecessarily receive treatments, which could lead to the development of chemical-resistant mites.

The drugs being used to treat Bare-nosed Wombats have the potential to cause harmful side effects in other species. Dogs that ingest moxidectin can experience neurotoxic effects and possible mortality. Faecal matter from treated animals contains traces of moxidectin, which can wash into waterways and affect aquatic systems. Responsible use of mange treatment drugs is critical to ensuring the negative impacts on ecological function are minimised.

4.13 Developers

The ACT population is projected to grow to 696,000 by 2050. Over the next few decades urban expansion is likely to further encroach on areas where Bare-nosed Wombats reside, resulting in management issues for urban developers. No developers were spoken to during this review. Consultation with developers is recommended to ensure urban expansion can be managed with minimal impacts on Bare-nosed Wombats.

5. Complexities of wombat management

The management of wombats is highly contentious, with challenges arising from the need to balance the competing interests of diverse stakeholder groups, including local government, leaseholders, First Nations, and wildlife care organisations (see Table 4). Conservation and wildlife care groups advocate for stronger protections for Bare-nosed Wombats, while agriculturalists and developers seek to manage the species to reduce damage to infrastructure, livestock, and personnel. This section seeks to bring together diverse stakeholder perspectives on a range of issues to highlight the complexities involved in reaching a management solution.

It is unlikely that all stakeholder groups will agree on a single approach to wombat management. However, participatory planning can improve communication and foster mutual understanding. Involving stakeholders in decision-making processes can lead to greater ownership of outcomes, enhance program credibility and transparency, and support the achievement of long-term goals (Hewitt and Messmer, 1997). Stakeholders are less likely to adopt or support management practices if they feel their opinions have not been taken into consideration and may take management actions into their own hands.

To date, there is no known research specifically examining the complexities of stakeholder relationships in wombat management. However, studies have explored landholder relationships with Southern Hairy-nosed Wombats (O'Brien, 2019, Sparrow, 2011, St John and Saunders, 1989, Stott, 1998) and Bare-nosed Wombats (Marks, 1998c). Additionally, the 5th IUCN World Parks Congress in 2004 brought together conservation experts to discuss human-wildlife conflict. Insights from this workshop, summarised by Madden (2004) provide a useful guiding resource for managing human-wildlife conflict.

5.1 Common causes of damage

5.1.1 Burrowing behaviour

Wombats are one of the largest burrowing herbivores in the world and create warren complexes that vary in complexity from single entrance burrows to a collection of interconnected burrows (warren). Burrows can vary in depth (0.4-2.8 m) and length (0.5-20 m), as such the spoil mound can be anywhere from 2.5-8 m² (Triggs, 2009, McIlroy, 1973). A Bare-nosed Wombat can use up to 11 burrows within their home range, though they typically favour the use of 1-2 burrows (Evans, 2008). Though their burrowing provides essential ecosystem services it often leads to conflicts with people. Bare-nosed Wombat burrows can undermine infrastructure such as roads, buildings, water tanks, fencing, dams which can result in substantial damage, financial costs and safety concerns.

One of the main points of contention for rural leaseholders with Bare-nosed Wombats on their properties in the ACT is the damage and occupational health and safety risks burrows can cause. This includes damage to fencing, dams, roads, buildings and erosion. Wombat damage to fencing can result in stock escaping from paddocks, posing a safety risk to both stock and people. Livestock may become injured or lost once they escape from the safety of a property resulting in financial losses to the rural leaseholders. Where properties adjoin parks and reserves there is a risk escaped stock may damage parks and reserves and incur fines for the landholder. Furthermore, rural leaseholders have a legal responsibility to ensure their stock does not stray from their property and can be held liable for any damages if they escape. Fence damage can also allow access to properties from undesirable pest species such as pigs.

Rural leaseholders and Icon Water have reported issues with Bare-nosed Wombats burrowing into the sides of dams or reservoirs. This is not only a safety concern for people but also the Bare-nosed Wombat. If a dam wall breaks it has the potential to release large volumes of water, threatening farm water supplies and downstream properties. In addition, it could cause

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increased erosion and sediment washing into the Murrumbidgee River and other major waterways. This places a significant financial burden on the rural leaseholders who are responsible for appropriately maintaining their dams. Icon Water have been managing Bare-nosed Wombats burrowing around dams by using one-way gates to force animals to leave the burrow and filling the hole with cement once they have been evicted.

Icon Water, rural landholders and PCS rangers have reported safety concerns with Bare-nosed Wombats burrowing under roads and tracks and within paddocks. The weight of a vehicle driving over a tunnel can cause the tunnel to collapse, causing damage to vehicles and necessitating vehicle and road maintenance. For rural leaseholders, burrows pose a significant safety risk to people and stock. Landholders using quadbikes and buggies can incur significant injuries if their vehicle falls into a burrow, which can lead to lengthy recovery times and a loss of income. Rural leaseholders have reported vehicles falling in tunnels as frequently as once a month with estimated damages costing ~\$1,000. This risk is increased in summer when grasses and other vegetation obscure burrow entrances. Landholders can also be liable for injuries to contractors and other staff working on their property, and landholders have been sued by injured contractors. Stock falling into wombat burrows can negatively affect animal welfare and lead to financial losses. One rural leaseholder has had to remove high value stock from a paddock with high levels of Bare-nosed Wombat activity. When wombat burrows limit accessibility of paddocks landholders may not be able to carry out other management tasks such as weed control. While burrow entrances can be mapped to reduce the risk, it would need to be updated regularly to account for new burrows. This is not feasible for rural landholders at a large scale.

Bare-nosed Wombats burrow under other infrastructure, such as buildings, water tanks and wastewater treatment drying beds. They can be removed with the use of one-way gates and burrows can be backfilled, but it is possible wombats will re-excavate the site. Rural leaseholders have tried using mesh to prevent re-excavation, but this treatment only lasts up to six months. Icon Water use a range of methods to prevent Bare-nosed Wombats re-excavating under infrastructure including the installation of cement skirts, placement of large rocks or mesh skirting. This requires ongoing maintenance and monitoring to keep animals out of undesirable areas. Burrows can also harbour rabbits, which creates an added layer of complexity in rabbit control. If rabbits are found using Bare-nosed Wombat warrens, Icon Water install one-way gates to remove the wombat before fumigating the burrow.

5.1.2 Grazing competition and crop damage

Within the ACT there are 20,869 ha of agricultural land, the majority of which is stock grazing land, with a small amount of cropping. Though competition for food resources between wombats and livestock has been reported as an issue of concern in other states (O'Brien, 2019, Stott, 1998, Marks, 1998c), rural leaseholders in the ACT have not reported it as an issue. The density of wombats on properties can vary at local and regional scales and may influence reports of grazing competition. For example, within the Murraylands of South Australia, Southern Hairy-nosed Wombats have an estimated DSE (dry sheep equivalent) of 0.5, comparatively sheep have a 1.2 DSE. Dry sheep equivalent is a unit of measure used to assess the nutritional needs of livestock and assess the carrying capacity of a farm. It equates to the amount of feed required by a two-year-old 50 kg Merino wether per day. Landholders have had to reduce their stocking rate by 20%, to account for the impacts of growing Southern Hairy-nosed Wombat populations, threatening the viability of some farms. Due to the differing climatic conditions in the ACT Bare-nosed Wombats might not have a substantial grazing impact. However, only three rural leaseholders were consulted in the writing of this document. Further consultation with rural leaseholders is recommended to understand the extent of the problems they are facing within the ACT before ruling grazing competition or crop damage out as a potential cause of conflict.

5.1.3 Erosion

Along waterways wombat burrows are often perceived to increase erosion in creeks and gullies (O'Brien, 2019); however, the extent of damage has not been quantified. Past land clearance may have resulted in increased soil instability, facilitating wind and water erosion of creek lines over time. When Bare-nosed Wombats burrow into steep banks, they undercut and destabilise them, the effects of which are exacerbated in unstable soils where there is a lack of vegetation. Eroding soils get transferred into waterways which has environmental implications for aquatic systems, including loss of fish habitat, aquatic barriers and increased nutrient loads. Erosion management would benefit from targeted monitoring to determine the underlying cause and quantify the damage so the most appropriate management actions can be implemented.

Rural leaseholders have used fencing to prevent stock from accessing creek lines and contributing to erosion risks. They are unable to prevent Bare-nosed Wombats from digging into creek banks and damaging the stock exclusion fencing. One rural leaseholder remediated the creek line of his property to reduce the erosion and subsequent damage to the

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surrounding aquatic environment with the help of ACT NRM and community groups (Figure 2). It took significant effort getting the necessary approvals on top of the time and costs of the work itself, totalling over \$50,000. This work was undertaken as part of a grant program and would otherwise have been infeasible for the rural leaseholder. The rural leaseholder reported difficulty in dealing with 'red tape' associated with the project and would not have completed it without the help of the ACT NRM.



Figure 2. Top - the eroding creek line on a leaseholder's property prior to remediation works. Bottom - the creek line after remediation works.

5.1.4 Land clearance for urban development

Recent expansion of urban development has caused concern among wildlife groups for wombats. Though Bare-nosed Wombats are a protected species they are not threatened and thus do not need to be considered when assessing a site for development approval. As such, developments have been planned, approved and construction commenced in areas where

Bare-nosed Wombats occur without considering the impacts. Though it is an offence to kill or interfere with a Bare-nosed Wombat under the *Nature Conservation Act 2014*, burrows have reportedly been destroyed during earthworks by developers, potentially burying Bare-nosed Wombats alive (pers. Comm., wildlife carers 2024). Wildlife carers have reported increased numbers of call outs in areas where urban development has or is occurring. This has highlighted the need for a greater understanding of the impacts of development on Bare-nosed Wombats.

As a response to potential impacts from development on Bare-nosed Wombats and other burrowing animals, the Conservator of Flora and Fauna has developed Conservator Guidelines for Burrowing Animals. The purpose of the guidelines is to improve consideration of burrowing animals during development and provide direction to developers on best practice methods to minimise harm. The guidelines will apply to any new developments within the ACT. During planning stages, developers will need a suitably qualified ecologist to identify burrow and shelter sites, monitor them for activity and ensure they are vacant or avoid developing over them wherever practicable. Wombat Rescue and ICON Water have highlighted the difficulties of conducting appropriate assessments due to the lack of capacity among suitably skilled ecologists in the ACT. Wombat Rescue are often called by ecologists seeking advice on how to manage wombats (pers. Comm., Wombat Rescue 2024). Where avoidance of burrows is not possible developers can apply for a licence to destroy burrows and must follow the guidelines to ensure this is done with minimal disturbance to animals.

The guidelines don't take into consideration the potential for new developments to fragment and isolate populations, limiting dispersal and resulting in genetic differentiation over time. Prior to any new land use zoning, consideration should be given to whether wildlife populations will be disconnected resulting in small and isolated populations that over time could result in inbreeding. There is concern development is pushing Bare-nosed Wombats into narrow river corridors where increased densities could result in increased competition for resources and creating stressful conditions for animals. Without a more detailed understanding of the abundance of Bare-nosed Wombats and carrying capacity in the ACT it is difficult to determine the impacts of increasing development and expansion. Furthermore, the carrying capacity of Bare-nosed Wombats is unknown and likely to vary from region to region based on habitat and resource availability.

If Bare-nosed Wombat densities are reaching a critical limit with food resources it can increase stress, competition and ultimately population declines. Increased stress and high Bare-nosed

Wombat densities are often associated with increased mange prevalence (Sengupta, 2019). Areas closer to fresh water are also predicted to have the highest suitability for mange (Ringwaldt et al., 2023). Urban areas abutting river corridors where Bare-nosed Wombats occur could result in increased human-wombat interactions. Dispersing Bare-nosed Wombats may wander into urban areas where conflicts can occur (e.g. burrow damage) and be more susceptible to road vehicle collisions. There could also be increased interactions between wombats and pets, resulting in injuries to domestic dogs and wombats. Dogs have been known to enter burrows where they may contract mange, get stuck or become injured. Increased public education on the implications of living near Bare-nosed Wombats will be essential.

It is important to note no developers were consulted in the preparation of this report. Consultation with developers is recommended to improve Bare-nosed Wombat management in areas under development.

5.2 Conservation concerns

5.2.1 Mange

Sarcoptic mange is a skin condition caused by the *Sarcoptes scabiei* mite. Mange initially presents as skin reddening and hair thinning. As the disease progresses, visible signs of itching, alopecia and epidermal crusting appear (Pence and Ueckermann, 2002). Mange has strong animal welfare implications as affected individuals can suffer a slow and agonising death, usually through secondary infection, blindness and/or starvation (WHA, 2021). Prevention of mange in Australia is considered almost impossible, as all disease transmission pathways would need to be interrupted, including transmission from host species such as foxes (WHA, 2021).

Ideally mange should be diagnosed and treated by qualified veterinarians so the condition is correctly identified, and animals can receive appropriate treatment. This is not feasible for wildlife populations. Mange in wombats is typically diagnosed and treated by wildlife carers and volunteer groups with varied levels of training, experience and coordination. Diagnosing the disease in its early stages can be difficult without catching and examining animals. The same symptoms can be caused by malnourishment from low quality feed, creating the potential for misdiagnosis (Fraser et al., 2018).

The distribution of mange and its impacts on wombat populations is poorly understood. Bare-nosed Wombat populations often persist in the presence of mange, and prevalence is usually $\leq 15\%$ (Carver et al., 2021). During outbreaks, mange prevalence can rise to $> 50\%$, with near

100% mortality of infected individuals (WHA, 2021). In some cases, mange outbreaks have resulted in > 90% decline in local Bare-nosed Wombat abundance (Skerratt 2005; Martin et al. 2018a). Research suggests population decline and range retraction can occur when mange prevalence is > 25% (Carver et al., 2023). Additional research is needed to understand which environmental variables may lead to mange outbreaks.

Increased rates of mange are often associated with high wombat densities and periods of drought or high stress (e.g. seasonal stress in winter) (Sengupta, 2019). Burrows are thought to be the predominant mode of sarcoptic mange transmission in wombats (Evans, 2008, Martin et al., 2019, Beeton et al., 2019). The humid and cool microclimate within wombat burrows provides favourable conditions to maximise mites off-host survival, particularly in cooler months (16.4 days in winter and 5.96 days in summer). Mites can survive in burrows longer than the minimum known frequency of wombat burrow switching 4- 10 days. Transmission is exacerbated by patterns of burrow use and sharing (Evans, 2008; Martin et al., 2019b).

Regulation of veterinary chemicals used to treat mange in Australia

The Australian Pesticides and Veterinary Medicines Authority (APVMA) is responsible for the regulation and control of agricultural and veterinary chemicals in Australia. Under legislation, the APVMA can evaluate, approve and register agricultural and veterinary chemicals, regulate supply, undertake compliance and issue permits for use. There are currently four active permits (valid in all states and territories of Australia) and three active permit holders approved for veterinary chemicals use for the treatment of mange in wombats.

The Wombat Protection Society holds two permits for the use of a Cydectin (active constituent Moxidectin). One permit allows for a dose 4 ml per kg of body weight with a maximum single dose of 100 ml on an adult wombat (>15 kg) with five days between doses and no more than five doses. The efficacy and toxicity associated with this dose rate has not been fully evaluated and users must observe wombats for any signs of toxicity. Any wombats that die after treatment must be reported to a veterinarian and a detailed postmortem carried out.

A second permit held for the use of Cydectin allows 0.8 ml dosage per kg of body weight with a maximum dose of 20 ml applied once weekly for 15 weeks. This permit is also held by Mange Management Incorporated. Cydectin can be delivered directly or by topical application using a pole and scoop to pour a dose onto the wombat's back, or indirectly by using a burrow flap that doses the wombat when passing underneath.

Intervet Australia holds a permit for use of Bravecto (active constituent Fluralaner) for mange treatment. The dose is 25 mg/kg with a maximum of three doses one month apart on wombats > 5 kg. Bravecto must be applied by topical application directly or by using a pole and scoop to pour a dose onto the wombat's back.

A condition of all these permits is that 'the product must only be used by persons who have appropriate experience in identifying mange infection and toxicity signs in wombats'. It is the permit holder's responsibility to ensure people operating under the permit are trained in the identification and treatment of mange in wombats. This is particularly relevant for care groups, where mange treatments may be administered by a range of volunteers. The permit holder must record any adverse experience associated with the use of the product and report them to the APVMA as soon as possible.

While there are no conditions on any of the APMVA permits with regards to Cydectin use near waterways, an environmental protection warning on the product states 'Moxidectin is extremely toxic to aquatic species. Do not contaminate dams, rivers, streams or other waterways with the chemical or used container.' This statement applies to use of the product under all APVMA permits.

Applying moxidectin indiscriminately across all burrows in an area may lead to unintentional overdosing of individual wombats over time, either from inaccurate dosage or from wombats relocating to treated burrows. Some wombats may not receive a full dose if the chemical splashes as they are exiting a burrow or they move away from the treatment area. Healthy animals within the population will also unnecessarily receive treatments. This could lead to the development of mite resistance arising from inappropriate chemical concentrations being administered.

There is also a risk non-target animals are treated, as wombat burrows are known to be used by a range of other native species (Linley et al., 2024, Thornett et al., 2016) and the impacts of moxidectin on these species is unknown. The broadscale use of these chemicals can result in chemical residues within the environment which can have negative impacts on native fauna, including invertebrates and aquatic species. Application with a pole and scoop though more time consuming can specifically target wombats with mange and promotes good chemical stewardship.

Some carers believe other products are safer or more effective and use a range of alternative treatments or supplementary products to relieve itching and treat secondary infection. Less invasive approaches include the one-off or repeated administration of a topical acaricide.

However, topical treatments may not reach mites due to a failure to penetrate parakeratotic scale crust or be adequately absorbed systemically due to a thickened epidermis. Even among experienced carers there is wide disagreement about how best to treat mange (O'Sullivan, 2018).

Current treatment of mange in the ACT

In the ACT, Bare-nosed Wombats are primarily treated for mange by Wombat Rescue volunteers, and to a lesser extent ACT Wildlife carers. Volunteers operate under APVMA permits PER89982 and PER90837 issued under section 112 of the Agricultural and Veterinary Chemicals Code 1994. The first permit allows for the treatment of Bare-nosed Wombats with mange using up to 20 ml of Cydectin via burrow flap or pour on/pole and scoop application methods. The second permit allows for the treatment of Bare-nosed Wombats with Bravecto using pour on methods only. Volunteer groups must also apply for a licence under the *Nature Conservation Act 2014* to use a vehicle within a reserve.

In addition, Wombat Rescue has a TCCS permit for use of Cydectin on public lands to undertake population treatments, with strict conditions of its use around waterways due to its toxicity to aquatic species. Cydectin must not be used when there is a medium chance or greater (>40 %) of heavy rain (>10 mm) forecast and all treatments within 5-15 m of a permanent waterway must be removed within 24 hours in the catchment area. A treatment area cannot exceed 1km of river reach, can only be treated at the population level once annually and no more than 6 treatment areas can be treated annually along the Murrumbidgee and Molonglo Rivers. Population level treatment by burrow flap application must not be used within 15 m of permanent waterways but is permitted for treating a maximum of 5 individuals at any one time. Cydectin cannot be used within 5 m of the water's edge or within 5 m from the centre of drainage lines and intermittent gullies, including unnamed drainages at any time. No treatments are to be applied in the Cotter Catchment above Cotter Dam, Namadgi National Park or Tidbinbilla Nature Reserve. The location and dosage details of all treatments, particularly those within 5-15 m of a permanent waterway, must be entered into a shared spatial layer once treatment has commenced.

Mange-affected Bare-nosed Wombats are treated both individually and at a population level. Population level treatments are conducted by Wombat Rescue and occur mainly in riparian areas along river corridors. Due to the substantial time it takes to install burrow flaps on every burrow, and permit restrictions, volunteers are only able to treat burrows along a 1 km stretch of the river at a time. Mange can be successfully eliminated in isolated areas, but where

connected populations of Bare-nosed Wombats occur along river corridors, it is difficult to eradicate mange as infected individuals from outside the treatment zone can wander in following the course of treatment. ACT Wildlife only administers mange treatments in areas where rehabilitated Bare-nosed Wombats are to be released if there has been isolated incidence of mange to maximise their chances of survival.

Wombat Rescue regularly responds to call outs to treat and rescue mangy Bare -nosed Wombats from concerned members of the public and ACT Parks and Conservation Service.

Mange distribution

To gain a better understanding of the distribution of mange in the ACT, CED have developed an online portal to enable the community to report sightings of mange-affected Bare-nosed Wombats. Sightings are also reported on WomSAT, an online application developed by researchers at the University of New South Wales. This data helps inform the national distribution and prevalence of mange in wombats. Users of WomSAT create an account and sightings must include a photo for verification. While applications of this nature enable capture of data across broad regions, reporting is typically skewed towards areas of high human activity and therefore may not accurately represent the presence/absence of mange (Figure 3).

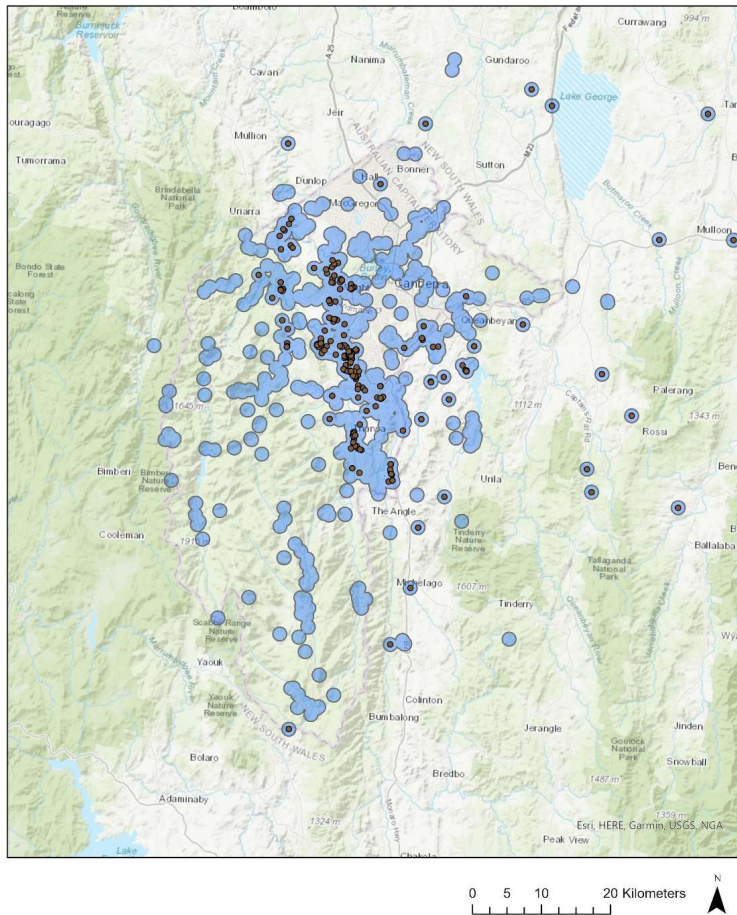


Figure 3. The known records of mange in Bare-nosed Wombats (red dots) in the ACT taken from CED survey data and ACT Wildlife Atlas wombat records and mange portal data.

Wombat Mange and Monitoring Group

To progress treatment of mange and improve monitoring of Bare-nosed Wombats in the ACT, CED convened the Wombat Mange and Monitoring Group (initiated March 2021). This group was formed as a subgroup of the Wombat Working Group. Members included two community wildlife care groups (Wombat Rescue and ACT Wildlife), Prof. Scott Carver of the University of Georgia USA (formerly of the University of Tasmania) and CED staff. The group took a collaborative approach to addressing mange and coordinates activities of the community and ACT Government. Previous activities of the Wombat Mange and Monitoring Group include:

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- Trialling the use of Bravecto, as a potentially longer-lasting, more effective, and target-specific treatment for mange.
- Developing a collaborative monitoring program to provide data on wombat populations, distribution, and mange prevalence across the ACT.
- Support mange treatment in public reserves while minimising risks associated with using Cydectin near waterways.
- Undertake collaborative research on the impacts of mange treatment chemicals on aquatic ecosystems.
- Develop and promote a publicly accessible web-based communication portal to enable community members to report Bare-nosed Wombat sightings and incidences of mange.

5.2.2 Road vehicle collisions

Collisions with vehicles are a source of mortality or injury for Bare-nosed Wombats and a safety concern for people. Roadkill records reported in the WomSAT app between 2015-2019 are relatively low in the ACT in comparison to other states (Figure 4, Mayadunnage et al., 2024). WomSAT relies on citizen scientists to report sightings and thus data may not be representative of all road kills occurring in the ACT. Roadkill records are collected by the Urban Wildlife Team, and it is worth reviewing them to gain a better understanding of the frequency of collisions and identify hotspot areas where intervention may help to reduce collisions.

The frequency of vehicle collisions is likely to vary depending on traffic levels, vehicle speed, Bare-nosed Wombat population density, climate and season (Mayadunnage et al., 2024, Ramp et al., 2005). Bare-nosed Wombat road mortalities are higher in winter and early spring (Roger et al., 2011, Mayadunnage et al., 2024, Nguyen et al., 2022). This could be linked to seasonal changes in the activity periods of Bare-nosed Wombats or more cars being on the road at dawn and dusk due to shorter winter days. High Bare-nosed Wombat road mortalities have been linked to areas of dense forest cover and the greenest ground cover in areas where wombat burrows are present (Roger and Ramp, 2009).

Within the ACT, most Bare-nosed Wombats (approximately 50 a year) come into care because of injuries from road vehicle collisions or being orphaned due to a vehicle collision. The relatively small number of Bare-nosed Wombats taken into care does not represent the total number of wombats killed.

Wombats can cause substantial damage to vehicles, the cost of which is unknown. Analysis of 17,000 animal collision claims between 1 January – 31 December 2023 by Suncorp Group revealed the most common animals drivers collide with are kangaroos, wallabies, wombats, deer, dogs, cows and emus (AAMI, 2024). The average cost of an animal collision insurance claim is greater than \$5,000 and 16% of vehicles were written off in claims that involved wildlife. The study revealed 76% of Australians believe kangaroos would cause the most damage to a car if involved in a collision, followed by wombats (16%).

Even if roadkill is not causing widespread declines of Bare-nosed Wombats, wildlife-vehicle collisions should be reduced where possible. Measures to reduce wildlife vehicle collisions include installing wildlife warning signs, installing underpasses or overpasses, and using deterrent devices (see section 10.5 for more information).

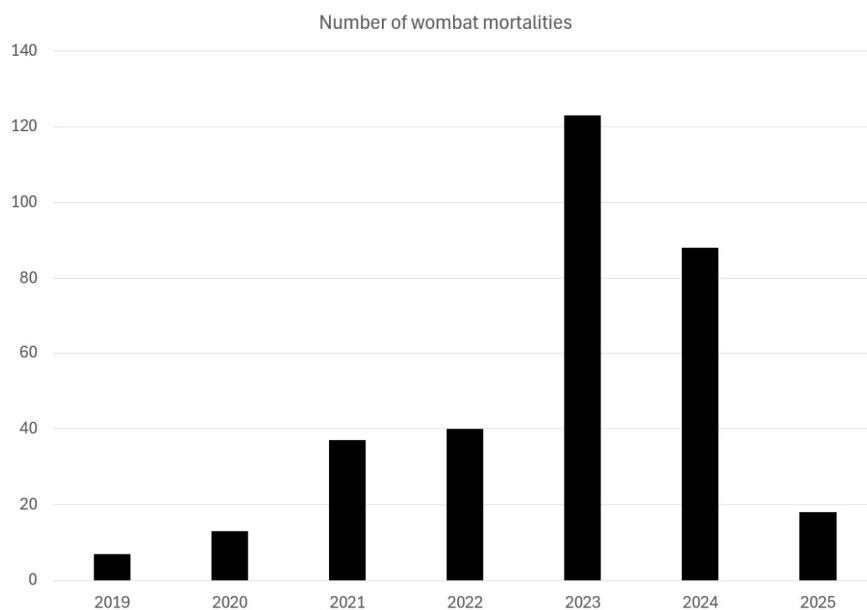


Figure 4. Temporal distribution of wombat roadkill records reported by the ACT Urban Wildlife Team between July 2019 and July 2025. For 2019, data is limited to July-December of that year; for 2025, data is limited to January-July of that year.

5.2.3 Habitat loss

The expansion of urban development has caused concern for the safety of Bare-nosed Wombats. The ACT is around 236,000 hectares, which is roughly 43.6 conservation estate, 10% highly modified urban land, and 15% highly modified rural and broadacre lands. The exact

division of land may be different as land zoned for urban areas may still be undeveloped or rezoned to another land use prior to development. Between 2006 and 2022, the ACT's urban area grew by 9% (2,760 ha). Most development has been in Gungahlin (Taylor, Throsby, Jacka and Moncrieff), West Belconnen (Ginninderry) and the Molonglo Valley (Whitlam and Denman Prospect). The increase in urban land has been driven by strong and sustained population growth over the last decade. The ACT population is projected to grow to 696,000 by 2050. The *ACT Planning Strategy 2018* aims to accommodate this growth while limiting urban spread by setting a target of 70% of new housing being built within existing urban areas. The impact of urban expansion of Bare-nosed Wombat populations is poorly understood. Urban development is thought to be pushing Bare-nosed Wombats into river corridors where their densities are high, resulting in increased stress from resource competition and territoriality (pers. comm wildlife carers 2024). In contrast, reports from other stakeholder groups indicate the distribution and abundance of wombats is increasing. The distribution of Bare-nosed Wombats across different land use zones is unknown and worth investigating to properly understand the potential impacts of further development on populations.

6. Wombat management methods and options

Conflicts with wombats have traditionally been resolved using lethal controls, but there is increasing advocacy for the development of alternative 'non-lethal' management options. Creating policy around alternative 'non-lethal' management options are hindered by a lack of quantitative evidence on their effectiveness and humaneness. Management options perceived as non-lethal can have negative ecological or animal welfare impacts, sometimes resulting in death. For example, translocation often has low survival rates but is perceived as a non-lethal management option because it does not involve the direct killing of animals. The term 'non-lethal' has not been used to classify management options in this review.

Research into damage mitigation techniques has not yielded conclusive results or sustained long-term benefits (Barlow et al., 2010, Koehler AE, 1990, Mason, 1998). Given the nature of conflicts vary greatly, no single management technique will alleviate all conflicts. A variety of damage mitigation techniques are needed that can be tailored to the ecological, social, cultural and economic realities in which conflicts occur (Dubois et al., 2017). Land managers also require data on the distribution and abundance of wombats, as well as the type and extent of damage, to effectively implement a management strategy.

This section reviews current research on wombat management and damage mitigation strategies.

6.1 Fencing

Exclusion fencing is a popular tool for eliminating damage to high value resources. While it is perceived as non-lethal it can have negative impacts on target and non-target species by prohibiting natural movement patterns or inhibiting access to important resources. Prior to installing exclusion fencing, careful consideration needs to be given to the ecological impacts on excluding species from their habitat.

6.1.1 Foot netting

Excluding wombats from areas where they are causing damage such as to high value infrastructure or resources can help to reduce damages and increase landholder tolerance towards wombats. Several wombat exclusion fence designs have been trialled. Attaching foot netting to the bottom of fences has been found to temporarily reduce the number of holes dug in fencing by 35-63% for up to 3 weeks (Marks, 1998b). Borchard et al. (2009b) trialled using hinged joint wire (80 cm wide x 15 cm spacings) attached to the outside of existing fencing and flattened along the ground and secured with tent pegs every 1 m along a 100 m section of fence and silt fencing (770 mm wide) laid out in the same manner and secured every 30 cm. In both designs hinge wire foot netting was placed on the inside of the fence at wombat breach points. The foot netting trial resulted in a mean exclusion rate of 35% for a one month. In the absence of aversive stimuli wombats quickly learned to chew through the silt fence or dig under the wire netting.

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6.1.2 Electric fencing

Electric fencing has been shown to exclude wombats from areas where their behaviour conflicts with human land use (Marks, 1998b; St John and Saunders, 1989). The electrification of the dog fence along the Nullarbor Plain in south east Australia has reduced damage to the fence caused by Southern Hairy-nosed Wombats, damage that allows Dingoes (*Canis familiaris dingo*) to pass through (St John and Saunders, 1989). On the outside of the dog fence, an additional two strands of wire 15 and 30 cm above the ground, positioned approximately 30 cm away from the original dog fence were constructed. The fence is patrolled regularly by dog baiters who assess the fence for signs of damage. Most damage occurs from Southern Hairy-nosed Wombats inside the fence attempting to travel north. Electrifying the fence has prevented Southern Hairy-nosed Wombats from travelling north, resulting in them moving

south of the highway into crop land where they had not previously been, resulting in conflicts with wombats and crop farmers (Sparrow, 2011). Marks (1998a) found electric fencing produced variable results, for Bare-nosed Wombats with electric fencing reducing the number of holes by 0-92% over 13 weeks. Landholders who used electric fencing to exclude Southern Hairy-nosed Wombats from their properties reported it to be unsuccessful as the electrified strands were often shorted out by vegetation or debris and it was too time intensive to check (O'Brien, 2019). Electric fencing is costly and time consuming to maintain on a small scale. Landholder perceptions of success may not be influenced solely by damage reduction, but also by the time and costs associated with implementing and maintaining control measures.

The use of electric fencing to reduce wombat damage is best suited to protecting small areas with important assets inside wombat free areas. Electric fencing will require regular inspections to ensure the fence hasn't been damaged or shorted out and involves construction costs and ongoing costs to run.

6.2 Wombat gates

Swinging gates have been recommended to reduce fence damage by wombats in Australia (Breckwoldt, 1983, Triggs, 2009) which can allow stock to escape paddocks or other unwanted animals from entering crop fields. Wombats can make numerous breaches in fencing and the installation of gates at every breach point may be impractical. The placement of gates would depend on the density of wombats in the area and the number of access points being used. Gates should be installed at the most well-used breaches and exclusion netting can be used to 'train' wombats to use the gates. Anecdotal evidence suggests Bare-nosed Wombats will use gates placed up to 800 m apart without making new holes (Triggs, 2009). Breckwoldt (1983) recommends gates of a timber construction which is likely to require regular maintenance. Newer fence designs consist of heavy-duty weld mesh gates weighing at least 2-3kg if trying to exclude other animals such as wallabies (Statham and Statham, 2009, Driessen et al., 2020). If Bare-nosed Wombats could not see through gates they would dig a hole next to it rather than use it (Statham and Statham, 2009). Gates weighing between 4.5-16 kg have also been reported to be used by Bare-nosed Wombats (Coates, 2013). Borchard et al. (2009a) found Bare-nosed Wombats continued to breach the foot netting of fencing for the first few months while they learned to use the gates requiring ongoing repairs. Driessen et al. (2020) wired gates open for two weeks to allow Bare-nosed Wombats a habituation period but did not report on fence breaches throughout the study.

The decision to use wombat gates or a combination of gates and exclusion fencing will depend on the extent of the problem, the cost of the damage and the cost to purchase, erect and maintain the length of fence required. The installation of gates can be laborious and will likely require ongoing maintenance. The installation of gates in fencing may prevent damage to fencing but it does not prevent wombats from accessing areas where their behaviour may cause further damage on the property, thus not all property managers will readily accept the use of swinging gates or view it as a successful damage mitigation strategy (Borchard and Collins, 2001).

6.3 Mapping wombat burrows

There are a variety of methods for surveying and mapping the location of wombat burrows. While it is not a direct damage mitigation method it may prove useful for choosing the most appropriate management action for burrows in unfavourable locations. Mapping the locations of tunnels can help to prevent accidents such as vehicles or machinery falling down tunnels which can collapse under their weight, by avoiding driving over them. However, in areas with a high density of tunnels this may be unavoidable.

6.4 Burrow collapsing

As wombats are known to use multiple burrows within their home range, the opportunity exists to remove problem burrows through collapsing them, moderating their burrowing activity with minimal impact on the wombats. However, widespread burrow destruction is not recommended as it can lead to the displacement of wombats. It is also important to consider the impact of burrow collapsing on young at foot who may not be able to travel long distances. Historically burrow collapsing has been used following fumigation to prevent neighbouring Southern Hairy-nosed Wombats from recolonising the area, however, it was rarely successful as burrows were re-excavated (Marks, 1998a). Burrow collapsing in combination with other methods to exclude wombats from areas where they are causing damage may prove more effective.

The gradual collapsing of burrows over three days in combination with the use of deterrents has been trialled as a management option for Southern Hairy-nosed Wombats (Sparrow et al., 2016, O'Brien, 2018). This method involves collapsing the first 1-2 m of the tunnel on day one, followed by another several meters on day two. The tunnel is left open, providing a clear exit point for wombats. The disturbance of the burrow over the first two days is 93% effective in getting Southern Hairy-nosed Wombats to exit the burrow before ripping the tunnel on day

three (O'Brien, 2018). On day three the tunnel is carefully ripped with a backhoe, stopping every few meters to check the direction of the tunnel and look for signs of occupancy. If a wombat is still within the tunnel, it can be left for another day to see if they will leave. On one occasion a Southern Hairy-nosed Wombat failed to leave on the fourth day and had excavated a further 7 m of tunnel overnight despite the presence of alternate inactive burrows nearby ($\leq 50\text{m}$ away). The failure of burrow disturbance to get the Southern Hairy-nosed Wombat to leave may reflect the importance of the burrow. Although Southern Hairy-nosed Wombats may use up to 10 different warrens within their home range, they usually use 1-2 warrens on most occasions to which they display high site fidelity (Shimmin *et al.* 2002; Finlayson *et al.* 2005).

Two studies trialled the effectiveness of dingo urine and faeces in deterring Southern Hairy-nosed Wombats from re-excavating collapsed tunnels and produced mixed results (O'Brien *et al.*; Sparrow *et al.* 2016). Sparrow *et al.* (2016) found untreated collapsed burrows on the Nullarbor plain in South Australia were recolonised within 75 days while those treated with dingo scents showed minimal activity. In contrast, O'Brien *et al.* found that in the Murraylands of South Australia deterrents didn't play a significant role in the time taken for recolonisation to occur. The differences in results between the two studies could be attributed to variances in the methods used or environmental factors such as predator densities at the sites or burrow availability and importance and warrants further investigation. Although burrow collapsing is considered non-lethal its impacts on evicted wombats has not been studied and warrants further investigation. Studying the impact of burrow collapsing on wombats may help to answer questions about the reasons for its success or failure. Burying steel mesh at the location of the collapsed burrow is untested but may prevent wombats from re-excavating.

Alternate methods could trap and relocate wombats or empty burrows using one-way gates placed in burrow entrances prior to collapse. Trapping is more time consuming and costly as traps need to be checked every morning and it requires careful planning and trained personnel to handle and relocate the wombat(s) but removing animals from the area may provide longer term relief from conflict. One-way gates can be installed and left in place until the burrow is empty, though regular assessment of the gate is recommended as wombats have been known to dig around or under them. Motion sensor cameras can be used to determine if a burrow is empty. Low-cost methods such as raking the soil to assess for footprints or the placing of sticks in a burrow entrance can be used to determine if a burrow is empty however, it is not always possible to determine if a wombat has gone into the burrow or exited.

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The time and costs of burrow collapsing will vary on a case-by-case basis. Some burrows may be simple single entrance tunnels that take 1.5 hrs to rip while other more complex 5 entrance warrens that are 4 m deep can take up to 10 hours (O'Brien, 2018). Soil type and burrow depth will impact the time and costs associated with burrow destruction. Given the time and costs of collapsing burrows along with the low success rate it is not a viable long-term solution to wombat management, but it may prove useful in certain situations. Given Bare-nosed Wombats within the ACT breed year-round consideration needs to be given to the potential for there to be young at foot that may not be able to travel to the next nearest burrow or move through a wombat gate. Though these studies found burrow collapsing did not result in new burrows being dug in other locations it is always possible that it could transfer the conflict to a new location.

6.5 Deterrents

Designed to capitalise on an animal's mechanisms of threat detection, deterrents aim to discourage the use of human resources with aversive stimuli (Ramp et al., 2005, Apfelbach R, 2005, Schakner and Blumstein, 2013). A wide range of deterrents, such as chemical cues, novel objects, and painful stimuli are increasingly being marketed as non-lethal means of reducing human wildlife conflict (Breitenmoser et al., 2005). Although there are numerous studies on the use of deterrents, many devices have not been quantitatively field-tested, and their perceived effectiveness lies in testimonial and anecdotal reports. Controlled lab studies often do not translate to field situations, where numerous uncontrollable environmental factors can influence the way animals detect and respond to threats (Mason, 1998, Koehler AE, 1990, Barlow et al., 2010). Even where devices have been field tested, they often produce conflicting results.

Before deterrents are recommended to mitigate wombat damage, a better understanding of the factors influencing wombat threat perceptions and responses to them is needed. Further research is required to evaluate responses in different environmental conditions such as varying distance to cover, and with different methods of application and placement, to determine the optimal conditions for success. In addition, future studies should consider conducting trials in a closed system with known individuals or capturing and marking individuals prior to commencing trials for ease of identification so individual variation in responses can be taken into consideration.

6.5.1 Olfactory deterrents

Olfaction is known to play an important role in social communication in wombats (Taggart and Temple-Smith, 2008, Triggs, 2009), little is known about its role in threat perception. Anecdotally, fertilisers such as blood and bone, dog and human urine are thought to deter wombats (O'Brien, 2019).

Dingo urine and faeces has been trialled with mixed results. Field trials found no difference in Southern Hairy-nosed Wombat activity before and after placing a cup of blood and bone in burrow entrances (O'Brien et al., 2021). Captive Southern Hairy-nosed Wombats increased their exploratory behaviour in response to dingo faeces placed inside burrows, followed by increased use of burrows and concealed locations (Descovich et al., 2012). Sparrow et al. (2016) reported Southern Hairy-nosed Wombats showed greater avoidance and prolonged time to recolonisation of collapsed warrens treated with dingo odours than control warrens on the Nullarbor in South Australia. Conversely, the application of dog urine and dingo faeces had no significant impact on the time taken for Southern Hairy-nosed Wombats to recolonise collapsed warrens in the Murraylands of South Australia (O'Brien, 2018) or deter them from using burrows where dingo urine and faeces were placed at the entrance (O'Brien, 2019). No known research has been conducted on the effects of odour deterrents on Bare-nosed Wombats.

The differing results of these studies indicate Southern Hairy-nosed Wombat responses to predator odours may be context dependent, but disparities in experimental design and analyses make it difficult to determine which factors are influencing threat perceptions. Control–impact studies may lead to a misconception of the effectiveness of treatments as they don't consider differences in pre-existing activity levels at treatment sites (Koehler AE, 1990, Parsons and Bondrup, 1996, Rytwinski et al., 2016). Southern Hairy-nosed Wombats may have responded to blood and bone or dingo odours with increased hiding or reduced ranging behaviour in a manner that was not evident from the camera data, or it could have been perceived as a low risk. The use of a greater volume and repeated or more widespread application of deterrents may elicit greater avoidance responses. The application of odours inside burrows or in open areas further from the safety of a burrow may heighten risk perceptions, resulting in greater avoidance responses (Atkinson et al., 1994).

6.5.2 Visual deterrents

Anecdotal evidence suggested wombats are fearful of shiny objects and actively avoid them. Stationary CDs have been found to elicit avoidance responses in Southern Hairy-nosed Wombats, with a decrease in the number of visits to burrows following their application (O'Brien et al., 2021). Visual stimuli produced avoidance responses most likely due to an immediate fear response (neophobia) of an unknown object within their environment (Harris and Knowlton, 2001, Davidson-Nelson and Gehring, 2010, Bruggers et al., 1986). Wombats may respond more readily to visual cues as they are easily detected from further away than olfactory cues, which require closer investigation. Though these preliminary investigations are encouraging, habituation to visual stimuli is a major limiting factor to their long-term use, particularly when unaccompanied by negative reinforcement (Koehler AE, 1990, Gilsdorf et al., 2002). Habituation to CDs was not observed in Southern Hairy-nosed Wombats over the 5-night trial, however, it may occur over a longer time frame.

6.5.3 Virtual fencing

Virtual fencing is a term often used for placing deterrents along roadsides that are activated by approaching vehicle headlights. On activation the device emits a sound, flashing lights or both with the aim of scaring away any animals that may be adjacent to the roadside. Virtual fencing is not a physical barrier and allows animals to move through the landscape. Early trials in Tasmania reported a 50% reduction in roadkill over a three-years (Fox et al., 2018), but the trial had many design flaws and likely had little to no effect on possums, wallabies or wombats (Coulson and Bender, 2019). A study on the impacts of virtual fencing on wombats found a small reduction in the number of wombats killed after the virtual fence was installed (Stannard et al., 2021), however the study design was flawed and widely disputed (Coulson and Bender, 2022, Candy and Englefield). Similarly, other deterrent devices mounted to vehicles like the Shuroo have been found ineffective, as the noise the device makes cannot be heard over the vehicle noise from >50 m away (Bender and Coulson, 2022).

6.6 Translocation

Translocation is a widely used “non-lethal” human-wildlife conflict mitigation measure, but its effectiveness is disputed. The survival of translocated animals is often low, and the conflict may not be resolved or could be transferred to the release site (Bradley et al., 2005, Linnell et al., 1997). Translocation has been trialled on Southern Hairy-nosed Wombats to relieve conflicts with agriculturalists. Southern Hairy-nosed Wombats were translocated from areas of

conflict to a property where species numbers were low and lots of inactive burrows were available to release them into. Animals were fitted with GPS and/or VHS collars to monitor their survival and behaviour in comparison to resident animals. Though translocated Southern Hairy-nosed Wombats had high survival rates and exhibited release site fidelity conflicts were not resolved. Neighbouring Southern Hairy-nosed Wombats moving into vacated burrows at the source site within a matter of weeks. Landholders using culling as a control measure to reduce conflicts with Southern Hairy-nosed Wombats have reported similar results, with neighbouring animals recolonising vacated warrens (St John and Saunders, 1989). Translocation of a larger number of animals may provide longer relief from conflict. However, Southern Hairy-nosed Wombats evaded traps by remaining underground or digging under fencing, resulting in a low trap rate of 5.95%. Similarly, the trapping success of Bare-nosed Wombats was 7.9% and Northern Hairy-nosed Wombats as low as 1-2%, all species avoid capture by remaining underground for extended periods of time (McIlroy, 1977a; Alan Horsup, pers. comm 2018). Thus, large scale translocation could be labour intensive and cost prohibitive. Furthermore, the ongoing translocation of large numbers of Southern Hairy-nosed Wombats would over time lead to shortages of suitable conflict free release sites with low numbers of conspecifics in the species natural range. Translocation could be used as a tool to repopulate areas where numbers are known to have declined, however, it may result in further deaths if the cause of the decline has not been addressed.

Similarly, the critically endangered Northern Hairy-nosed Wombat has been successfully re-introduced into areas they were extirpated from by releasing them into starter burrows (Horsup, 2004). A study on the survival of rescued and rehabilitated Bare-nosed Wombats reported high survival (94.5%) of animals released onto a private property within the first 42 days following release and 77% survival after eight years (Saran et al., 2011). Survival was not found to be related to age, sex, provision of supplemental food, season or time spent in rehabilitation.

Despite its limitations, translocation may prove useful for removing a small number of individuals from areas of conflict, where alternative measures fail or are unsuitable. When used in combination with burrow collapsing or deterrent use it may yield more promising results in reducing conflict at the source site. Prior to carrying out a translocation careful planning is needed. Translocation plans should adhere to the Conservator Guidelines for the Translocation of Native Flora and Fauna in the ACT. . Important biological and ecological factors need to be taken into consideration, such as capture stress, disease transmission, habitat suitability, and competition with conspecifics. The availability of burrows at the release site is a key

consideration when it comes to translocating wombats, which would require up to date knowledge of wombat distribution and density. Follow up monitoring is imperative to ensure survival of translocated animals.

6.7 Culling

Historically, conflicts with wombats have been managed using lethal controls. In most states, there are provisions to cull wombats causing damage or threatening human safety under permit systems (see section [Error! Reference source not found.6-1](#)). The lethal control of wombats has become a highly contentious and controversial issue in the last few decades, due to changing public attitudes towards its use and concerns about wombat conservation. Permits to destroy Bare-nosed Wombats have decreased greatly in Tasmania and other states where it is allowed in the last few years due to increasing public pressure. The impacts of culling on wombats populations are poorly understood (Tartowski and Stelmann, 1998, Taggart et al., 2008). If conducted at unsustainable levels it can result in range contractions and population isolation (Powell, 2006, Fuller et al., 1992, Woodroffe et al., 2005). In contrast, killing an insufficient number of animals can fail to reduce damage to an acceptable level (Hone, 2007). In some cases, the removal of animals from a population can encourage population growth and immigration, thereby increasing conflict (Treves et al., 2016). Culling can disrupt social structures that lead to fractured social groups and increases in conflicts (Wallach et al., 2009, Allen et al., 2015). Despite the limitations of culling, there may always be some situations in which it is the best intervention method (Warburton and Norton, 2009).

There is one known study examining the effects of culling on Southern Hairy-nosed Wombats. Changes in the number of active burrows were monitored in an area where culling occurred and an adjacent control zone where no culling took place. Over the two-year term of the study an estimated 12% of the population was culled per year. Despite this there was an estimated 30-40% increase in the number of Southern Hairy-nosed Wombats in the culled area, while in the uncultured area there was an estimated 50-60% increase. The increase in Southern Hairy-nosed Wombat numbers over this time frame could have been a result of increased rainfall and recovery from the 1981-83 drought, the effects are unlikely to be the same on a stable or decreasing population (Tartowski and Stelmann, 1998).

Culling is often preferred as a conflict reduction tool by landholders, as it is convenient, immediately shows results, satisfies their need for control, and is perceived as cost effective (Horton RR, 1997, Zinn et al., 1998, Treves and Naughton Treves, 2005).

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Landholders surveyed in South Australia most widely used culling to reduce conflicts with Southern Hairy-nosed Wombats in South Australia and those who were financially dependent on their property or had experienced damage were more likely to cull wombats (O'Brien, 2019). Despite the widespread use of culling, only half of the landholders using it perceived it to be effective. A lack of data on wombat numbers makes it difficult for state agencies to set balanced culling quotas often resulting in ineffective conflict resolution (Taggart et al., 2008). Many landholders feel they are rarely permitted to cull enough wombats to mitigate damage with recolonisation of burrows being an ongoing problem (Stott, 1998, Taggart et al., 2008, St John and Saunders, 1989). Official government registers are considered an underestimate of the true numbers of wombats culled, as some landholders resort to culling outside the permit system (St John and Saunders, 1989, Taggart et al., 2008). The use of lethal controls needs to be carefully evaluated and managed based on scientific evidence, to ensure conflict reduction without threatening species conservation.

6.8 Wombat monitoring and research

There are significant knowledge gaps in our understanding of Bare-nosed Wombat populations in the ACT. Addressing these gaps will require dedicated monitoring and survey effort to collect fit-for-purpose datasets. This section examines a variety of survey options, and their costs and benefits.

6.8.1 Quantify the frequency and occurrence of wombat damage

Perceptions and tolerance of damage caused by wildlife are often shaped by financial dependence on crops or livestock and previous experiences (Naughton-Treves L, 2005, Van Tassell et al., 2000). Perceived damage can sometimes be disproportionate to actual damages (Dickman, 2010, Knight, 2000, Madden, 2004, Wigley and Garner, 1986). Quantifying the frequency and cost of Bare-nosed Wombat-related damage is crucial to distinguish between real and perceived impacts. This data can help identify high-conflict areas and guide wildlife managers in developing targeted management actions. In regions where damage is minimal or misattributed, educating stakeholders can be crucial to mitigating conflict. Conversely, where significant damage occurs, targeted management interventions to reduce damages may be necessary to alleviate its effects.

Accurately reporting the prevalence and costs of wombat damage from landholders and other relevant stakeholders will require a consistent approach to data collection. This will require

CED to develop a reporting tool for stakeholders to submit information such as: (1) the type of damage; (2) the location of the damage; (3) the financial costs associated with damage; and (4) negative safety outcomes associated with damage. Collecting a consistent set of data in each report will allow for comparison with wombat population data and other key population metrics. This tool will need to be managed by CED or another relevant team within the ACT Government.

6.8.2 Ecological surveys of wombats in the ACT

One of the critical aspects of species management is understanding population dynamics. Currently, Bare-nosed Wombat population monitoring in the ACT is limited, with few systematic surveys to track wombat numbers or distribution. Animal welfare and stakeholder concerns around the prevalence of mange also require systematic surveys that include areas with and without mange treatment applications. High-quality distribution and abundance data paired with standardised impact and mange assessments will provide land managers with the tools for effective management and conflict mitigation.

Current monitoring

CED has commenced a long-term monitoring program at eleven sites within the ACT. The purpose of these surveys is to detect changes in populations over time, and to collect data on mange prevalence and severity. Survey sites were selected based on known presence of Bare-nosed Wombats and ease of accessibility. Surveys are conducted twice annually in winter and consist of walking 1 km transects at a slow pace (45 mins), commencing 30 mins after sunset (Figure 5). Surveys are carried out in teams of at least two people for health and safety reasons. Surveyors use night vision binoculars to reduce disturbance of animals.

When a Bare-nosed Wombat is seen, the surveyor notes their location using a GPS, takes a compass bearing and estimates the distance to the animal. Wombats are given a body condition score (ranked 1-5, with 1 being poor and 5 being excellent) and a mange score using the categories described in Stannard et al. (2020). Observers also record a mange confidence score to reflect how confident the surveyor is in their assessment in the presence or absence of mange, noting that it can be difficult to assess from a distance. Weather variables including temperature, rainfall, wind speed, cloud cover and visibility of the moon are measured at the beginning of each transect. A further two sites in Namadgi National Park are surveyed annually using the same method as above, with the exception that surveys are undertaken from a vehicle.

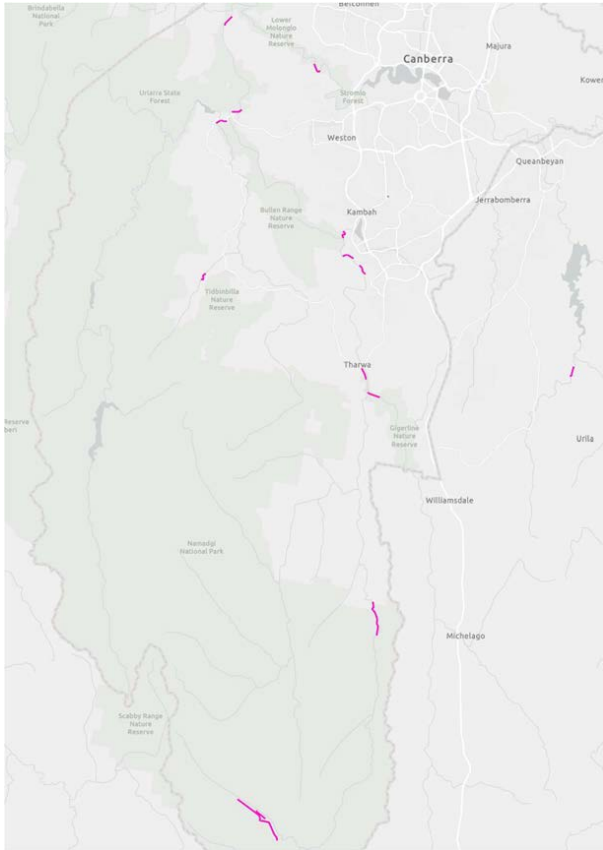


Figure 5. Locations (pink) of the line transect surveys conducted to detect changes in populations over time, and to collect data on mange prevalence and severity.

Bare-nosed Wombat records are also collected using applications such as NatureMapr and the Atlas of Living Australia. These are useful tools that enable public reporting of wombat sightings over large areas that would otherwise be infeasible for ecologists to survey. These incidental sightings are typically biased towards areas of high human activity (i.e., roads or trails) and there are caveats around their value in understanding a species distribution or abundance. Without standardised survey effort, it is difficult to determine whether areas with a lower number of records represent a true absence or a low survey effort. Species and signs of their presence, such as faeces, tracks and burrows, can also be misidentified or difficult to detect. Burrows also present a challenging proxy for wombat occupancy as burrows may remain in an area after an individual has moved on (Tartowski and Stelmann, 1998).

Gaps in current methodology

A comprehensive survey program to inform wombat management in the ACT requires data on (1) wombat density or relative activity across areas of suitable habitat; (2) prevalence of mange across existing wombat populations; and (3) the effect of mange treatments on the prevalence of mange. The current monitoring program captures relative activity data within the conservation estate but is not representative of all Bare-nosed Wombat habitat in the ACT. A more representative selection of sites would require survey transects to be located across conservation estate, rural lands, and other stakeholder areas (i.e., Icon Water). This would require approval from stakeholders for ecologists to access their land for surveys.

The current site selection does not consider whether sites have been actively or historically treated for mange. This makes it difficult to determine whether the abundance or current health of the local population is affected by these treatments. In future, monitoring sites should be evenly stratified into two groups: treated and untreated. Once these sites are selected, treatment conditions should remain consistent throughout the study period.

The current survey methodology as described above is subject to imperfect detection of both mange prevalence and individual wombats. Vegetation and uneven topography can make it difficult to detect individuals and assess mange severity. For more information on alternative survey methodologies that may be more suitable, refer to the section below.

The current monitoring program is conducted across 26 survey nights annually, with two staff or volunteer members required to conduct each survey. In the past this work has been done by CED ecologists and volunteers from Wombat Rescue. Expanding the survey scope to include transects on rural land and other stakeholder properties would increase the survey time required. For consistency and impartiality, this should be done by trained ecologists and not members of any stakeholder group.

Alternative monitoring methods for consideration

Due to the nocturnal and burrowing nature of Bare-nosed Wombats they are difficult to survey. Direct counting using spotlight surveys are labour intensive and not practical over large areas. Spotlight counts are not representative of population numbers as wombats may remain in their burrows and avoid being counted (McIlroy, 1977b).

Mark recapture studies, requiring individuals to be captured on more than one occasion, are challenging as Bare-nosed Wombats are difficult to capture. They can remain underground for

prolonged periods or dig around traps to avoid capture (McIlroy, 1977b, Skerratt et al., 2004). In these surveys, trapping only a portion of burrows can result in imprecise abundance estimates (Banks et al., 2003). Trapping every burrow across a large area is impractical due to the time and labour required.

The number of active burrows has successfully been linked to wombat abundances using mark-recapture methods (McIlroy, 1977a), burrow flap counters (Tiver, 1981) and remote cameras (Swinbourne et al., 2018). A combination of burrow activity levels and the number of active burrows is a relatively low-cost method and has been used to infer population abundances (St John and Saunders, 1989). Burrow activity can be estimated using burrow flap counters or remote cameras. Abundance estimates using these measures will allow land managers to track trends in population levels but will not provide an exact density.

Ground penetrating radar has been used successfully to map Southern Hairy-nosed Wombat burrows (Swinbourne* et al., 2015). It can be used to determine the length, depth and direction of wombat tunnels and help determine if a burrow is a main, secondary or starter burrow. There are various ground penetrating radar systems available, simple units can be hired for between \$200-400 a day and can penetrate up to 8 m depth.

Drones have successfully been used to map wombat burrow locations in New South Wales grasslands (Old et al, 2019). In their study, Old et al. (2019) detected a similar number of burrows using desktop analysis of drone imagery and ground-based surveys. In aerial surveys observer errors can result in inaccurate counts, but standardising the results using a transect with a known number of burrows can help develop a correction factor for the dataset (Tiver, 1981). Recording video footage during aerial surveys can also allow for more accurate and repeatable scores of wombat warrens (McGregor and Wells, 1998). Drone surveys can be affected by vegetation, with reduced efficacy in dense vegetation where burrow entries are obscured (Old et al 2019; Taggart et al, 2008). These aerial surveys provide an alternative to manual searching for burrows and can be used to quickly assess range expansion in local wombat populations. Detecting decreases in distribution based on burrow surveys is more difficult, as warrens remain visible long after they have been vacated.

Integrating drones with thermal sensors has been used effectively to directly survey a range of terrestrial and arboreal species (Beaver et al, 2020; Howell et al, 2021; Witt et al, 2020). These methods have not yet been tested on wombats, but they may provide a suitable alternative to ground-based surveys. While thermal drone surveys may reduce labour inputs and reduced

detection abilities in dense vegetation, they are still subject to the pitfalls of direct count methodologies. Direct counting will still be subject to imperfect detection if individual wombats remain underground during the surveys.

6.8.3 Furthering research by partnering with scientists

There are lots of knowledge gaps that hinder the effective management of Bare-nosed Wombats in the ACT. While it is not necessarily the role of the ACT Government to conduct the research to fill these knowledge gaps, collaboration with scientists may help to overcome some of these knowledge gaps.

Collaboration between the ACT Government and researchers could help fill the knowledge gaps discussed above. Key research areas include developing a deeper understanding of complex stakeholder views and collecting more robust population-level data for wombats in the ACT. Additional topics could include further research into mange treatment and collaborating with landholders to develop effective damage mitigation strategies. Landholders currently lack reliable options for mitigating conflict with wombats. These options need to be well-tested, and the limitations and benefits of each need to be clearly understood.

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Managing wombats

A review of current practice, issues and challenges to inform wombat management in the ACT.

Office of Nature Conservation

DRAFT Technical Report to the Conservator for
Flora and Fauna

October 2025

Acknowledgement of Country

The City and Environment Directorate acknowledges the Ngunnawal people as traditional custodians of the ACT and recognise any other people or families with connection to the lands of the ACT and region.

We respect the Aboriginal and Torres Strait Islander people, particularly our Aboriginal and Torres Strait Islander staff, and their continuing culture and contribution they make to the Canberra region and the life of our city.

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Glossary

- **City and Environment Directorate (CED)** – ACT government department responsible for managing conservation estate and public land.
- **Closed season** – A defined period during which hunting or capturing was prohibited for listed species.
- **Deterrent** – Something that discourages or prevents someone from taking an action due to the perception of negative consequences.
- **Dry sheep equivalent (DSE)** – A unit of measure used to assess the nutritional needs of livestock and the carrying capacity of a farm. It equates to the amount of feed required daily by a two-year-old, 50 kg Merino wether.
- **Leaseholder** – A person or entity granted a Crown lease by the Territory, giving them the right to occupy and use land according to the terms and conditions of the lease.
- **Noxious pest/pest** – An animal, insect, or plant considered harmful to agriculture, the environment, or human health, and officially declared or classified as such under relevant legislation or regulations.
- **Olfaction** – The sense of smell.
- **Open season** – A specific period during which it is legally permissible to hunt, take, or possess certain wildlife species that are otherwise protected. An open season is officially declared by the relevant authority (e.g., the Minister responsible for wildlife or a delegated agency) and specifies:
 - The dates during which hunting or taking of wildlife is allowed.
 - The species to which it applies.
 - Any conditions or restrictions, such as location, bag limits, or methods of hunting.
- **Pasture Protection Board** – Local government bodies established under the *Pastures Protection Act 1934*. The 59 boards in NSW were responsible for managing grazing, controlling pests like rabbits and feral animals, and promoting sustainable land management.
- **Protected species** – Species protected by law that cannot be taken, harmed, or interfered with without appropriate authorisation.
- **Reintroduction** – The movement of wild animals into part of their former range from which they have been extirpated.
- **Translocation** – The deliberate movement of wild animals from one part of their range to another.

- **Vermin** – Species of animals not protected by law and often considered pests due to their negative impacts on agriculture, native species, or the environment.
 - Declared vermin can usually be destroyed or managed at any time, including outside of open seasons, unless other laws (such as firearms laws) apply.
 - The list of vermin is not fixed and can be updated by regulation or proclamation.

Executive summary

The ACT seeks to adopt a holistic and informed approach to wombat management, balancing species conservation with protection of landholder and industry assets. This document reviews relevant information to inform best-practice wombat management and to ensure populations persist in the ACT.

The scope encompasses cross-jurisdictional legislation, stakeholder views, management methods and monitoring approaches. The document also highlights current challenges within the ACT, including the complexities involved in balancing conservation with stakeholder needs.

As native marsupials wombats are integral to the region's ecosystem but present several management issues. These include wildlife-vehicle collisions and conflict with agricultural activities. Wombats may face challenges including urban expansion, habitat loss and the prevalence of sarcoptic mange.

Key findings from the review include:

- **Legislation and Policy:** Unlike other Australian jurisdictions, the ACT does not allow specific provisions for the control of wombats nor provide guidance on non-lethal conflict mitigation. This has led to frustration among leaseholders managing wombat-related damages.
- **Threats to Wombats:** Habitat loss and sarcoptic mange remain the primary threats. Management of sarcoptic mange is complex and is currently conducted by wildlife carers. There is no clear mechanism for the government to limit the application of mange treatments in areas where chemicals may have negative ecological consequences. There are currently no guidelines around the release of rehabilitated wombats, including identified release zones that are ecologically suitable.
- **Stakeholder Conflicts:** The ACT has diverse stakeholders who hold conflicting views on how wombats should be managed. Consultation with stakeholder groups on policy changes is a possible method for reducing tension and increasing stakeholder support. Working groups, such as the Wombat Mange and Monitoring Group, also provide forums for stakeholders to engage on topics relevant to their concerns and interests.
- **Public education:** Development of housing near areas of wombat activity can increase incidences of human-wildlife conflict. Providing informative material and engaging in public communication are strategies to increase awareness in the community.

- **Management Tools:** Fencing, burrow modifications, and deterrents are available to manage wombat damage, but are often resource-intensive and may yield inconsistent results. Many have not been trialled in the ACT and stakeholders may not be aware of the available options. Burrow modification interventions would require additional approvals, and there is currently no streamlined application process to make this available to landholders.
- **Research and collaboration:** The ACT partners with citizen scientists to collect data on wombats through the ACT Wombat Portal, NatureMapr, and WomSAT. Where possible, decision-making should be based on systematic surveys that are scientifically robust and fit for purpose. Leaseholders currently do not have a method of reporting wombat impacts on their property.

Recommendations include:

- Support non-lethal methods for wombat control by land managers to mitigate damage, which may include the provision of information, resources and training;
- Develop an appropriate mechanism to allow humane euthanasia of wombats on rural lands that are afflicted with severe mange, noting animal welfare considerations;
- Coordination between ONC ecologists and PCS Licensing and Compliance to clearly identify areas within the ACT, and possibly NSW, where rehabilitated wombats can be released. Selection of suitable sites can reduce the likelihood of overabundance and future human-wildlife conflict;
- Review procedures and licensing pathways for the deployment of Cydectin and other mange treatments to ensure appropriate placement that minimises negative impacts on aquatic systems;
- Over the longer term, explore and evaluate options to support holistic management of Bare-nosed Wombats in the ACT through an appropriate policy mechanism, including for example, a Controlled Native Species Management Plan under the *Nature Conservation Act 2014*.

1. Introduction

Wombats are iconic Australian marsupials, deeply embedded in the cultural heritage of First Nations Peoples and the national identity (Garvey et al., 2016). There are three extant species: the Bare-nosed Wombat (*Vombatus ursinus*), the Southern Hairy-nosed Wombat (*Lasiorchinus latifrons*), and the Northern Hairy-nosed Wombat (*Lasiorchinus krefftii*). Although once likely widespread, all three species have experienced significant declines and range contractions since European settlement (Aitken, 1971, Gordon et al., 1985, Buchan A and DC, 1998, Cooke, 1998, McIlroy, 2008). The clearing of land for agriculture and urban development, coupled with the introduction of European rabbits (*Oryctolagus cuniculus*), has had a profound impact on wombat populations (Aitken, 1971, Cooke, 1998). Rabbits provided competition for food and shelter (Cooke, 1998), and wombat warrens were often destroyed during rabbit control efforts (Triggs, 2009). Increasing conflict with livestock (Crossman et al., 1994) also contributed to population pressures. The Northern Hairy-nosed Wombat suffered the greatest decline, reduced to a single known population of approximately 30 individuals by 1982 (Gordon et al., 1985). It is now listed as endangered under the *Nature Conservation Act 1992*. In contrast, the Bare-nosed Wombat was declared vermin as early as 1906 in Victoria, and considered a pest in other states (Temby, 1998).

Historically wombats were widely regarded as pests, particularly because their burrowing behaviour damaged rabbit exclusion fencing (Aitken, 1971, Temby, 1998). This view contributed to sustained population control efforts and legislative measures in all jurisdictions to reduce their impact. The Australian Capital Territory (ACT) awarded early protection to Bare-nosed Wombats under the *Animals & Birds Protection Ordinance 1918*. Growing public concern over animal welfare, conservation, and sarcoptic mange has pressured other state governments to adopt more protective policies. Though wombats are now protected species in most states, they can be controlled under permit systems where they cause damage.

The management of wombats has become a highly contentious issue due to the complexities of trying to balance competing interests of stakeholder groups, including but not limited to local government, rural leaseholders, First Peoples and wildlife care groups. Conservation and wildlife care groups are concerned for the welfare of Bare-nosed Wombats and advocate for better protections. Agriculturalists want to manage the species to minimise the damage it can cause to infrastructure, stock and farm personnel. Given the diversity of stakeholder interests, reaching agreement on the best approach to wombat management is a persistent challenge.

This review highlights the legislative, ecological, and stakeholder challenges involved in balancing species conservation with human land use and infrastructure needs. It reviews past and current legislation across the Australian states and territories to inform the conservation and management of wombats in the ACT.

2. Legislation, policy and regulation

2.1 Policy and legislation

Following European settlement and the expansion of agriculture in Australia, all three wombat species have experienced conflicts with humans. Initially, conflicts arose because wombats caused damage to rabbit exclusion fencing and wombat burrows provided refuge for rabbits. As a result, wombats were commonly viewed as pests and were able to be lethally controlled under legislation in most states.

The range of all three species of wombat contracted significantly as a result of large-scale land clearance for agricultural and urban development, and the introduction of European rabbits (*Oryctolagus cuniculus*) (Aitken, 1971, Temby, 1998, Gordon et al., 1985, Buchan and Goldney, 1998, McIlroy, 2008, Cooke, 1998). Over time attitudes towards wombats and concern for their conservation increased and legislation changed to reflect this.

This section provides an overview of the legislative frameworks and policies related to wombat management across various Australian states and territories. These frameworks serve to inform the management approaches in the Australian Capital Territory (ACT) and offer potential insights into improving wombat conservation and management strategies.

2.1.1 Victoria

Legislative history

The Bare-nosed Wombat was declared vermin throughout the state of Victoria in 1906, under provisions of the *Vermin Destruction Act 1890* (Seebeck 1988). In 1925, a bounty was placed on Bare-nosed Wombats under the *Vermin and Noxious Weed Act 1922*, with more than 60,000 bounties paid up until 1955. The bounty was subsequently suspended in 1966 and officially abolished in 1971. Bare-nosed Wombats remained a pest to many and from 1971 to 1986 government officials fumigated their burrows on Crown land.

In 1977, Bare-nosed Wombats were declared protected under the *Wildlife Act 1975* in the region west of the Melbourne to Sydney railway line, where they occurred in low numbers. The vermin status of the species was maintained in eastern Victoria until 1984, when Bare-nosed Wombats were protected under the *Wildlife Act 1975* across all Victoria. Lobbying by farmers led the species to be declared ‘unprotected wildlife’ in 193 parishes in eastern Victoria under the *Wildlife Act 1975*. The declaration of the species as ‘unprotected wildlife’ enabled the destruction of Bare-nosed Wombats by landholders, their families, and employees by means of fumigation, trapping or shooting on freehold or leasehold land, and within 1 km of such land on adjoining Crown land. In June 1997, the *Wildlife Act 1975* was modified to enable destruction only on the occupier’s property with a high-powered, centre-fire rifle of .222 calibre or larger.

Current legislation and process

In February 2020, an amendment to the *Wildlife Act 1975* revoked the unregulated control of Bare-nosed Wombats across 193 parishes in eastern Victoria. It is now an offence to kill, take, control or harm Bare-nosed Wombats across the entire state of Victoria without authorisation. This includes activities such as destroying or disturbing their burrows. To destroy a wombat without a permit carries a penalty ranging from \$8,261 to \$39,652 and/or six to twelve months in jail. On March 19, 2025 the Victorian Legislative Council voted to review the state’s lethal control program for wombats and explore alternative control measures. The review was still underway at the time of writing and no formal legislative changes had been announced.

To destroy a wombat or their burrows landowners need to apply for an authority to control wildlife permit (ATCW) from the Department of Energy, Environment and Climate Action which can be done [online](#), by post or email (Table 1). Applicants are required to demonstrate damage to their property, crops or pasture, impacts on biodiversity values, or risks to human health or safety. Applicants must also demonstrate that all other reasonable options have been considered. A [wombat management methods factsheet](#) outlines “non-lethal” management options for landholders. Forest and Wildlife Officers review applications and may require a property inspection. This process can take up to six weeks to complete.

Each ATCW specifies the species of wildlife that can be controlled and the method of control. Anyone shooting wildlife under the *Wildlife Act 1975* must also comply with the [Firearms Act 1996](#).

Table 1. The number of permits issued to control Bare-nosed Wombats and the number of animals to be harmed in Victoria over the last seven years

Year	Number of permits	Animals authorised to be culled
2023	222	1902
2022	226	1862
2021	207	1675
2020	273	1478
2019	268	3655
2018	252	3830
2017	270	3374

2.1.2 New South Wales

Legislative history

New South Wales was home to all three species of wombat until the last claimed sighting of Northern Hairy-nosed Wombats in 1909. Bare-nosed and Northern Hairy-nosed Wombats had partial protection under the *Native Animals Protection Act* 1903. Under this act both species were protected from destruction during the declared closed season from August to January each year. Bare-nosed Wombats lost these protections when they were not included on the list of protected species under the *Animals and Birds Protection Act* 1918. Bare-nosed Wombats regained legal protection under the subsequent *Fauna Protection Act* 1948. Landholders were required to obtain permits for wombat destruction, except in areas governed by Pasture Protection Boards. At this time, wombats were also regarded as a noxious pest by the Department of Agriculture under the *Pastures Protection Act* 1934. This created a conflict in areas where landholders were required to destroy wombats under the *Pastures Protection Act* 1934, but could be prosecuted for doing so under the *Fauna Protection Act* 1948.

In 1959 the National Parks and Wildlife Service and the Department of Agriculture reached a compromise, leaving Bare-nosed Wombats unprotected but no longer declared noxious. As a result, both species of wombat became fair game for sports shooters and landholders. In March 1973, Bare-nosed Wombats were awarded full protection with provision for destruction for damage control purposes by being removed from the First Schedule (list of unprotected animals) of the *Fauna Protection Act* 1948-67. The following *National Parks and Wildlife Act* 1974 provided full protection to Northern Hairy-nosed Wombats, which were classed as endangered. Bare-nosed Wombats were also given protection with a provision for damage control under a permit system.

Current legislation

Wombats are protected under the *NSW Biodiversity Conservation Act* 2016. It is an offence to harm a wombat unless a licence is obtained from the Department of Climate Change, Energy, the Environment and Water.

To obtain a licence landholders must demonstrate animals are a threat to human safety, damaging property and/or causing economic hardship. Where possible, the department seeks to resolve negative interactions using non-destructive methods and recommends non-lethal methods [on their website](#). However, a licence to harm individual animals may be required to mitigate problems. To apply for a licence, landholders must contact their local National Parks and Wildlife Service (NPWS) office to discuss the nature and severity of the issue and any non-lethal measures that may resolve the problem. They can then [download and fill in an application form](#) and lodge it with their local NPWS. The National Parks and Wildlife Service may grant a licence to the owner or occupier of a property to cull wombats. Records of the number of animals harmed need to be kept on a record sheet provided and lodged with the NPWS office within 7 days of the licence expiry. All people operating under the licence must comply with the *Firearms Act* 1996 and the Code of Practice for the Humane Destruction of Wombats by Shooting in NSW. Harming wildlife without a permit may receive a maximum fine of \$330,000 with an additional \$33,000 for each animal harmed or two years in jail.

Within the last seven years a small number of permits have been issued (Table 2). The maximum number of Bare-nosed Wombats to be harmed on any one permit was 50 animals. More commonly permits range from 1 – 20 animals for issues including damage to crops, competition with stock, hazard for vehicles, damage to fencing, and causing erosion and disease.

Table 2. The number of permits issued to control Bare-nosed Wombats and the number of animals to be harmed in New South Wales over the last seven years.

Year	Permits issued	Number of wombats to be harmed
2023	34	187
2022	38	219
2021	26	138
2020	42	221
2019	76	501
2018	103	752
2017	40	193

2.1.3 Queensland

Legislative history

The Northern Hairy-nosed Wombat and Bare-nosed Wombat were protected in Queensland under the *Native Animals Protection Act 1906*. However, this and subsequent Acts provided provisions for damage control. By 1982, the Northern Hairy-nosed Wombat was restricted to a single population of approximately 30 animals (Gordon et al., 1985). The *Fauna Conservation Act 1974-1989* provided permanent protection for the Northern Hairy-nosed Wombat with no provision for damage control. Northern Hairy-nosed Wombats were declared endangered under the *Nature Conservation Act 1992*. Bare-nosed Wombats remained protected with provision for damage control under a permit system.

Current legislation

Northern hairy-nosed and Bare-nosed Wombats are protected under the *Nature Conservation Act 1992*, though there are provisions to control Bare-nosed Wombats *for* damage mitigation purposes. A damage mitigation permit is required to take wildlife to minimise damage or loss of property (e.g. crops) or to protect human health and wellbeing. Damage mitigation permits may cover the removal and translocation of problem animals or lethal control.

To obtain a three-year permit to remove and relocate wildlife applicants must demonstrate the following:

- Certificate of completion of a training course concerning the keep, relocation, and safe handling of relevant wildlife.
- A current first aid certificate issued by an approved first aid provider.
- Referee reports from two suitably skilled and qualified persons.
- Statements outlining the ability to handle wildlife, including safety procedures to be applied when handling or moving wildlife and access to appropriate equipment.
- Statements outlining wildlife identification skills.
- A resume including details of qualifications provided with the application.

If an applicant does not have any experience, they are recommended to contact a local damage mitigation permit holder for guidance and possible endorsement under this permit type.

To obtain a permit to lethally control wildlife, applicants must demonstrate damages caused and the economic losses incurred, or any threats to human health (e.g. disease or injury risks). Two non-lethal damage mitigation measures to prevent or minimise damage need to have been attempted prior to application for lethal control. There are no specifications about suitable non-lethal methods to be used or the duration of use. A statement outlining the applicant's relevant knowledge and experience in correctly identifying the relevant species is required. Permits are issued for one-year unless the landholder has an approved property management plan, in which case permits can be issued for three years. The Department of Environment Science and Innovation offers a service to guide applicants through the assessment process. The service includes meeting with a departmental project manager to discuss the information needed for the application. Applicants can email a [downloadable form](#) to the permits and licensing department and may take up to 40 business days to process. Once a permit has been granted, permit holders are required to lodge a return of operations form every three months and within 10 days of the permit expiry detailing how many animals were taken under the permit. The maximum penalty for *controlling protected wildlife without a permit* is \$15,480 (100 penalty units).

2.1.4 Tasmania

Legislative history

Bare-nosed Wombats were not protected in Tasmania until the passing of the *National Parks and Wildlife Act* 1970, which provided partial protection allowing for the declaration of an

open season. The Minister by order, could declare the dates and places on which the taking of any partially protected wildlife may start, stop, be prohibited or permitted and impose any conditions on the order. No open seasons were declared, and destruction for damage control purposes was undertaken by permit.

Current legislation

Bare-nosed Wombats are protected under the *Nature Conservation Act 2002* with provision for damage control.

The Department of Natural Resources and Environment encourages people to use non-lethal management options for mitigating wombat damage and several factsheets can be found on their website for [Living with Wombats](#). A [property protection permit](#) is needed to control protected wildlife, including Bare-nosed Wombats (Table 3). Permits can be applied for by landholders, managers or lessees of land to prevent the destruction of, or injury to any stock, crops and equipment or infrastructure used in crop and/or stock production. Applications must identify the damage caused, the method of control to be used and the number of animals they want to take. The Department of Natural Resources and Environment must be satisfied a financial loss is likely to occur if the crop, stock, equipment or infrastructure is not protected. Applications are assessed on a case-by-case basis, which may include a visit to the applicant's property. The local abundance of Bare-nosed Wombats, the impacts they may have on the property, and whether non-lethal measures will be effective at the site are considered when issuing permits.

The Department of Natural Resources and Environment Tasmania assesses population trends using annual spotlight monitoring of 190 10-km transects across the state. Issued permits specify the number of Bare-nosed Wombats that may be taken and a timeframe of up to 12 months. Permit holders are required to maintain accurate records of animals destroyed and report them within 28 days of the permit expiry. Persons controlling wildlife without a permit or who do not comply with the terms of their permit can receive a penalty of up to \$19,500 (100 penalty units).

Table 3. The number of permits issued to control Bare-nosed Wombats and the number of animals to be harmed in Tasmania from 2016 to 2022. N/A cells indicate a lack of data.

Year	Permits issued	Total quota issued	Wombats culled
2022	9	165	29
2021	6	N/A	17
2020	5	51	20
2019	4	N/A	107
2018	6	110	N/A
2017	22	160	N/A
2016	52	2171	N/A

2.1.5 Western Australia

Legislative history

Southern Hairy-nosed Wombats were not provided protection under early game acts in Western Australia. The *Game Act 1912* provided protection to all “non harmful” native fauna, but it is unclear whether this extended to Southern Hairy-nosed Wombats. The *Fauna Protection Act 1950* was the first to provide blanket protection to all native fauna in the state, including Southern Hairy-nosed Wombats. In 1975 it was re-named the *Wildlife Conservation Act 1950* and included new provisions for damage control permits.

To prevent Southern Hairy-nosed Wombats from becoming an agricultural threat across the state, the Agricultural Protection Board declared them as vermin in areas of WA outside their known range. In 1973, the declaration was amended to include Southern Hairy-nosed Wombats as a pest species under the *Vermin Control Act 1918-1970*. When the *Vermin Control Act* was replaced by the *Agriculture and Related Resources Protection Act 1976*, the Southern Hairy-nosed Wombat was included as a category seven declared animal. As a category seven species, the Minister had the authority to recommend and approve a species management plan that included management by lethal control.

Current legislation

In 2019 the *Wildlife Conservation Act* 1950 was replaced by the *Biodiversity and Conservation Act* 2016 and the Biodiversity Conservation Regulations 2018. Under the Biodiversity Conservation Regulations 2018, there are provisions for controlling fauna that have been listed as managed species. Fauna may be listed as a managed species if they are determined to be impacting public safety or biosecurity or causing economic or ecological damage. The Southern Hairy-nosed Wombat is not currently listed as a managed species. There are no records of licence applications or grants for Southern Hairy-nosed Wombat control in Western Australia.

When fauna cause damage to agriculture, native animals may be declared pests under the *Biosecurity and Agriculture Management Act* 2007 (BAM Act). Under the BAM Act, every organism except a human being has a legal status assigned through a declaration made by the Minister. If the Minister has not made a declaration, the status automatically remains unlisted. BAM status determines whether a permit is required to import the organism into Western Australia. The Southern Hairy-nosed Wombat is listed as a Permitted species S11 (exempt) on the Western Australian organism [list](#) under the BAM Act. This means they are not a declared pest and can be imported into the state without a permit provided they satisfy import permits and can be kept without a permit.

2.1.6 South Australia

Legislative history

Wombats gained their first legal recognition under the *Animals Protection Act* 1912 on the schedule of unprotected animals. Partial protection was achieved under the provision of *Animals and Birds Protection Act* 1919 with the declaration of a closed season on wombats from July to December. During the closed season landholders were only permitted to cull wombats for damage control purposes. The Fauna Conservation Act 1964 provided full protection with a provision for controlling wombats for damage mitigation. Under the *National Parks & Wildlife Act* 1972, the Bare-nosed Wombat was listed as 'Vulnerable' with full protection. The Southern Hairy-nosed Wombat was permitted to be controlled for damage mitigation purposes.

Current legislation

The Bare-nosed Wombat and Southern Hairy-nosed Wombat are protected under the National Parks and Wildlife Act 1972 (NPW Act). It is an offence to catch, interfere with, harass, or kill both species without a permit. The Department for Environment and Water recommends

using non-lethal means for managing wombats prior to resorting to culling and has a “Living with Wombats” [factsheet](#). The Department of Environment Water can issue destruction permits in circumstances where wombats cause damage or threaten human safety (*section 53.1c of the SA National Parks and Wildlife Act 1972*). Permit application forms are available [online](#) and can be emailed, posted or dropped off at the nearest regional office. Applications are considered by National Parks and Wildlife rangers on an individual basis. Consideration is given to whether non-lethal means may resolve the problem, the extent of the damage and threats to safety. There is a [code of practice for the humane destruction of wombats](#) which permit holders must abide by. The penalty for killing a wombat without a permit is a \$2,500 fine or six months in prison.

An amendment was made to the National Parks and Wildlife Act in 2023 prohibiting the destruction, damage or disturbance of wombat burrows without a permit, with a maximum penalty of \$5 000 or imprisonment for 12 months. Permits are not required if:

- you are the owner of the land where the burrow is located,
- you are authorised to destroy, damage or disturb the burrow by the owner of the land where the burrow is located; and
 - the burrow is located outside of a Wombat Burrow Protection Zone; and
 - the burrow is causing, or is likely to cause, damage to crops, stock, machinery or infrastructure (including tracks and built structures) or may constitute a safety risk or hazard to people.

If a burrow is located within a declared Wombat Burrow Protection Zone a person must not, without a permit, destroy, damage or disturb the burrow. No Wombat Burrow Protection Zones currently exist so a permit is not presently needed to destroy a wombat burrow. There is a protection for wombat burrows [factsheet outlining the new changes](#).

2.1.7 Australian Capital Territory

Legislative history

Bare-nosed Wombats have been fully protected in the ACT since the *Animals & Birds Protection Ordinance* 1918. Successive Commonwealth ordinances and the *Nature Conservation Act* 1980 kept full protection in place.

Current legislation

As native animals under the *Nature Conservation Act 2014*, Bare-nosed Wombats remain protected. Killing a native animal is an offence under section 130 of the Act, which presently carries a maximum penalty of \$16,000 and/or imprisonment of 1 year for an individual, or \$81,000 for a corporation (higher if the species is specially protected). Under sections 128-129 of the Act, it is an offence to interfere with a nest (including burrow) of a native animal. These offences presently carry a range of penalties, up to (in a case involving a wombat) \$16,000 and/or imprisonment of 1 year for an individual, or \$81,000 for a corporation. A range of offences apply to damaging land in a reserve. The maximum penalty for the most serious of these offences is presently \$400,000 and/or 7 years' imprisonment for an individual, or \$2,025,000 for a corporation. Some activities, including nest destruction, may potentially be carried out under a licence issued by the Conservator of Flora and Fauna. It is the responsibility of the proponent to apply for a licence for any proposed activity that may otherwise be an offence under the Act. The ACT Parks and Conservation Service administers the Act and conservation officers are responsible for conducting compliance activities. These include public education, inspections and investigations to promote and support compliance.

In 2025, the ACT Government strengthened its regulatory framework for wildlife protection during development by introducing the Nature Conservation (Protection of Burrowing Animals During Development) Conservator Guidelines. These guidelines, issued by the ACT Conservator of Flora and Fauna, are a notifiable instrument under the *Nature Conservation Act 2014*, giving them legal force and requiring compliance from developers operating in areas with suitable habitat. The guidelines aim to minimise harm to native burrowing animals, such as Bare-nosed Wombats, by requiring site assessments, avoidance of active burrows, and consultation with the Conservator where disturbance is unavoidable.

2.1.8 Differences between the ACT and other jurisdictions on wombat control

Apart from the ACT, all jurisdictions currently have a specific provision under legislation to enable wombat control for the purpose of damage mitigation. Victoria is currently conducting a review of their lethal control policies for wombats, but this review is still in progress and there have been no legislative changes. Control is regulated by a permit system, and landholders are required to pursue alternative management methods in almost all states before seeking a culling permit.

Tasmania is the only state which considers trends in wombat populations when setting permit allocations. Understanding baseline population data is critical to assessing a program's efficacy and impacts. Controlling too few individuals can be ineffective at reducing damages, while removing too many can have negative conservation outcomes (Taggart et al. 2008).

Most states have an online permit application system or provide a form that can be submitted to the relevant department. Applications typically take 4-6 weeks to process, and landholders may be frustrated by these timeframes (Sparrow, 2011, Stott, 1998, Bunn, 2019). When landholders are faced with wombats burrowing under dams and other infrastructure, they feel prompt action is required to prevent further damage. Most states require the applicant to have tried 'non-lethal' damage mitigation strategies before applying for a permit, but guidance on 'non-lethal interventions' may not be provided. Further research into the efficacy and animal welfare considerations of common 'non-lethal interventions' is also required.

There has been a substantial reduction in the number of permits and the number of wombats permitted to be culled within the last decade across all states. This is in response to mounting public pressure on government agencies from conservationists and animal welfare advocates. As a result, landholders feel they are unable to reduce the damage caused by wombats on their property. For many farmers, the lengthy application process is not worth the time it takes to apply for a permit if they are only permitted to cull 10-25 wombats. As such some landholders act outside of permit systems and official government registers are considered an underestimate of the true numbers of wombats culled (St John and Saunders, 1989, Taggart et al., 2008).

3. Wombats in the ACT

3.1 Distribution and abundance

Prior to European settlement Bare-nosed Wombats were thought to have a continuous distribution across much of their range including the ACT. Following European settlement, the establishment of farming along with the introduction of rabbits is thought to have had a significant reduction on the distribution and abundance of all three species of wombats (Buchan A and DC, 1998, Cooke, 1998). Dingoes (*Canis familiaris dingo*) have been known to predate on wombats where the two species co-occur, but their effects on overall population numbers is unclear (Thorley and Old, 2020). Current occurrence records from the ACT Wildlife Atlas show Bare-nosed Wombats are widespread across the ACT, particularly along the

Murrumbidgee and Molonglo River (Figure 1). Wombats are also known to occur across Namadgi National Park (CED survey data).

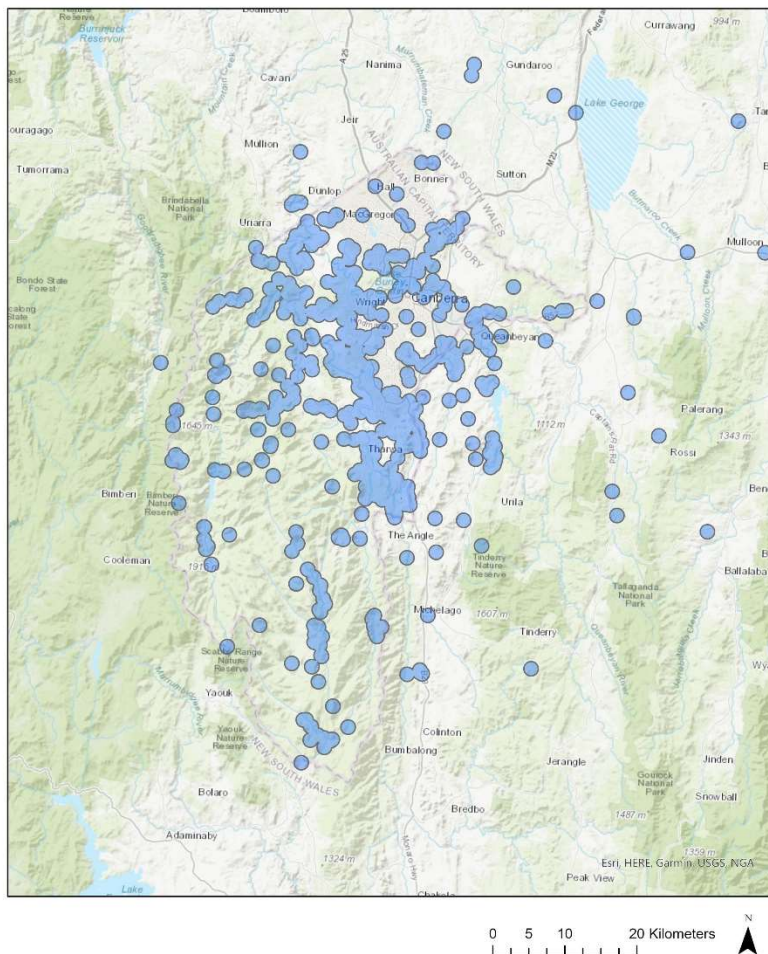


Figure 1. The known distribution of Bare-nosed Wombats (blue) in the Australian Capital Territory, taken from ACT Wildlife Atlas records, CED survey data and the [ACT Wombat Manage Portal Map](#). This data collection system is designed to capture data within the ACT and is likely an underrepresentation of wombat distributions in NSW.

Abundance is likely to vary locally and regionally, depending on a range of factors, such as habitat type, soil type and climatic conditions. Competition from rabbits and kangaroos for food resources also limits Bare-nosed Wombat numbers in many areas (Tamura et al., 2021, Bird et al., 2012, Cooke, 1998).

There are currently no reliable estimates of abundance for Bare-nosed Wombats in the ACT. After an initial likely decline from habitat loss, following the expansion of agriculture and urbanisation, anecdotal reports from leaseholders suggest the distribution and abundance of Bare-nosed Wombats have increased over the last 10-20 years. Anecdotal evidence from park rangers also support an increase in distribution. Reports dating back to 1975 indicate Bare-nosed Wombats were not present on the Canberra plains or in Canberra Nature Park at the

time, though they were present in Tidbinbilla and Namadgi National Park. Rabbit control officers were known to target Bare-nosed Wombats because of the holes they made in rabbit proof fencing (Don Fletcher, pers. comm.; Higgins, 1991).

3.2 ACT Government stakeholder engagement

The Office of Nature Conservation (in CED) initiated a Wombat Working Group in 2021 to bring together stakeholders with interests in Bare-nosed Wombat management in the ACT to share knowledge and discuss management issues. The group consisted of wildlife carers, ACT Government, agriculturalists and researchers. The group met several times virtually, but lack of attendance meant that it was disbanded. A Wombat Mange Management Sub-group also commenced in 2021. The subgroup met quarterly until it was scaled back and eventually paused in 2024. For more information on relevant stakeholders in the ACT see Section 4.

3.3 Monitoring and management

The Office of Nature Conservation conducted line transect surveys across 13 sites to monitor wombat populations in the ACT, but these methods have now been judged insufficient to robustly estimate abundance. For more information on monitoring wombat populations see Section 6.8.

Mange is treated by wildlife care groups under a CED permit for use of moxidectin on public land in the ACT, with strict conditions of its use around waterways due to its toxicity to aquatic species. For more information on the prevalence and treatment of sarcoptic mange in the ACT see Section 5.2.1.

3.4 Rescue and rehabilitation

There are two wildlife rescue organisations within the ACT that care for and rehabilitate sick and injured Bare-nosed Wombats. Wombat Rescue is solely dedicated to Bare-nosed Wombats, and ACT Wildlife cares for all injured wildlife. Wombat Rescue operates under a licence to take, rehabilitate and release wildlife in the ACT issued under Section 273 of the *Nature Conservation Act 2014*. Both groups work closely with each other and NSW care groups to coordinate resources for the care of Bare-nosed Wombats.

Wombat Rescue reports responding to several call outs a day. In the last 6 months Wombat Rescue have taken 19 Bare-nosed Wombats into care. Records indicate up to 50 wombats are taken into care annually by Wombat Rescue and ACT Wildlife cares for 20-30. What most individuals take into care are pouch young orphaned as a result of road vehicle collisions. To a

lesser extent Bare-nosed Wombats with severe mange are taken into care for treatment, with carers preferring to treat mange in situ where possible.

Of the approximately 50-60 Bare-nosed Wombats taken into care each year fewer than 10 animals are released in the ACT. In 2024, 28 wombats from the ACT were taken into care and only five were released into the ACT. Animals that come into care from New South Wales must be released in NSW. Release sites are resource intensive to find. For wombats these may include a large enough area that is free from mange, away from roads, has available food and water, and a low density of resident wombats. ACT Wildlife procures empty burrows to release animals by evicting resident Bare-nosed Wombats with the use of one-way gates. Wombat Rescue creates artificial starter burrows to release animals by digging a 70 cm deep L-shaped tunnel in flat ground. They place a 45 cm diameter trench liner half pipe over the hole before filling it back in to make a tunnel. When creating tunnels on private land they use soft release techniques, fencing the burrow and providing supplemental food. Animals released into parks and reserves are not provided supplemental food or fenced burrows. Carers monitor released individuals for a few weeks using wildlife cameras, but released animals rarely stay in the release area.

More recently, there has been request from Wombat Rescue that ACT Government provide land for a pre-release wombat sanctuary or haven to prepare rehabilitated wombats for wild release. Areas would need to be designated and fenced for this purpose, and policy or guidelines developed around effective and safe release of wombats. The feasibility and need for a wombat sanctuary, and the role of the ACT Government in providing such a facility, is still in discussion.

4. Stakeholder consultation and interviews

This section lists the primary stakeholders invested in Bare-nosed Wombat management in the ACT, and their interests in this issue (Table 4). It is important to note this is not a comprehensive review of stakeholder opinions on Bare-nosed Wombat management in the ACT and only expresses the views and opinions of a small number of people from each stakeholder group. Views and opinions are likely to vary within stakeholder groups. A formal review of stakeholder views is recommended.

Table 4. Identified stakeholders within the ACT with an interest in Bare-nosed Wombat management

Group	Organisation/name	Role in relation to Bare-nosed Wombats
ACT Government	Office of the Conservator of Flora and Fauna, City and Environment Directorate	Acts on issues that affect the conservation matters covered in the <i>Nature Conservation Act 2014</i> , particularly protecting native plants and animals
	Office of Nature Conservation Policy, City and Environment Directorate	Updates policy and legislation under the <i>Nature Conservation Act 2014</i>
	Office of Nature Conservation, City and Environment Directorate	Undertake a range of nature conservation programs in the ACT, including research on local flora and fauna, preparing scientific advice on ecological and natural resource management, conducting ecological surveys, biodiversity monitoring
	City Services, City and Environment Directorate	Deliver a range of services, including shop and playground upgrades, road and path maintenance, domestic animal services, and the management of urban open spaces including tree planting and grass mowing that may be impacted by Bare-nosed Wombat behaviour
	ACT Natural Resource Management, City and Environment Directorate	Integrated management of ACT's natural resources, including biodiversity, sustainable agriculture and cultural history
	ACT Parks and Conservation Service, City and Environment Directorate	Land management of the conservation estate, vertebrate pest and weed control, and managing visitor experiences.
	Licensing and Compliance, City and Environment Directorate	Licensing and compliance under the <i>Nature Conservation Act 2014</i>
	Urban Wildlife, ACT Parks and Conservation Service, City and Environment Directorate	Manage the outcomes of human-wildlife conflict, including nuisance animals, vehicle strikes and sick and injured animals

Group	Organisation/name	Role in relation to Bare-nosed Wombats
	Veterinarians, City and Environment Directorate	Administering treatment and care of animals including wildlife within the ACT
Industry	Icon Water	Responsible for maintaining supply of water and sewage services in the ACT. These services may be impacted by Bare-nosed Wombat activity on occasion and require management
	Developers	Construction of new developments within the ACT in compliance with Conservator Guidelines for Burrowing Animals
Agriculturalists	Rural leaseholders	Land management and agricultural production which may be impacted by Bare-nosed Wombat behaviour
	ACT Rural Landholders Association	Advocacy for farmers and best practice farming within the ACT
Wildlife carers	Wombat Rescue	Caring for injured wombats and treating mange infected populations within the ACT. Advocate for wombat conservation and welfare
	ACT Wildlife	
Researchers	Prof Scott Carver	Conducting research on wombat ecology, biology and management
Ngunnawal	Dhawura-Ngunnawal Caring for Country Committee (DNCCC)	The representative body for ACT Government for traditional custodians of the Country in and around the ACT

4.1 Rural leaseholders

Rural leaseholders are frustrated by their current ability, or lack thereof, to manage Bare-nosed Wombats on their properties. Streambank erosion and reduced water quality as a result of wombat burrowing near waterways have been raised as a concern by landholders in correspondence with the ACT Government. Burrows and tunnels are becoming a big safety concern, with some paddocks described as ‘Swiss cheese’. Staff and stock are frequently injured by falling into burrows (see section 9.2.1). Rabbits have become difficult to control, as they shelter in Bare-nosed Wombat burrows and cannot be treated. Landholders have

expressed interest in the development of an authorised control program like the kangaroo management program in the ACT.

The management of mange on private properties is a cause of concern for rural leaseholders. Some leaseholders have reported their dogs have contracted mange from the burrows of infected animals. This has resulted in expensive vet bills and distress to both dogs and their owners. Wildlife carers have also been caught trespassing on private property to treat mange. Landholders are concerned carers may be applying toxic chemicals without their knowledge. Furthermore, some leaseholders have experienced pressure from lobby groups in relation to kangaroo management and are apprehensive of similar dynamics with wombat carer groups.

Rural landholders within the ACT are frustrated by the current level of engagement with ACT Government on wombat management issues. Those involved in the Wombat Working Group have expressed concern that the group was heavily focused on conservation and mange treatment and did not adequately address the difficulties of managing wombats on rural properties. Their view is that rural landholders should be engaged directly to better understand the management issues they are facing, and to develop damage mitigation strategies to improve co-existence with wombats. Concerns about sick wombats on rural lands were raised. For these strategies to be successfully implemented, they must be accepted by landholders as feasible and effective options. Additionally, continuing discussions between researchers, ecologists and landholders on the ecological value of wombats may improve landholder tolerance of wombats and facilitate effective management (Schumann et al, 2012).

It is important to note, there are 381 farmers within the ACT and only three rural leaseholders were consulted in the writing of this review. The views presented here do not necessarily represent the views of all rural leaseholders within the ACT.

4.2 Wildlife carers

ACT Wildlife and Wombat Rescue are two groups rehabilitating Bare-nosed Wombats in the ACT. Wombat Rescue are often called out to assess the condition of injured or mange-affected animals by the ACT Parks and Conservation Service (PCS) and the public. Wombat Rescue has approximately 20 active members who respond to calls and their resources are strained. They are concerned about the level of awareness and training rangers have in assessing mange cases and determining if treatment or euthanasia is needed. While carers acknowledge assessing the severity of mange is subjective, they would like mange training courses to be mandatory for all rangers to attend. To address this issue in part, the ACT Chief Veterinary

Officer developed the 'Assessment of sarcoptic mange in wombats: A guide for rangers' as a decision sheet for PCS rangers assessing mange severity and the need for humane euthanasia. Additionally, carers are concerned about the lack of suitable release sites for rehabilitated animals in the ACT, leading to most releases occurring in NSW. Both care groups worry about post-release survival and are exploring GPS tracking to monitor outcomes.

Wombat Rescue leads efforts to treat mange across populations, while ACT Wildlife limits treatment to intended release areas (see section 9.3.1). Despite ongoing efforts, carers lack the resources to eliminate mange from populations and believe more needs to be done to control the disease. Wombat Rescue also notes that some leaseholders are reluctant to allow property access to wildlife carers to treat mange affected Bare-nosed Wombats, increasing tension between the stakeholder groups.

Urban development in the ACT is encroaching on Bare-nosed Wombat habitats, likely forcing them into river corridors and increasing population density (see section 9.3.2). While carers have positive relationships with some developers, they are concerned others neglect proper wombat management. Carers fear Bare-nosed Wombats are being pushed into narrow river corridors which will place a strain on resources and result in more aggressive territorial behaviour. They would like to see buffer zones placed around new developments to minimise impacts to Bare-nosed Wombats, but no context was provided.

4.3 Community

Bare-nosed Wombats frequently interact with areas used by the broader community. As urban sprawl encroaches on Bare-nosed Wombat habitat there will likely be increases in human-wombat interactions and potential conflicts in urban areas. The broader community was not consulted as part of this review, and their opinions remain unknown.

Many people who do not live with wombats on their properties are often unaware of the issues these animals can cause, which contributes to resistance toward their management. Increasing public education about Bare-nosed Wombat biology, ecology, and the challenges they present can improve acceptance of species management strategies (Reiter et al., 1999). Including educational material on wombat ecology, impacts and management options on the CED website could be a valuable resource for the community. This would be similar to the information that is currently provided for other managed species (e.g. kangaroos). By fostering understanding through a well-structured information campaign, communities can better

support responsible Bare-nosed Wombat conservation and reduce human-wombat conflicts across urban and rural settings.

4.4 Ngunnawal

Bare-nosed Wombats were widely used by First Nations people in many parts of southeast Australia. Much of the traditional knowledge has been disrupted due to the impacts of colonisation. Unfortunately, limited access to relevant contacts has constrained our ability to assess the importance of Bare-nosed Wombats to the Ngunnawal community at this stage. Reviving and incorporating First Nations perspectives into contemporary conservation efforts can help honour cultural importance and provide holistic approaches to managing Bare-nosed Wombat populations in the ACT.

4.5 Office of Nature Conservation (ONC)

The management of Bare-nosed Wombats is becoming an emerging and complex issue for ONC. ONC initiated a Wombat Working Group to work with stakeholders and better understand the complexities and conflicting viewpoints in this space, but reported they had trouble engaging leaseholders within the working group. The working group came to an end when there was no new information to guide decision-making. ONC faces pressure from wildlife groups to manage mangle and has worked with researchers and wildlife carers to mitigate mangle impacts. This includes the creation of the Wombat Mangle and Monitoring Group, a subgroup of the Wombat Working Group focused on monitoring wombat populations and assessing mangle. While there is a desire within ONC to effectively manage this species, a range of knowledge gaps and resource allocation has proven to be a significant hurdle.

Ecologists in ONC are also responsible for the monitoring and conservation of a range of threatened riparian and aquatic species in the ACT. There are concerns that mangle treatments such as moxidectin are highly toxic to aquatic life, and the negative consequences this may have on threatened aquatic species.

4.6 ACT Parks and Conservation Service (PCS)

Rangers find it challenging to manage community frustrations surrounding wombat burrow management in ACT parks and reserves. Walking and cycling trails are often re-routed along sub-optimal routes due to the presence of Bare-nosed Wombat burrows. As conservation officers, rangers are permitted to interfere with wombat burrows where necessary and are required to adhere to the Conservator Guidelines for the Protection of Burrowing Animals.

Rangers would like support to manage burrows, particularly short starter burrows that are not used as a primary refuge.

Rangers have also raised concerns around streambank erosion and damage caused by wombats burrowing near waterways, particularly along the Murrumbidgee River.

4.7 ACT Natural Resource Management

The primary issues ACT Natural Resource Management (ACT NRM) encountered with Bare-nosed Wombat management were a result of conflicts with farmers. Anecdotally Bare-nosed Wombat numbers have increased in the last 15-20 years, and subsequently the number of conflicts has increased. Among landholders there is an appetite to declare Bare-nosed Wombats overabundant and allow lethal controls as a management tool. ACT NRM would be reluctant to implement lethal control as there are multiple knowledge gaps around current population levels and minimum viable populations. ACT NRM also highlighted the lack of resourcing for non-lethal options for managing conflict between landholders and Bare-nosed Wombats. Subsidising exclusion fencing in hotspot areas may be a feasible option for conflict resolution. One-way gates, another management option, may remove conflict in one area but relocate wombats and conflict to another area.

4.8 Icon Water

Bare-nosed Wombats have damaged Icon water essential services infrastructure (see section 9.2.1). Icon Water sought advice from ecologists on damage mitigation strategies but had difficulties finding skilled ecologists with capacity to assess the problem and implement recommendations. As a result, Icon Water now manages wombat damage independently based on online consultation with ecologists. They have adopted a variety of management strategies, but they require monitoring and management investments. Icon Water currently has sufficient resources to continue implementing their management program.

4.9 Licensing and Compliance

The Licensing and Compliance team is supportive of developing a CNSMP for wombats and indicated that this is preferable to issuing licenses for control. They recommended that if the ACT government was to permit lethal control of Bare-nosed Wombats it should be part of an evidence-based controlled native species management plan (CNSMP), similar to macropods. Additionally, the Licensing and Compliance team noted that a CNSMP should include clear guidelines around when control is appropriate, and the criteria that must be met for control to

occur. For example, the existing CNSMP for Eastern Grey Kangaroos clearly defines when control occurs, the number of animals to be removed, and benchmarks for shooter proficiency. A CNSMP for wombats should also be paired with a new code under the *Animal Welfare Act* that defines how wombats are to be controlled humanely. Currently there have been no formal complaints to the licencing department about Bare-nosed Wombats.

4.10 Office of the Conservator for Flora and Fauna

In recent years, wildlife carers have been concerned about the impacts of new development on Bare-nosed Wombats. In response, the Office of the Conservator for Flora and Fauna developed the Conservator Guidelines for the Protection of Burrowing Animals during development (Protection of Burrowing Animals During Development) Conservator Guidelines 2025 notified under the [Legislation Act 2001](#)). There are currently two licences issued to interfere with Bare-nosed Wombat burrows.

4.11 Scientists

The only scientist consulted during this review was Dr. Scott Carver, who specialises in researching wildlife disease ecology. Dr. Carver was a member of CED's Wombat Working Group and has worked with the ACT and Tasmanian governments on mange-related projects. He felt the Wombat Working Group effectively achieved its intended purpose. Similar to the Tasmanian wombat working group, the CED-led group came to a natural end when participants ran out of new information to bring to the table.

Dr. Carver has worked extensively with wildlife carers on mange treatment. He noted that within the stakeholder group there is disagreement over best practice treatment methods and determining when euthanasia is appropriate. He noted that conversations in this space can escalate quickly, and more research is necessary. A recent study by the Wombat Protection Society and associated researchers trialled increasing the dose of moxidectin from 20 ml to 100 ml to treat mange in wombats. Dr. Carver noted that this is a large increase in dosage, and studies gradually increasing the treatment dose to determine the lowest effective amount would be key to preventing excessive use of moxidectin.

Dr. Carver acknowledged leaseholders had conflicts with Bare-nosed Wombats and more research was necessary in this space, but it was outside his area of expertise.

4.12 Chief Veterinary Officer

The ACT Government Chief Veterinary Officer (CVO) was primarily concerned Bare-nosed Wombats treated for mange *in situ* are not getting the proper care they need. Ideally animals would be diagnosed by a qualified veterinarian prior to being given treatment, although the CVO did acknowledge that this was not possible when treating wild animals *in situ*. They raised concern that the indiscriminate application of moxidectin at all burrows within an area can lead to accidental overdosing of individual Bare-nosed Wombats. Conversely, some wombats may not receive a full dose if the chemical splashes as they are exiting a burrow or they move away from the treatment area. Healthy animals within the population will also unnecessarily receive treatments, which could lead to the development of chemical-resistant mites.

The drugs being used to treat Bare-nosed Wombats have the potential to cause harmful side effects in other species. Dogs that ingest moxidectin can experience neurotoxic effects and possible mortality. Faecal matter from treated animals contains traces of moxidectin, which can wash into waterways and affect aquatic systems. Responsible use of mange treatment drugs is critical to ensuring the negative impacts on ecological function are minimised.

4.13 Developers

The ACT population is projected to grow to 696,000 by 2050. Over the next few decades urban expansion is likely to further encroach on areas where Bare-nosed Wombats reside, resulting in management issues for urban developers. No developers were spoken to during this review. Consultation with developers is recommended to ensure urban expansion can be managed with minimal impacts on Bare-nosed Wombats.

5. Complexities of wombat management

The management of wombats is highly contentious, with challenges arising from the need to balance the competing interests of diverse stakeholder groups, including local government, leaseholders, First Nations, and wildlife care organisations (see Table 4). Conservation and wildlife care groups advocate for stronger protections for Bare-nosed Wombats, while agriculturalists and developers seek to manage the species to reduce damage to infrastructure, livestock, and personnel. This section seeks to bring together diverse stakeholder perspectives on a range of issues to highlight the complexities involved in reaching a management solution.

It is unlikely that all stakeholder groups will agree on a single approach to wombat management. However, participatory planning can improve communication and foster mutual understanding. Involving stakeholders in decision-making processes can lead to greater ownership of outcomes, enhance program credibility and transparency, and support the achievement of long-term goals (Hewitt and Messmer, 1997). Stakeholders are less likely to adopt or support management practices if they feel their opinions have not been taken into consideration and may take management actions into their own hands.

To date, there is no known research specifically examining the complexities of stakeholder relationships in wombat management. However, studies have explored landholder relationships with Southern Hairy-nosed Wombats (O'Brien, 2019, Sparrow, 2011, St John and Saunders, 1989, Stott, 1998) and Bare-nosed Wombats (Marks, 1998c). Additionally, the 5th IUCN World Parks Congress in 2004 brought together conservation experts to discuss human-wildlife conflict. Insights from this workshop, summarised by Madden (2004) provide a useful guiding resource for managing human-wildlife conflict.

5.1 Common causes of damage

5.1.1 Burrowing behaviour

Wombats are one of the largest burrowing herbivores in the world and create warren complexes that vary in complexity from single entrance burrows to a collection of interconnected burrows (warren). Burrows can vary in depth (0.4-2.8 m) and length (0.5-20 m), as such the spoil mound can be anywhere from 2.5-8 m² (Triggs, 2009, McIlroy, 1973). A Bare-nosed Wombat can use up to 11 burrows within their home range, though they typically favour the use of 1-2 burrows (Evans, 2008). Though their burrowing provides essential ecosystem services it often leads to conflicts with people. Bare-nosed Wombat burrows can undermine infrastructure such as roads, buildings, water tanks, fencing, dams which can result in substantial damage, financial costs and safety concerns.

One of the main points of contention for rural leaseholders with Bare-nosed Wombats on their properties in the ACT is the damage and occupational health and safety risks burrows can cause. This includes damage to fencing, dams, roads, buildings and erosion. Wombat damage to fencing can result in stock escaping from paddocks, posing a safety risk to both stock and people. Livestock may become injured or lost once they escape from the safety of a property resulting in financial losses to the rural leaseholders. Where properties adjoin parks and reserves there is a risk escaped stock may damage parks and reserves and incur fines for the

landholder. Furthermore, rural leaseholders have a legal responsibility to ensure their stock does not stray from their property and can be held liable for any damages if they escape. Fence damage can also allow access to properties from undesirable pest species such as pigs.

Rural leaseholders and Icon Water have reported issues with Bare-nosed Wombats burrowing into the sides of dams or reservoirs. This is not only a safety concern for people but also the Bare-nosed Wombat. If a dam wall breaks it has the potential to release large volumes of water, threatening farm water supplies and downstream properties. In addition, it could cause increased erosion and sediment washing into the Murrumbidgee River and other major waterways. This places a significant financial burden on the rural leaseholders who are responsible for appropriately maintaining their dams. Icon Water have been managing Bare-nosed Wombats burrowing around dams by using one-way gates to force animals to leave the burrow and filling the hole with cement once they have been evicted.

Icon Water, rural landholders and PCS rangers have reported safety concerns with Bare-nosed Wombats burrowing under roads and tracks and within paddocks. The weight of a vehicle driving over a tunnel can cause the tunnel to collapse, causing damage to vehicles and necessitating vehicle and road maintenance. For rural leaseholders, burrows pose a significant safety risk to people and stock. Landholders using quadbikes and buggies can incur significant injuries if their vehicle falls into a burrow, which can lead to lengthy recovery times and a loss of income. Rural leaseholders have reported vehicles falling in tunnels as frequently as once a month with estimated damages costing ~\$1,000. This risk is increased in summer when grasses and other vegetation obscure burrow entrances. Landholders can also be liable for injuries to contractors and other staff working on their property, and landholders have been sued by injured contractors. Stock falling into wombat burrows can negatively affect animal welfare and lead to financial losses. One rural leaseholder has had to remove high value stock from a paddock with high levels of Bare-nosed Wombat activity. When wombat burrows limit accessibility of paddocks landholders may not be able to carry out other management tasks such as weed control. While burrow entrances can be mapped to reduce the risk, it would need to be updated regularly to account for new burrows. This is not feasible for rural landholders at a large scale.

Bare-nosed Wombats burrow under other infrastructure, such as buildings, water tanks and wastewater treatment drying beds. They can be removed with the use of one-way gates and burrows can be backfilled, but it is possible wombats will re-excavate the site. Rural leaseholders have tried using mesh to prevent re-excavation, but this treatment only lasts up

to six months. Icon Water use a range of methods to prevent Bare-nosed Wombats re-excavating under infrastructure including the installation of cement skirts, placement of large rocks or mesh skirting. This requires ongoing maintenance and monitoring to keep animals out of undesirable areas. Burrows can also harbour rabbits, which creates an added layer of complexity in rabbit control. If rabbits are found using Bare-nosed Wombat warrens, Icon Water install one-way gates to remove the wombat before fumigating the burrow.

5.1.2 Grazing competition and crop damage

Within the ACT there are 20,869 ha of agricultural land, the majority of which is stock grazing land, with a small amount of cropping. Though competition for food resources between wombats and livestock has been reported as an issue of concern in other states (O'Brien, 2019, Stott, 1998, Marks, 1998c), rural leaseholders in the ACT have not reported it as an issue. The density of wombats on properties can vary at local and regional scales and may influence reports of grazing competition. For example, within the Murraylands of South Australia, Southern Hairy-nosed Wombats have an estimated DSE (dry sheep equivalent) of 0.5, comparatively sheep have a 1.2 DSE. Dry sheep equivalent is a unit of measure used to assess the nutritional needs of livestock and assess the carrying capacity of a farm. It equates to the amount of feed required by a two-year-old 50 kg Merino wether per day. Landholders have had to reduce their stocking rate by 20%, to account for the impacts of growing Southern Hairy-nosed Wombat populations, threatening the viability of some farms. Due to the differing climatic conditions in the ACT Bare-nosed Wombats might not have a substantial grazing impact. However, only three rural leaseholders were consulted in the writing of this document. Further consultation with rural leaseholders is recommended to understand the extent of the problems they are facing within the ACT before ruling grazing competition or crop damage out as a potential cause of conflict.

5.1.3 Erosion

Along waterways wombat burrows are often perceived to increase erosion in creeks and gullies (O'Brien, 2019); however, the extent of damage has not been quantified. Past land clearance may have resulted in increased soil instability, facilitating wind and water erosion of creek lines over time. When Bare-nosed Wombats burrow into steep banks, they undercut and destabilise them, the effects of which are exacerbated in unstable soils where there is a lack of vegetation. Eroding soils are transferred into waterways with environmental implications for aquatic systems, including loss of fish habitat, aquatic barriers and increased nutrient loads.

Targeted monitoring in areas suffering from erosion is necessary to determine the extent and underlying cause of erosion and inform best practice management actions.

Rural leaseholders have used fencing to prevent stock from accessing creek lines and contributing to erosion risks. They are unable to prevent Bare-nosed Wombats from digging into creek banks and damaging the stock exclusion fencing. One rural leaseholder remediated the creek line of his property to reduce the erosion and subsequent damage to the surrounding aquatic environment with the help of ACT NRM and community groups (Figure 2). It took significant effort getting the necessary approvals on top of the time and costs of the



Figure 2. Top - the eroding creek line on a leaseholder's property prior to remediation works. Bottom - the creek line after remediation works.

work itself, totalling over \$50,000. This work was undertaken as part of a grant program and would otherwise have been infeasible for the rural leaseholder. The rural leaseholder reported difficulty in dealing with 'red tape' associated with the project and would not have completed it without the help of the ACT NRM.

5.1.4 Land clearance for urban development

Recent expansion of urban development has caused concern among wildlife groups for wombats. Though Bare-nosed Wombats are a protected species they are not threatened and thus do not need to be considered when assessing a site for development approval. As such, developments have been planned, approved and construction commenced in areas where Bare-nosed Wombats occur without considering the impacts. Though it is an offence to kill or interfere with a Bare-nosed Wombat under the *Nature Conservation Act 2014*, burrows have reportedly been destroyed during earthworks by developers, potentially burying Bare-nosed Wombats alive (pers. Comm., wildlife carers 2024). Wildlife carers have reported increased numbers of call outs in areas where urban development has or is occurring. This has highlighted the need for a greater understanding of the impacts of development on Bare-nosed Wombats.

As a response to potential impacts from development on Bare-nosed Wombats and other burrowing animals, the Conservator of Flora and Fauna has developed Conservator Guidelines for Burrowing Animals. The purpose of the guidelines is to improve consideration of burrowing animals during development and provide direction to developers on best practice methods to minimise harm. The guidelines will apply to any new developments within the ACT. During planning stages, developers will need a suitably qualified ecologist to identify burrow and shelter sites, monitor them for activity and ensure they are vacant or avoid developing over them wherever practicable. Wombat Rescue and ICON Water have highlighted the difficulties of conducting appropriate assessments due to the lack of capacity among suitably skilled ecologists in the ACT. Wombat Rescue are often called by ecologists seeking advice on how to manage wombats (pers. Comm., Wombat Rescue 2024). Where avoidance of burrows is not possible developers can apply for a licence to destroy burrows and must follow the guidelines to ensure this is done with minimal disturbance to animals.

The guidelines don't take into consideration the potential for new developments to fragment and isolate populations, limiting dispersal and resulting in genetic differentiation over time. Prior to any new land use zoning, consideration should be given to whether wildlife populations will be disconnected resulting in small and isolated populations that over time could result in inbreeding. There is concern development is pushing Bare-nosed Wombats into narrow river corridors where increased densities could result in increased competition for resources and creating stressful conditions for animals. Without a more detailed understanding of the abundance of Bare-nosed Wombats and carrying capacity in the ACT it is

difficult to determine the impacts of increasing development and expansion. Furthermore, the carrying capacity of Bare-nosed Wombats is unknown and likely to vary from region to region based on habitat and resource availability.

If Bare-nosed Wombat densities are reaching a critical limit with food resources it can increase stress, competition and ultimately population declines. Increased stress and high Bare-nosed Wombat densities are often associated with increased mange prevalence (Sengupta, 2019). Areas closer to fresh water are also predicted to have the highest suitability for mange (Ringwaldt *et al.*, 2023). Urban areas abutting river corridors where Bare-nosed Wombats occur could result in increased human-wombat interactions. Dispersing Bare-nosed Wombats may wander into urban areas where conflicts can occur (e.g. burrow damage) and be more susceptible to road vehicle collisions. There could also be increased interactions between wombats and pets, resulting in injuries to domestic dogs and wombats. Dogs have been known to enter burrows where they may contract mange, get stuck or become injured. Increased public education on the implications of living near Bare-nosed Wombats will be essential.

It is important to note no developers were consulted in the preparation of this report. Consultation with developers is recommended to improve Bare-nosed Wombat management in areas under development.

5.2 Conservation concerns

5.2.1 Mange

Sarcoptic mange is a skin condition caused by the *Sarcoptes scabiei* mite. Mange initially presents as skin reddening and hair thinning. As the disease progresses, visible signs of itching, alopecia and epidermal crusting appear (Pence and Ueckermann, 2002). Mange has strong animal welfare implications as affected individuals can suffer a slow and agonising death, usually through secondary infection, blindness and/or starvation (WHA, 2021). Prevention of mange in Australia is considered almost impossible, as all disease transmission pathways would need to be interrupted, including transmission from host species such as foxes (WHA, 2021).

Ideally mange should be diagnosed and treated by qualified veterinarians so the condition is correctly identified, and animals can receive appropriate treatment. This is not feasible for wildlife populations. Mange in wombats is typically diagnosed and treated by wildlife carers and volunteer groups with varied levels of training, experience and coordination. Diagnosing the disease in its early stages can be difficult without catching and examining animals. The

same symptoms can be caused by malnourishment from low quality feed, creating the potential for misdiagnosis (Fraser et al., 2018).

The distribution of mange and its impacts on wombat populations is poorly understood. Bare-nosed Wombat populations often persist in the presence of mange, and prevalence is usually $\leq 15\%$ (Carver et al., 2021). During outbreaks, mange prevalence can rise to $> 50\%$, with near 100% mortality of infected individuals (WHA, 2021). In some cases, mange outbreaks have resulted in $> 90\%$ decline in local Bare-nosed Wombat abundance (Skerratt 2005; Martin et al. 2018a). Research suggests population decline and range retraction can occur when mange prevalence is $> 25\%$ (Carver et al., 2023). Additional research is needed to understand which environmental variables may lead to mange outbreaks.

Increased rates of mange are often associated with high wombat densities and periods of drought or high stress (e.g. seasonal stress in winter) (Sengupta, 2019). Burrows are thought to be the predominant mode of sarcoptic mange transmission in wombats (Evans, 2008, Martin et al., 2019, Beeton et al., 2019). The humid and cool microclimate within wombat burrows provides favourable conditions to maximise mites off-host survival, particularly in cooler months (16.4 days in winter and 5.96 days in summer). Mites can survive in burrows longer than the minimum known frequency of wombat burrow switching 4- 10 days. Transmission is exacerbated by patterns of burrow use and sharing (Evans, 2008; Martin et al., 2019b).

Regulation of veterinary chemicals used to treat mange in Australia

The Australian Pesticides and Veterinary Medicines Authority (APVMA) is responsible for the regulation and control of agricultural and veterinary chemicals in Australia. Under legislation, the APVMA can evaluate, approve and register agricultural and veterinary chemicals, regulate supply, undertake compliance and issue permits for use. There are currently four active permits (valid in all states and territories of Australia) and three active permit holders approved for veterinary chemicals use for the treatment of mange in wombats.

The Wombat Protection Society holds two permits for the use of a Cydectin (active constituent Moxidectin). One permit allows for a dose 4 ml per kg of body weight with a maximum single dose of 100 ml on an adult wombat (>15 kg) with five days between doses and no more than five doses. The efficacy and toxicity associated with this dose rate has not been fully evaluated and users must observe wombats for any signs of toxicity. Any wombats that die after treatment must be reported to a veterinarian and a detailed postmortem carried out.

A second permit held for the use of Cydectin allows 0.8 ml dosage per kg of body weight with a maximum dose of 20 ml applied once weekly for 15 weeks. This permit is also held by Mange Management Incorporated. Cydectin can be delivered directly or by topical application using a pole and scoop to pour a dose onto the wombat's back, or indirectly by using a burrow flap that doses the wombat when passing underneath.

Intervet Australia holds a permit for use of Bravecto (active constituent Fluralaner) for mange treatment. The dose is 25 mg/kg with a maximum of three doses one month apart on wombats > 5 kg. Bravecto must be applied by topical application directly or by using a pole and scoop to pour a dose onto the wombat's back.

A condition of all these permits is that 'the product must only be used by persons who have appropriate experience in identifying mange infection and toxicity signs in wombats'. It is the permit holder's responsibility to ensure people operating under the permit are trained in the identification and treatment of mange in wombats. This is particularly relevant for care groups, where mange treatments may be administered by a range of volunteers. The permit holder must record any adverse experience associated with the use of the product and report them to the APVMA as soon as possible.

While there are no conditions on any of the APMVA permits with regards to Cydectin use near waterways, an environmental protection warning on the product states 'Moxidectin is extremely toxic to aquatic species. Do not contaminate dams, rivers, streams or other waterways with the chemical or used container.' This statement applies to use of the product under all APVMA permits.

Applying moxidectin indiscriminately across all burrows in an area may lead to unintentional overdosing of individual wombats over time, either from inaccurate dosage or from wombats relocating to treated burrows. Some wombats may not receive a full dose if the chemical splashes as they are exiting a burrow or they move away from the treatment area. Healthy animals within the population will also unnecessarily receive treatments. This could lead to the development of mite resistance arising from inappropriate chemical concentrations being administered.

There is also a risk non-target animals are treated, as wombat burrows are known to be used by a range of other native species (Linley et al., 2024, Thornett et al., 2016) and the impacts of moxidectin on these species is unknown. The broadscale use of these chemicals can result in chemical residues within the environment which can have negative impacts on native fauna,

including invertebrates and aquatic species. Application with a pole and scoop though more time consuming can specifically target wombats with mange and promotes good chemical stewardship.

Some carers believe other products are safer or more effective and use a range of alternative treatments or supplementary products to relieve itching and treat secondary infection. Less invasive approaches include the one-off or repeated administration of a topical acaricide. However, topical treatments may not reach mites due to a failure to penetrate parakeratotic scale crust or be adequately absorbed systemically due to a thickened epidermis. Even among experienced carers there is wide disagreement about how best to treat mange (O'Sullivan, 2018).

Current treatment of mange in the ACT

In the ACT, Bare-nosed Wombats are primarily treated for mange by Wombat Rescue volunteers, and to a lesser extent ACT Wildlife carers. Volunteers operate under APVMA permits PER89982 and PER90837 issued under section 112 of the Agricultural and Veterinary Chemicals Code 1994. The first permit allows for the treatment of Bare-nosed Wombats with mange using up to 20 ml of Cydectin via burrow flap or pour on/pole and scoop application methods. The second permit allows for the treatment of Bare-nosed Wombats with Bravecto using pour on methods only. Volunteer groups must also apply for a licence under the *Nature Conservation Act 2014* to use a vehicle within a reserve.

In addition, Wombat Rescue has a TCCS permit for use of Cydectin on public lands to undertake population treatments, with strict conditions of its use around waterways due to its toxicity to aquatic species. Cydectin must not be used when there is a medium chance or greater (>40 %) of heavy rain (>10 mm) forecast and all treatments within 5-15 m of a permanent waterway must be removed within 24 hours in the catchment area. A treatment area cannot exceed 1km of river reach, can only be treated at the population level once annually and no more than 6 treatment areas can be treated annually along the Murrumbidgee and Molonglo Rivers. Population level treatment by burrow flap application must not be used within 15 m of permanent waterways but is permitted for treating a maximum of 5 individuals at any one time. Cydectin cannot be used within 5 m of the water's edge or within 5 m from the centre of drainage lines and intermittent gullies, including unnamed drainages at any time. No treatments are to be applied in the Cotter Catchment above Cotter Dam, Namadgi National Park or Tidbinbilla Nature Reserve. The location and

dosage details of all treatments, particularly those within 5-15 m of a permanent waterway, must be entered into a shared spatial layer once treatment has commenced.

Mange-affected Bare-nosed Wombats are treated both individually and at a population level. Population level treatments are conducted by Wombat Rescue and occur mainly in riparian areas along river corridors. Due to the substantial time it takes to install burrow flaps on every burrow, and permit restrictions, volunteers are only able to treat burrows along a 1 km stretch of the river at a time. Mange can be successfully eliminated in isolated areas, but where connected populations of Bare-nosed Wombats occur along river corridors, it is difficult to eradicate mange as infected individuals from outside the treatment zone can wander in following the course of treatment. Access of carer groups to rural lands at a broad scale is not supported by many rural landholders due in part to safety and security concerns, which means treatment of mangy wombats on rural leases is limited. This has welfare implications for animals severely affected by mange.

ACT Wildlife only administers mange treatments in areas where rehabilitated Bare-nosed Wombats are to be released if there has been isolated incidence of mange to maximise their chances of survival.

Wombat Rescue regularly responds to call outs to treat and rescue mangy Bare -nosed Wombats from concerned members of the public and ACT Parks and Conservation Service.

Mange distribution

To gain a better understanding of the distribution of mange in the ACT, CED have developed an online portal to enable the community to report sightings of mange-affected Bare-nosed Wombats. Sightings are also reported on WomSAT, an online application developed by researchers at the University of New South Wales. This data helps inform the national distribution and prevalence of mange in wombats. Users of WomSAT create an account and sightings must include a photo for verification. While applications of this nature enable capture of data across broad regions, reporting is typically skewed towards areas of high human activity and therefore may not accurately represent the presence/absence of mange (Figure 3).

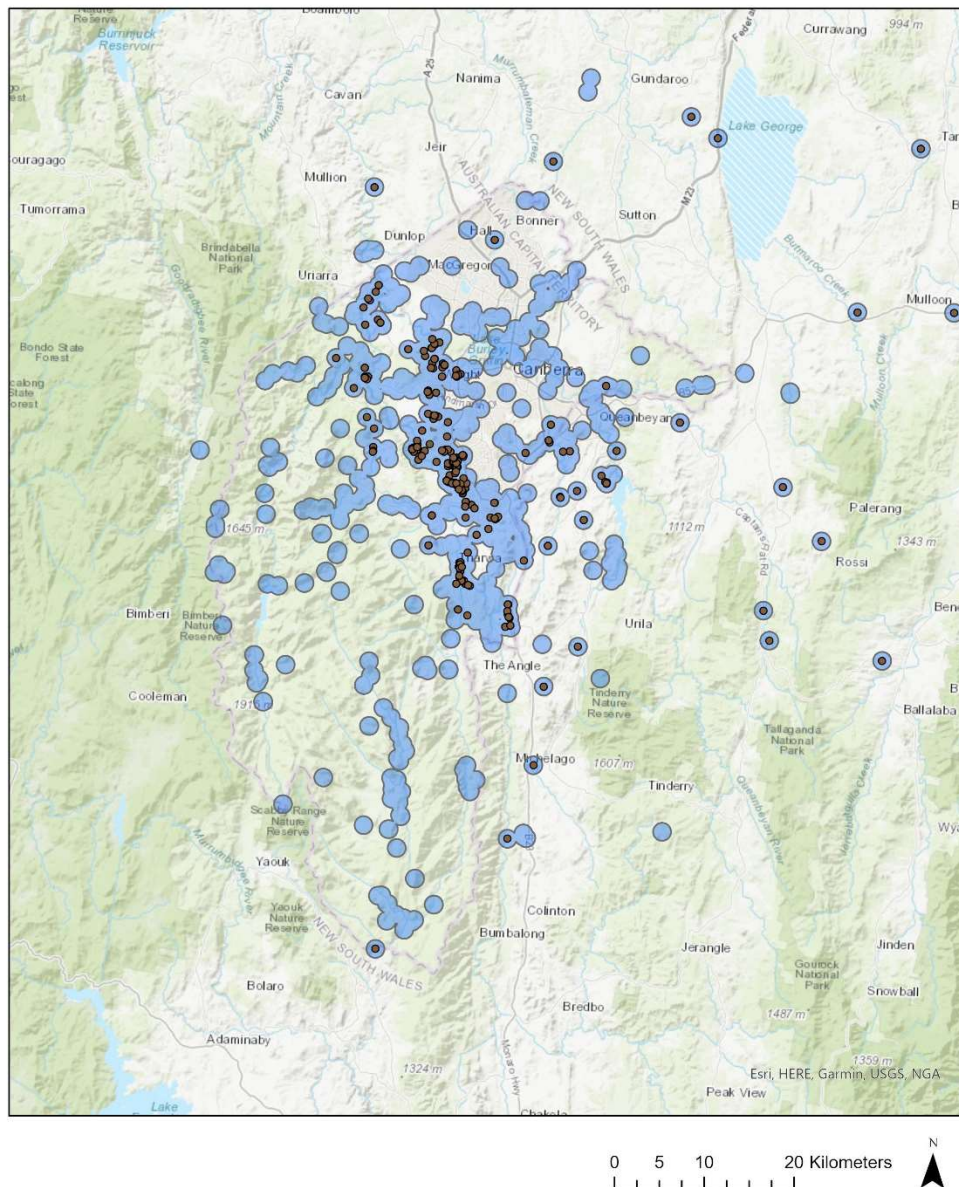


Figure 3. The known records of mangle in Bare-nosed Wombats (red dots) in the ACT taken from CED survey data and ACT Wildlife Atlas wombat records and mangle portal data.

Wombat Mangle and Monitoring Group

To progress treatment of mangle and improve monitoring of Bare-nosed Wombats in the ACT, CED convened the Wombat Mangle and Monitoring Group (initiated March 2021). This group was formed as a subgroup of the Wombat Working Group. Members included two community wildlife care groups (Wombat Rescue and ACT Wildlife), Prof. Scott Carver of the University of Georgia USA (formerly of the University of Tasmania) and CED staff. The group took a collaborative approach to addressing mangle and coordinates activities of the community and ACT Government. Previous activities of the Wombat Mangle and Monitoring Group include:

- Trialling the use of Bravecto, as a potentially longer-lasting, more effective, and target-specific treatment for mange.
- Developing a collaborative monitoring program to provide data on wombat populations, distribution, and mange prevalence across the ACT.
- Support mange treatment in public reserves while minimising risks associated with using Cydectin near waterways.
- Undertake collaborative research on the impacts of mange treatment chemicals on aquatic ecosystems.
- Develop and promote a publicly accessible web-based communication portal to enable community members to report Bare-nosed Wombat sightings and incidences of mange.

5.2.2 Road vehicle collisions

Collisions with vehicles are a source of mortality or injury for Bare-nosed Wombats and a safety concern for people. Roadkill records reported in the WomSAT app between 2015-2019 are relatively low in the ACT in comparison to other states (Figure 4, Mayadunnage et al., 2024). WomSAT relies on citizen scientists to report sightings and thus data may not be representative of all road kills occurring in the ACT. Roadkill records are collected by the Urban Wildlife Team, and it is worth reviewing them to gain a better understanding of the frequency of collisions and identify hotspot areas where intervention may help to reduce collisions.

The frequency of vehicle collisions is likely to vary depending on traffic levels, vehicle speed, Bare-nosed Wombat population density, climate and season (Mayadunnage et al., 2024, Ramp et al., 2005). Bare-nosed Wombat road mortalities are higher in winter and early spring (Roger et al., 2011, Mayadunnage et al., 2024, Nguyen et al., 2022). This could be linked to seasonal changes in the activity periods of Bare-nosed Wombats or more cars being on the road at dawn and dusk due to shorter winter days. High Bare-nosed Wombat road mortalities have been linked to areas of dense forest cover and the greenest ground cover in areas where wombat burrows are present (Roger and Ramp, 2009).

Within the ACT, most Bare-nosed Wombats (approximately 50 a year) come into care because of injuries from road vehicle collisions or being orphaned due to a vehicle collision. The relatively small number of Bare-nosed Wombats taken into care does not represent the total number of wombats killed.

Wombats can cause substantial damage to vehicles, the cost of which is unknown. Analysis of 17,000 animal collision claims between 1 January – 31 December 2023 by Suncorp Group revealed the most common animals drivers collide with are kangaroos, wallabies, wombats, deer, dogs, cows and emus (AAMI, 2024). The average cost of an animal collision insurance claim is greater than \$5,000 and 16% of vehicles were written off in claims that involved wildlife. The study revealed 76% of Australians believe kangaroos would cause the most damage to a car if involved in a collision, followed by wombats (16%).

Even if roadkill is not causing widespread declines of Bare-nosed Wombats, wildlife-vehicle collisions should be reduced where possible. Measures to reduce wildlife vehicle collisions include installing wildlife warning signs, installing underpasses or overpasses, and using deterrent devices (see section 10.5 for more information).

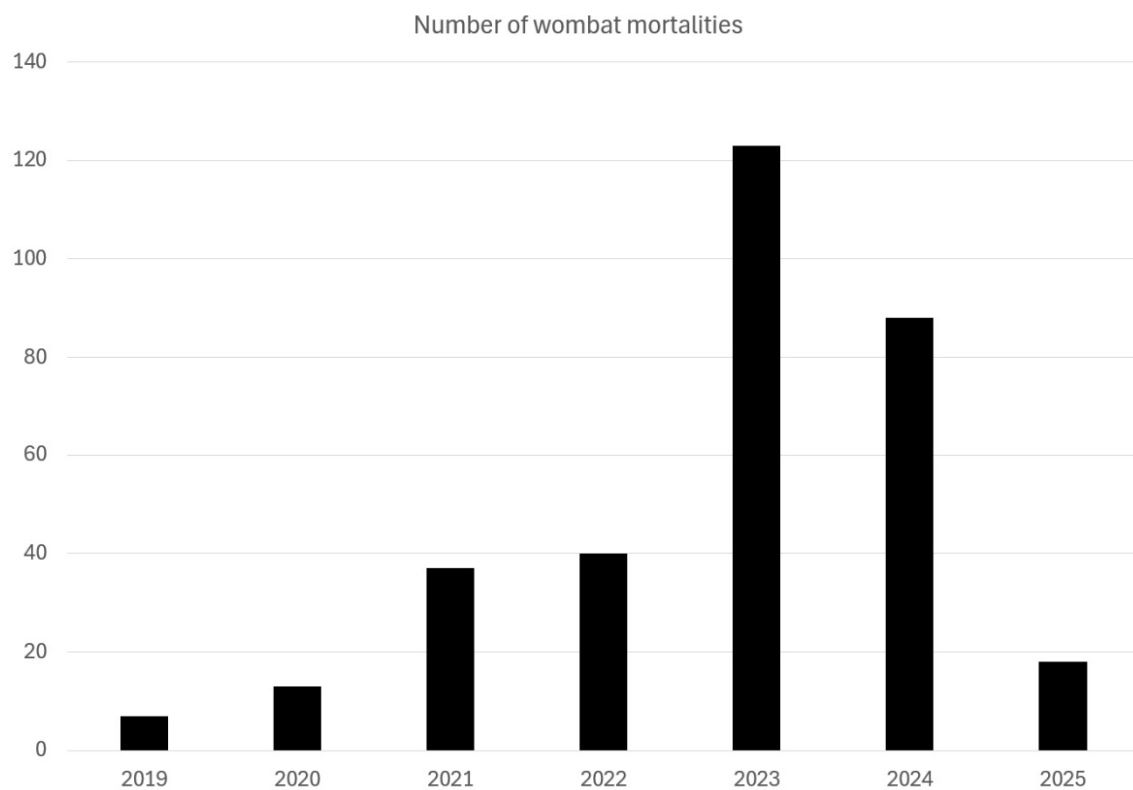


Figure 4. Temporal distribution of wombat roadkill records reported by the ACT Urban Wildlife Team between July 2019 and July 2025. For 2019, data is limited to July-December of that year; for 2025, data is limited to January-July of that year.

5.2.3 Habitat loss

The expansion of urban development has caused concern for the safety of Bare-nosed Wombats. The ACT is around 236,000 hectares, which is roughly 43.6 conservation estate, 10% highly modified urban land, and 15% highly modified rural and broadacre lands. The exact

division of land may be different as land zoned for urban areas may still be undeveloped or rezoned to another land use prior to development. Between 2006 and 2022, the ACT's urban area grew by 9% (2,760 ha). Most development has been in Gungahlin (Taylor, Throsby, Jacka and Moncrieff), West Belconnen (Ginninderry) and the Molonglo Valley (Whitlam and Denman Prospect). The increase in urban land has been driven by strong and sustained population growth over the last decade. The ACT population is projected to grow to 696,000 by 2050. The *ACT Planning Strategy 2018* aims to accommodate this growth while limiting urban spread by setting a target of 70% of new housing being built within existing urban areas. The impact of urban expansion of Bare-nosed Wombat populations is poorly understood. Urban development is thought to be pushing Bare-nosed Wombats into river corridors where their densities are high, resulting in increased stress from resource competition and territoriality (pers. comm wildlife carers 2024). In contrast, reports from other stakeholder groups indicate the distribution and abundance of wombats is increasing. The distribution of Bare-nosed Wombats across different land use zones is unknown and worth investigating to properly understand the potential impacts of further development on populations.

6. Wombat management methods and options

Conflicts with wombats have traditionally been resolved using lethal controls, but there is increasing advocacy for the development of alternative 'non-lethal' management options. Creating policy around alternative 'non-lethal' management options are hindered by a lack of quantitative evidence on their effectiveness and humaneness. Management options perceived as non-lethal can have negative ecological or animal welfare impacts, sometimes resulting in death. For example, translocation often has low survival rates but is perceived as a non-lethal management option because it does not involve the direct killing of animals. The term 'non-lethal' has not been used to classify management options in this review.

Research into damage mitigation techniques has not yielded conclusive results or sustained long-term benefits (Barlow et al., 2010, Koehler AE, 1990, Mason, 1998). Given the nature of conflicts vary greatly, no single management technique will alleviate all conflicts. A variety of damage mitigation techniques are needed that can be tailored to the ecological, social, cultural and economic realities in which conflicts occur (Dubois et al., 2017). Land managers also require data on the distribution and abundance of wombats, as well as the type and extent of damage, to effectively implement a management strategy.

This section reviews current research on wombat management and damage mitigation strategies.

6.1 Fencing

Exclusion fencing is a popular tool for eliminating damage to high value resources. While it is perceived as non-lethal it can have negative impacts on target and non-target species by prohibiting natural movement patterns or inhibiting access to important resources. Prior to installing exclusion fencing, careful consideration needs to be given to the ecological impacts on excluding species from their habitat.

6.1.1 Foot netting

Excluding wombats from areas where they are causing damage such as to high value infrastructure or resources can help to reduce damages and increase landholder tolerance towards wombats. Several wombat exclusion fence designs have been trialled. Attaching foot netting to the bottom of fences has been found to temporarily reduce the number of holes dug in fencing by 35-63% for up to 3 weeks (Marks, 1998b). Borchard et al. (2009b) trialled using hinged joint wire (80 cm wide x 15 cm spacings) attached to the outside of existing fencing and flattened along the ground and secured with tent pegs every 1 m along a 100 m section of fence and silt fencing (770 mm wide) laid out in the same manner and secured every 30 cm. In both designs hinge wire foot netting was placed on the inside of the fence at wombat breach points. The foot netting trial resulted in a mean exclusion rate of 35% for a one month. In the absence of aversive stimuli wombats quickly learned to chew through the silt fence or dig under the wire netting.

6.1.2 Electric fencing

Electric fencing has been shown to exclude wombats from areas where their behaviour conflicts with human land use (Marks, 1998b; St John and Saunders, 1989). The electrification of the dog fence along the Nullarbor Plain in south east Australia has reduced damage to the fence caused by Southern Hairy-nosed Wombats, damage that allows Dingoes (*Canis familiaris dingo*) to pass through (St John and Saunders, 1989). On the outside of the dog fence, an additional two strands of wire 15 and 30 cm above the ground, positioned approximately 30 cm away from the original dog fence were constructed. The fence is patrolled regularly by dog baiters who assess the fence for signs of damage. Most damage occurs from Southern Hairy-nosed Wombats inside the fence attempting to travel north. Electrifying the fence has prevented Southern Hairy-nosed Wombats from travelling north, resulting in them moving

south of the highway into crop land where they had not previously been, resulting in conflicts with wombats and crop farmers (Sparrow, 2011). Marks (1998a) found electric fencing produced variable results, for Bare-nosed Wombats with electric fencing reducing the number of holes by 0-92% over 13 weeks. Landholders who used electric fencing to exclude Southern Hairy-nosed Wombats from their properties reported it to be unsuccessful as the electrified strands were often shorted out by vegetation or debris and it was too time intensive to check (O'Brien, 2019). Electric fencing is costly and time consuming to maintain on a small scale. Landholder perceptions of success may not be influenced solely by damage reduction, but also by the time and costs associated with implementing and maintaining control measures.

The use of electric fencing to reduce wombat damage is best suited to protecting small areas with important assets inside wombat free areas. Electric fencing will require regular inspections to ensure the fence hasn't been damaged or shorted out and involves construction costs and ongoing costs to run.

6.2 Wombat gates

Swinging gates have been recommended to reduce fence damage by wombats in Australia (Breckwoldt, 1983, Triggs, 2009) which can allow stock to escape paddocks or other unwanted animals from entering crop fields. Wombats can make numerous breaches in fencing and the installation of gates at every breach point may be impractical. The placement of gates would depend on the density of wombats in the area and the number of access points being used. Gates should be installed at the most well-used breaches and exclusion netting can be used to 'train' wombats to use the gates. Anecdotal evidence suggests Bare-nosed Wombats will use gates placed up to 800 m apart without making new holes (Triggs, 2009). Breckwoldt (1983) recommends gates of a timber construction which is likely to require regular maintenance. Newer fence designs consist of heavy-duty weld mesh gates weighing at least 2-3kg if trying to exclude other animals such as wallabies (Statham and Statham, 2009, Driessen et al., 2020). If Bare-nosed Wombats could not see through gates they would dig a hole next to it rather than use it (Statham and Statham, 2009). Gates weighing between 4.5-16 kg have also been reported to be used by Bare-nosed Wombats (Coates, 2013). Borchard et al. (2009a) found Bare-nosed Wombats continued to breach the foot netting of fencing for the first few months while they learned to use the gates requiring ongoing repairs. Driessen et al. (2020) wired gates open for two weeks to allow Bare-nosed Wombats a habituation period but did not report on fence breaches throughout the study.

The decision to use wombat gates or a combination of gates and exclusion fencing will depend on the extent of the problem, the cost of the damage and the cost to purchase, erect and maintain the length of fence required. The installation of gates can be laborious and will likely require ongoing maintenance. The installation of gates in fencing may prevent damage to fencing but it does not prevent wombats from accessing areas where their behaviour may cause further damage on the property, thus not all property managers will readily accept the use of swinging gates or view it as a successful damage mitigation strategy (Borchard and Collins, 2001).

6.3 Mapping wombat burrows

There are a variety of methods for surveying and mapping the location of wombat burrows. While it is not a direct damage mitigation method it may prove useful for choosing the most appropriate management action for burrows in unfavourable locations. Mapping the locations of tunnels can help to prevent accidents such as vehicles or machinery falling down tunnels which can collapse under their weight, by avoiding driving over them. However, in areas with a high density of tunnels this may be unavoidable.

6.4 Burrow collapsing

As wombats are known to use multiple burrows within their home range, the opportunity exists to remove problem burrows through collapsing them, moderating their burrowing activity with minimal impact on the wombats. However, widespread burrow destruction is not recommended as it can lead to the displacement of wombats. It is also important to consider the impact of burrow collapsing on young at foot who may not be able to travel long distances. Historically burrow collapsing has been used following fumigation to prevent neighbouring Southern Hairy-nosed Wombats from recolonising the area, however, it was rarely successful as burrows were re-excavated (Marks, 1998a). Burrow collapsing in combination with other methods to exclude wombats from areas where they are causing damage may prove more effective.

The gradual collapsing of burrows over three days in combination with the use of deterrents has been trialled as a management option for Southern Hairy-nosed Wombats (Sparrow et al., 2016, O'Brien, 2018). This method involves collapsing the first 1-2 m of the tunnel on day one, followed by another several meters on day two. The tunnel is left open, providing a clear exit point for wombats. The disturbance of the burrow over the first two days is 93% effective in getting Southern Hairy-nosed Wombats to exit the burrow before ripping the tunnel on day

three (O'Brien, 2018). On day three the tunnel is carefully ripped with a backhoe, stopping every few meters to check the direction of the tunnel and look for signs of occupancy. If a wombat is still within the tunnel, it can be left for another day to see if they will leave. On one occasion a Southern Hairy-nosed Wombat failed to leave on the fourth day and had excavated a further 7 m of tunnel overnight despite the presence of alternate inactive burrows nearby ($\leq$ 50m away). The failure of burrow disturbance to get the Southern Hairy-nosed Wombat to leave may reflect the importance of the burrow. Although Southern Hairy-nosed Wombats may use up to 10 different warrens within their home range, they usually use 1-2 warrens on most occasions to which they display high site fidelity (Shimmin *et al.* 2002; Finlayson *et al.* 2005).

Two studies trialled the effectiveness of dingo urine and faeces in deterring Southern Hairy-nosed Wombats from re-excavating collapsed tunnels and produced mixed results (O'Brien *et al.*; Sparrow *et al.* 2016). Sparrow *et al.* (2016) found untreated collapsed burrows on the Nullarbor plain in South Australia were recolonised within 75 days while those treated with dingo scents showed minimal activity. In contrast, O'Brien *et al.* found that in the Murraylands of South Australia deterrents didn't play a significant role in the time taken for recolonisation to occur. The differences in results between the two studies could be attributed to variances in the methods used or environmental factors such as predator densities at the sites or burrow availability and importance and warrants further investigation. Although burrow collapsing is considered non-lethal its impacts on evicted wombats has not been studied and warrants further investigation. Studying the impact of burrow collapsing on wombats may help to answer questions about the reasons for its success or failure. Burying steel mesh at the location of the collapsed burrow is untested but may prevent wombats from re-excavating.

Alternate methods could trap and relocate wombats or empty burrows using one-way gates placed in burrow entrances prior to collapse. Trapping is more time consuming and costly as traps need to be checked every morning and it requires careful planning and trained personnel to handle and relocate the wombat(s) but removing animals from the area may provide longer term relief from conflict. One-way gates can be installed and left in place until the burrow is empty, though regular assessment of the gate is recommended as wombats have been known to dig around or under them. Motion sensor cameras can be used to determine if a burrow is empty. Low-cost methods such as raking the soil to assess for footprints or the placing of sticks in a burrow entrance can be used to determine if a burrow is empty however, it is not always possible to determine if a wombat has gone into the burrow or exited.

The time and costs of burrow collapsing will vary on a case-by-case basis. Some burrows may be simple single entrance tunnels that take 1.5 hrs to rip while other more complex 5 entrance warrens that are 4 m deep can take up to 10 hours (O'Brien, 2018). Soil type and burrow depth will impact the time and costs associated with burrow destruction. Given the time and costs of collapsing burrows along with the low success rate it is not a viable long-term solution to wombat management, but it may prove useful in certain situations. Given Bare-nosed Wombats within the ACT breed year-round consideration needs to be given to the potential for there to be young at foot that may not be able to travel to the next nearest burrow or move through a wombat gate. Though these studies found burrow collapsing did not result in new burrows being dug in other locations it is always possible that it could transfer the conflict to a new location.

6.5 Deterrents

Designed to capitalise on an animal's mechanisms of threat detection, deterrents aim to discourage the use of human resources with aversive stimuli (Ramp et al., 2005, Apfelbach R, 2005, Schakner and Blumstein, 2013). A wide range of deterrents, such as chemical cues, novel objects, and painful stimuli are increasingly being marketed as non-lethal means of reducing human wildlife conflict (Breitenmoser et al., 2005). Although there are numerous studies on the use of deterrents, many devices have not been quantitatively field-tested, and their perceived effectiveness lies in testimonial and anecdotal reports. Controlled lab studies often do not translate to field situations, where numerous uncontrollable environmental factors can influence the way animals detect and respond to threats (Mason, 1998, Koehler AE, 1990, Barlow et al., 2010). Even where devices have been field tested, they often produce conflicting results.

Before deterrents are recommended to mitigate wombat damage, a better understanding of the factors influencing wombat threat perceptions and responses to them is needed. Further research is required to evaluate responses in different environmental conditions such as varying distance to cover, and with different methods of application and placement, to determine the optimal conditions for success. In addition, future studies should consider conducting trials in a closed system with known individuals or capturing and marking individuals prior to commencing trials for ease of identification so individual variation in responses can be taken into consideration.

6.5.1 Olfactory deterrents

Olfaction is known to play an important role in social communication in wombats (Taggart and Temple-Smith, 2008, Triggs, 2009), little is known about its role in threat perception.

Anecdotal, fertilisers such as blood and bone, dog and human urine are thought to deter wombats (O'Brien, 2019).

Dingo urine and faeces has been trialled with mixed results. Field trials found no difference in Southern Hairy-nosed Wombat activity before and after placing a cup of blood and bone in burrow entrances (O'Brien et al., 2021). Captive Southern Hairy-nosed Wombats increased their exploratory behaviour in response to dingo faeces placed inside burrows, followed by increased use of burrows and concealed locations (Descovich et al., 2012). Sparrow et al. (2016) reported Southern Hairy-nosed Wombats showed greater avoidance and prolonged time to recolonisation of collapsed warrens treated with dingo odours than control warrens on the Nullarbor in South Australia. Conversely, the application of dog urine and dingo faeces had no significant impact on the time taken for Southern Hairy-nosed Wombats to recolonise collapsed warrens in the Murraylands of South Australia (O'Brien, 2018) or deter them from using burrows where dingo urine and faeces were placed at the entrance (O'Brien, 2019). No known research has been conducted on the effects of odour deterrents on Bare-nosed Wombats.

The differing results of these studies indicate Southern Hairy-nosed Wombat responses to predator odours may be context dependent, but disparities in experimental design and analyses make it difficult to determine which factors are influencing threat perceptions. Control–impact studies may lead to a misconception of the effectiveness of treatments as they don't consider differences in pre-existing activity levels at treatment sites (Koehler AE, 1990, Parsons and Bondrup, 1996, Rytwinski et al., 2016). Southern Hairy-nosed Wombats may have responded to blood and bone or dingo odours with increased hiding or reduced ranging behaviour in a manner that was not evident from the camera data, or it could have been perceived as a low risk. The use of a greater volume and repeated or more widespread application of deterrents may elicit greater avoidance responses. The application of odours inside burrows or in open areas further from the safety of a burrow may heighten risk perceptions, resulting in greater avoidance responses (Atkinson et al., 1994).

6.5.2 Visual deterrents

Anecdotal evidence suggested wombats are fearful of shiny objects and actively avoid them. Stationary CDs have been found to elicit avoidance responses in Southern Hairy-nosed Wombats, with a decrease in the number of visits to burrows following their application (O'Brien et al., 2021). Visual stimuli produced avoidance responses most likely due to an immediate fear response (neophobia) of an unknown object within their environment (Harris and Knowlton, 2001, Davidson-Nelson and Gehring, 2010, Bruggers et al., 1986). Wombats may respond more readily to visual cues as they are easily detected from further away than olfactory cues, which require closer investigation. Though these preliminary investigations are encouraging, habituation to visual stimuli is a major limiting factor to their long-term use, particularly when unaccompanied by negative reinforcement (Koehler AE, 1990, Gilsdorf et al., 2002). Habituation to CDs was not observed in Southern Hairy-nosed Wombats over the 5-night trial, however, it may occur over a longer time frame.

6.5.3 Virtual fencing

Virtual fencing is a term often used for placing deterrents along roadsides that are activated by approaching vehicle headlights. On activation the device emits a sound, flashing lights or both with the aim of scaring away any animals that may be adjacent to the roadside. Virtual fencing is not a physical barrier and allows animals to move through the landscape. Early trials in Tasmania reported a 50% reduction in roadkill over a three-years (Fox et al., 2018), but the trial had many design flaws and likely had little to no effect on possums, wallabies or wombats (Coulson and Bender, 2019). A study on the impacts of virtual fencing on wombats found a small reduction in the number of wombats killed after the virtual fence was installed (Stannard et al., 2021), however the study design was flawed and widely disputed (Coulson and Bender, 2022, Candy and Englefield). Similarly, other deterrent devices mounted to vehicles like the Shuroo have been found ineffective, as the noise the device makes cannot be heard over the vehicle noise from >50 m away (Bender and Coulson, 2022).

6.6 Translocation

Translocation is a widely used “non-lethal” human-wildlife conflict mitigation measure, but its effectiveness is disputed. The survival of translocated animals is often low, and the conflict may not be resolved or could be transferred to the release site (Bradley et al., 2005, Linnell et al., 1997). Translocation has been trialled on Southern Hairy-nosed Wombats to relieve conflicts with agriculturalists. Southern Hairy-nosed Wombats were translocated from areas of

conflict to a property where species numbers were low and lots of inactive burrows were available to release them into. Animals were fitted with GPS and/or VHS collars to monitor their survival and behaviour in comparison to resident animals. Though translocated Southern Hairy-nosed Wombats had high survival rates and exhibited release site fidelity conflicts were not resolved. Neighbouring Southern Hairy-nosed Wombats moving into vacated burrows at the source site within a matter of weeks. Landholders using culling as a control measure to reduce conflicts with Southern Hairy-nosed Wombats have reported similar results, with neighbouring animals recolonising vacated warrens (St John and Saunders, 1989).

Translocation of a larger number of animals may provide longer relief from conflict. However, Southern Hairy-nosed Wombats evaded traps by remaining underground or digging under fencing, resulting in a low trap rate of 5.95%. Similarly, the trapping success of Bare-nosed Wombats was 7.9% and Northern Hairy-nosed Wombats as low as 1-2%, all species avoid capture by remaining underground for extended periods of time (McIlroy, 1977a; Alan Horsup, pers. comm 2018). Thus, large scale translocation could be labour intensive and cost prohibitive. Furthermore, the ongoing translocation of large numbers of Southern Hairy-nosed Wombats would over time lead to shortages of suitable conflict free release sites with low numbers of conspecifics in the species natural range. Translocation could be used as a tool to repopulate areas where numbers are known to have declined, however, it may result in further deaths if the cause of the decline has not been addressed.

Similarly, the critically endangered Northern Hairy-nosed Wombat has been successfully re-introduced into areas they were extirpated from by releasing them into starter burrows (Horsup, 2004). A study on the survival of rescued and rehabilitated Bare-nosed Wombats reported high survival (94.5%) of animals released onto a private property within the first 42 days following release and 77% survival after eight years (Saran et al., 2011). Survival was not found to be related to age, sex, provision of supplemental food, season or time spent in rehabilitation.

Despite its limitations, translocation may prove useful for removing a small number of individuals from areas of conflict, where alternative measures fail or are unsuitable. When used in combination with burrow collapsing or deterrent use it may yield more promising results in reducing conflict at the source site. Prior to carrying out a translocation careful planning is needed. Translocation plans should adhere to the Conservator Guidelines for the Translocation of Native Flora and Fauna in the ACT. . Important biological and ecological factors need to be taken into consideration, such as capture stress, disease transmission, habitat suitability, and competition with conspecifics. The availability of burrows at the release site is a key

consideration when it comes to translocating wombats, which would require up to date knowledge of wombat distribution and density. Follow up monitoring is imperative to ensure survival of translocated animals.

6.7 Culling

Historically, conflicts with wombats have been managed using lethal controls. In most states, there are provisions to cull wombats causing damage or threatening human safety under permit systems (see section **Error! Reference source not found.**). The lethal control of wombats has become a highly contentious and controversial issue in the last few decades, due to changing public attitudes towards its use and concerns about wombat conservation. Permits to destroy Bare-nosed Wombats have decreased greatly in Tasmania and other states where it is allowed in the last few years due to increasing public pressure. The impacts of culling on wombats populations are poorly understood (Tartowski and Stelmann, 1998, Taggart et al., 2008). If conducted at unsustainable levels it can result in range contractions and population isolation (Powell, 2006, Fuller et al., 1992, Woodroffe et al., 2005). In contrast, killing an insufficient number of animals can fail to reduce damage to an acceptable level (Hone, 2007). In some cases, the removal of animals from a population can encourage population growth and immigration, thereby increasing conflict (Treves et al., 2016). Culling can disrupt social structures that lead to fractured social groups and increases in conflicts (Wallach et al., 2009, Allen et al., 2015). Despite the limitations of culling, there may always be some situations in which it is the best intervention method (Warburton and Norton, 2009).

There is one known study examining the effects of culling on Southern Hairy-nosed Wombats. Changes in the number of active burrows were monitored in an area where culling occurred and an adjacent control zone where no culling took place. Over the two-year term of the study an estimated 12% of the population was culled per year. Despite this there was an estimated 30-40% increase in the number of Southern Hairy-nosed Wombats in the culled area, while in the uncultured area there was an estimated 50-60% increase. The increase in Southern Hairy-nosed Wombat numbers over this time frame could have been a result of increased rainfall and recovery from the 1981-83 drought, the effects are unlikely to be the same on a stable or decreasing population (Tartowski and Stelmann, 1998).

Culling it is often preferred as a conflict reduction tool by landholders, as it is convenient, immediately shows results, satisfies their need for control, and is perceived as cost effective (Horton RR, 1997, Zinn et al., 1998, Treves and Naughton Treves, 2005).

Landholders surveyed in South Australia most widely used culling to reduce conflicts with Southern Hairy-nosed Wombats in South Australia and those who were financially dependent on their property or had experienced damage were more likely to cull wombats (O'Brien, 2019). Despite the widespread use of culling, only half of the landholders using it perceived it to be effective. A lack of data on wombat numbers makes it difficult for state agencies to set balanced culling quotas often resulting in ineffective conflict resolution (Taggart et al., 2008). Many landholders feel they are rarely permitted to cull enough wombats to mitigate damage with recolonisation of burrows being an ongoing problem (Stott, 1998, Taggart et al., 2008, St John and Saunders, 1989). Official government registers are considered an underestimate of the true numbers of wombats culled, as some landholders resort to culling outside the permit system (St John and Saunders, 1989, Taggart et al., 2008). The use of lethal controls needs to be carefully evaluated and managed based on scientific evidence, to ensure conflict reduction without threatening species conservation.

6.8 Wombat monitoring and research

There are significant knowledge gaps in our understanding of Bare-nosed Wombat populations in the ACT. Addressing these gaps will require dedicated monitoring and survey effort to collect fit-for-purpose datasets. This section examines a variety of survey options, and their costs and benefits.

6.8.1 Quantify the frequency and occurrence of wombat damage

Perceptions and tolerance of damage caused by wildlife are often shaped by financial dependence on crops or livestock and previous experiences (Naughton-Treves L, 2005, Van Tassell et al., 2000). Perceived damage can sometimes be disproportionate to actual damages (Dickman, 2010, Knight, 2000, Madden, 2004, Wigley and Garner, 1986). Quantifying the frequency and cost of Bare-nosed Wombat-related damage is crucial to distinguish between real and perceived impacts. This data can help identify high-conflict areas and guide wildlife managers in developing targeted management actions. In regions where damage is minimal or misattributed, educating stakeholders can be crucial to mitigating conflict. Conversely, where significant damage occurs, targeted management interventions to reduce damages may be necessary to alleviate its effects.

Accurately reporting the prevalence and costs of wombat damage from landholders and other relevant stakeholders will require a consistent approach to data collection. This will require

CED to develop a reporting tool for stakeholders to submit information such as: (1) the type of damage; (2) the location of the damage; (3) the financial costs associated with damage; and (4) negative safety outcomes associated with damage. Collecting a consistent set of data in each report will allow for comparison with wombat population data and other key population metrics. This tool will need to be managed by CED or another relevant team within the ACT Government.

6.8.2 Ecological surveys of wombats in the ACT

One of the critical aspects of species management is understanding population dynamics. Currently, Bare-nosed Wombat population monitoring in the ACT is limited, with few systematic surveys to track wombat numbers or distribution. Animal welfare and stakeholder concerns around the prevalence of mange also require systematic surveys that include areas with and without mange treatment applications. High-quality distribution and abundance data paired with standardised impact and mange assessments will provide land managers with the tools for effective management and conflict mitigation.

Current monitoring

CED has commenced a long-term monitoring program at eleven sites within the ACT. The purpose of these surveys is to detect changes in populations over time, and to collect data on mange prevalence and severity. Survey sites were selected based on known presence of Bare-nosed Wombats and ease of accessibility. Surveys are conducted twice annually in winter and consist of walking 1 km transects at a slow pace (45 mins), commencing 30 mins after sunset (Figure 5). Surveys are carried out in teams of at least two people for health and safety reasons. Surveyors use night vision binoculars to reduce disturbance of animals.

When a Bare-nosed Wombat is seen, the surveyor notes their location using a GPS, takes a compass bearing and estimates the distance to the animal. Wombats are given a body condition score (ranked 1-5, with 1 being poor and 5 being excellent) and a mange score using the categories described in Stannard et al. (2020). Observers also record a mange confidence score to reflect how confident the surveyor is in their assessment in the presence or absence of mange, noting that it can be difficult to assess from a distance. Weather variables including temperature, rainfall, wind speed, cloud cover and visibility of the moon are measured at the beginning of each transect. A further two sites in Namadgi National Park are surveyed annually using the same method as above, with the exception that surveys are undertaken from a vehicle.

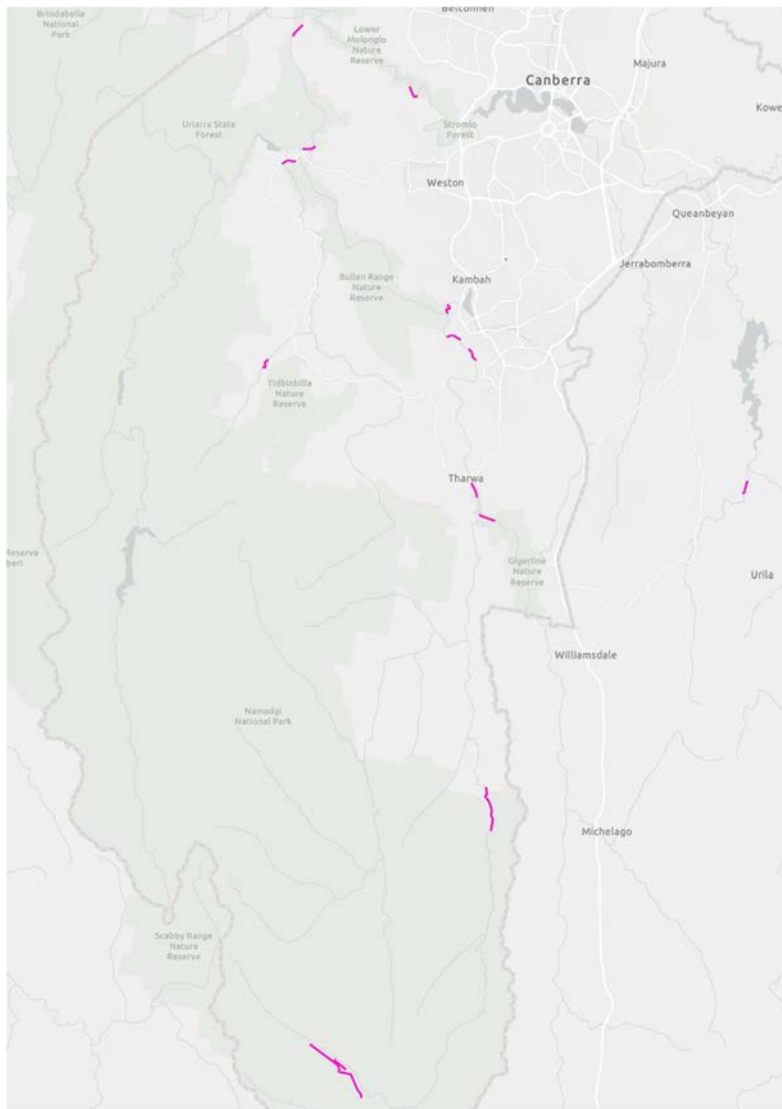


Figure 5. Locations (pink) of the line transect surveys conducted to detect changes in populations over time, and to collect data on mange prevalence and severity.

Bare-nosed Wombat records are also collected using applications such as NatureMapr and the Atlas of Living Australia. These are useful tools that enable public reporting of wombat sightings over large areas that would otherwise be infeasible for ecologists to survey. These incidental sightings are typically biased towards areas of high human activity (i.e., roads or trails) and there are caveats around their value in understanding a species distribution or abundance. Without standardised survey effort, it is difficult to determine whether areas with a lower number of records represent a true absence or a low survey effort. Species and signs of their presence, such as faeces, tracks and burrows, can also be misidentified or difficult to detect. Burrows also present a challenging proxy for wombat occupancy as burrows may remain in an area after an individual has moved on (Tartowski and Stelmann, 1998).

Gaps in current methodology

A comprehensive survey program to inform wombat management in the ACT requires data on (1) wombat density or relative activity across areas of suitable habitat; (2) prevalence of mange across existing wombat populations; and (3) the effect of mange treatments on the prevalence of mange. The current monitoring program captures relative activity data within the conservation estate but is not representative of all Bare-nosed Wombat habitat in the ACT. A more representative selection of sites would require survey transects to be located across conservation estate, rural lands, and other stakeholder areas (i.e., Icon Water). This would require approval from stakeholders for ecologists to access their land for surveys.

The current site selection does not consider whether sites have been actively or historically treated for mange. This makes it difficult to determine whether the abundance or current health of the local population is affected by these treatments. In future, monitoring sites should be evenly stratified into two groups: treated and untreated. Once these sites are selected, treatment conditions should remain consistent throughout the study period.

The current survey methodology as described above is subject to imperfect detection of both mange prevalence and individual wombats. Vegetation and uneven topography can make it difficult to detect individuals and assess mange severity. For more information on alternative survey methodologies that may be more suitable, refer to the section below.

The current monitoring program is conducted across 26 survey nights annually, with two staff or volunteer members required to conduct each survey. In the past this work has been done by CED ecologists and volunteers from Wombat Rescue. Expanding the survey scope to include transects on rural land and other stakeholder properties would increase the survey time required. For consistency and impartiality, this should be done by trained ecologists and not members of any stakeholder group.

Alternative monitoring methods for consideration

Due to the nocturnal and burrowing nature of Bare-nosed Wombats they are difficult to survey. Direct counting using spotlight surveys are labour intensive and not practical over large areas. Spotlight counts are not representative of population numbers as wombats may remain in their burrows and avoid being counted (McIlroy, 1977b).

Mark recapture studies, requiring individuals to be captured on more than one occasion, are challenging as Bare-nosed Wombats are difficult to capture. They can remain underground for

prolonged periods or dig around traps to avoid capture (McIlroy, 1977b, Skerratt et al., 2004). In these surveys, trapping only a portion of burrows can result in imprecise abundance estimates (Banks et al., 2003). Trapping every burrow across a large area is impractical due to the time and labour required.

The number of active burrows has successfully been linked to wombat abundances using mark-recapture methods (McIlroy, 1977a), burrow flap counters (Tiver, 1981) and remote cameras (Swinbourne et al., 2018). A combination of burrow activity levels and the number of active burrows is a relatively low-cost method and has been used to infer population abundances (St John and Saunders, 1989). Burrow activity can be estimated using burrow flap counters or remote cameras. Abundance estimates using these measures will allow land managers to track trends in population levels but will not provide an exact density.

Ground penetrating radar has been used successfully to map Southern Hairy-nosed Wombat burrows (Swinbourne* et al., 2015). It can be used to determine the length, depth and direction of wombat tunnels and help determine if a burrow is a main, secondary or starter burrow. There are various ground penetrating radar systems available, simple units can be hired for between \$200-400 a day and can penetrate up to 8 m depth.

Drones have successfully been used to map wombat burrow locations in New South Wales grasslands (Old et al, 2019). In their study, Old et al. (2019) detected a similar number of burrows using desktop analysis of drone imagery and ground-based surveys. In aerial surveys observer errors can result in inaccurate counts, but standardising the results using a transect with a known number of burrows can help develop a correction factor for the dataset (Tiver, 1981). Recording video footage during aerial surveys can also allow for more accurate and repeatable scores of wombat warrens (McGregor and Wells, 1998). Drone surveys can be affected by vegetation, with reduced efficacy in dense vegetation where burrow entries are obscured (Old et al 2019; Taggart et al, 2008). These aerial surveys provide an alternative to manual searching for burrows and can be used to quickly assess range expansion in local wombat populations. Detecting decreases in distribution based on burrow surveys is more difficult, as warrens remain visible long after they have been vacated.

Integrating drones with thermal sensors has been used effectively to directly survey a range of terrestrial and arboreal species (Beaver et al, 2020; Howell et al, 2021; Witt et al, 2020). These methods have not yet been tested on wombats, but they may provide a suitable alternative to ground-based surveys. While thermal drone surveys may reduce labour inputs and reduced

detection abilities in dense vegetation, they are still subject to the pitfalls of direct count methodologies. Direct counting will still be subject to imperfect detection if individual wombats remain underground during the surveys.

6.8.3 Furthering research by partnering with scientists

There are lots of knowledge gaps that hinder the effective management of Bare-nosed Wombats in the ACT. While it is not necessarily the role of the ACT Government to conduct the research to fill these knowledge gaps, collaboration with scientists may help to overcome some of these knowledge gaps.

Collaboration between the ACT Government and researchers could help fill the knowledge gaps discussed above. Key research areas include developing a deeper understanding of complex stakeholder views and collecting more robust population-level data for wombats in the ACT. Additional topics could include further research into mange treatment and collaborating with landholders to develop effective damage mitigation strategies. Landholders currently lack reliable options for mitigating conflict with wombats. These options need to be well-tested, and the limitations and benefits of each need to be clearly understood.

7. Recommendations

The following steps are recommended to address key stakeholder concerns in a responsible and balanced manner:

- Support non-lethal methods for wombat control by land managers to mitigate damage, which may include the provision of information, resources and training;
- Develop an appropriate mechanism to allow humane euthanasia of wombats on rural lands that are afflicted with severe mange, noting animal welfare considerations;
- Coordination between ONC ecologists and PCS Licensing and Compliance to clearly identify areas within the ACT, and possibly NSW, where rehabilitated wombats can be released. Selection of suitable sites can reduce the likelihood of overabundance and future human-wildlife conflict;
- Review procedures and licensing pathways for the deployment of Cydectin and other mange treatments to ensure appropriate placement that minimises negative impacts on aquatic systems;
- Over the longer term, explore and evaluate options to support holistic management of Bare-nosed Wombats in the ACT through an appropriate policy mechanism, including

for example, a Controlled Native Species Management Plan under the *Nature Conservation Act 2014*.

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Managing wombats

A review of current practice, issues and challenges to inform wombat management in the ACT.

Office of Nature Conservation

Technical Report to the Conservator for Flora and Fauna

October 2025

Acknowledgement of Country

The City and Environment Directorate acknowledges the Ngunnawal people as traditional custodians of the ACT and recognise any other people or families with connection to the lands of the ACT and region.

We respect the Aboriginal and Torres Strait Islander people, particularly our Aboriginal and Torres Strait Islander staff, and their continuing culture and contribution they make to the Canberra region and the life of our city.

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Glossary

- **City and Environment Directorate (CED)** – ACT government department responsible for managing conservation estate and public land
- **Closed season** – A defined period during which hunting or capturing was prohibited for listed species.
- **Deterrent** – Something that discourages or prevents someone from taking an action due to the perception of negative consequences.
- **Dry sheep equivalent (DSE)** – A unit of measure used to assess the nutritional needs of livestock and the carrying capacity of a farm. It equates to the amount of feed required daily by a two-year-old, 50 kg Merino wether.
- **Leaseholder** – A person or entity granted a Crown lease by the Territory, giving them the right to occupy and use land according to the terms and conditions of the lease.
- **Noxious pest/pest** – An animal, insect, or plant considered harmful to agriculture, the environment, or human health, and officially declared or classified as such under relevant legislation or regulations.
- **Olfaction** – The sense of smell.
- **Open season** – A specific period during which it is legally permissible to hunt, take, or possess certain wildlife species that are otherwise protected. An open season is officially declared by the relevant authority (e.g., the Minister responsible for wildlife or a delegated agency) and specifies:
 - The dates during which hunting or taking of wildlife is allowed.
 - The species to which it applies.
 - Any conditions or restrictions, such as location, bag limits, or methods of hunting.
- **Pasture Protection Board** – Local government bodies established under the *Pastures Protection Act 1934*. The 59 boards in NSW were responsible for managing grazing, controlling pests like rabbits and feral animals, and promoting sustainable land management.
- **Protected species** – Species protected by law that cannot be taken, harmed, or interfered with without appropriate authorisation.
- **Reintroduction** – The movement of wild animals into part of their former range from which they have been extirpated.
- **Translocation** – The deliberate movement of wild animals from one part of their range to another.

- **Vermin** – Species of animals not protected by law and often considered pests due to their negative impacts on agriculture, native species, or the environment.
 - Declared vermin can usually be destroyed or managed at any time, including outside of open seasons, unless other laws (such as firearms laws) apply.
 - The list of vermin is not fixed and can be updated by regulation or proclamation.

Executive summary

The ACT seeks to adopt a holistic and informed approach to wombat management, balancing species conservation with protection of landholder and industry assets. This document reviews relevant information to inform best-practice wombat management and to ensure populations persist in the ACT.

The scope encompasses cross-jurisdictional legislation, stakeholder views, management methods and monitoring approaches. The document also highlights current challenges within the ACT, including the complexities involved in balancing conservation with stakeholder needs.

As native marsupials wombats are integral to the region's ecosystem but present several management issues. These include wildlife-vehicle collisions and conflict with agricultural activities. Wombats may face challenges including urban expansion, habitat loss and the prevalence of sarcoptic mange.

Key findings from the review include:

- **Legislation and Policy:** Unlike other Australian jurisdictions, the ACT does not allow specific provisions for the control of wombats nor provide guidance on non-lethal conflict mitigation. This has led to frustration among leaseholders managing wombat-related damages.
- **Threats to Wombats:** Habitat loss and sarcoptic mange remain the primary threats. Management of sarcoptic mange is complex and is currently conducted by wildlife carers. There is no clear mechanism for the government to limit the application of mange treatments in areas where chemicals may have negative ecological consequences. There are currently no guidelines around the release of rehabilitated wombats, including identified release zones that are ecologically suitable.
- **Stakeholder Conflicts:** The ACT has diverse stakeholders who hold conflicting views on how wombats should be managed. Consultation with stakeholder groups on policy changes is a possible method for reducing tension and increasing stakeholder support. Working groups, such as the Wombat Mange and Monitoring Group, also provide forums for stakeholders to engage on topics relevant to their concerns and interests.
- **Public education:** Development of housing near areas of wombat activity can increase incidences of human-wildlife conflict. Providing informative material and engaging in public communication are strategies to increase awareness in the community.

- **Management Tools:** Fencing, burrow modifications, and deterrents are available to manage wombat damage, but are often resource-intensive and may yield inconsistent results. Many have not been trialled in the ACT and stakeholders may not be aware of the available options. Burrow modification interventions would require additional approvals, and there is currently no streamlined application process to make this available to landholders.
- **Research and collaboration:** The ACT partners with citizen scientists to collect data on wombats through the ACT Wombat Portal, NatureMapr, and WomSAT. These data can inform management decisions but should be paired with systematic surveys to reduce inherent biases in the data. Leaseholders currently do not have a method of reporting wombat impacts on their property.

Recommendations include:

- Support non-lethal methods for wombat control by land managers to mitigate damage, which may include the provision of information, resources and training;
- Develop an appropriate mechanism to allow humane euthanasia of wombats on rural lands that are afflicted with severe mange, noting animal welfare considerations;
- Coordination between ONC ecologists and PCS Licensing and Compliance to clearly identify areas within the ACT, and possibly NSW, where rehabilitated wombats can be released. Selection of suitable sites can reduce the likelihood of overabundance and future human-wildlife conflict;
- Review procedures and licensing pathways for the deployment of Cydectin and other mange treatments to ensure appropriate placement that minimises negative impacts on aquatic systems;
- Over the longer term, explore and evaluate options to support holistic management of Bare-nosed Wombats in the ACT through an appropriate policy mechanism, including for example, a Controlled Native Species Management Plan under the *Nature Conservation Act 2014*.

1. Introduction

Wombats are iconic Australian marsupials, deeply embedded in the cultural heritage of First Nations Peoples and the national identity (Garvey et al., 2016). There are three extant species: the Bare-nosed Wombat (*Vombatus ursinus*), the Southern Hairy-nosed Wombat (*Lasiorhinus latifrons*), and the Northern Hairy-nosed Wombat (*Lasiorhinus krefftii*). Although once likely widespread, all three species have experienced significant declines and range contractions since European settlement (Aitken, 1971, Gordon et al., 1985, Buchan A and DC, 1998, Cooke, 1998, McIlroy, 2008). The clearing of land for agriculture and urban development, coupled with the introduction of European rabbits (*Oryctolagus cuniculus*), has had a profound impact on wombat populations (Aitken, 1971, Cooke, 1998). Rabbits provided competition for food and shelter (Cooke, 1998), and wombat warrens were often destroyed during rabbit control efforts (Triggs, 2009). Increasing conflict with livestock (Crossman et al., 1994) also contributed to population pressures. The Northern Hairy-nosed Wombat suffered the greatest decline, reduced to a single known population of approximately 30 individuals by 1982 (Gordon et al., 1985). It is now listed as endangered under the *Nature Conservation Act 1992*. In contrast, the Bare-nosed Wombat was declared vermin as early as 1906 in Victoria, and considered a pest in other states (Temby, 1998).

Historically wombats were widely regarded as pests, particularly because their burrowing behaviour damaged rabbit exclusion fencing (Aitken, 1971, Temby, 1998). This view contributed to sustained population control efforts and legislative measures in all jurisdictions to reduce their impact. The Australian Capital Territory (ACT) awarded early protection to Bare-nosed Wombats under the *Animals & Birds Protection Ordinance 1918*. Growing public concern over animal welfare, conservation, and sarcoptic mange has pressured other state governments to adopt more protective policies. Though wombats are now protected species in most states, they can be controlled under permit systems where they cause damage.

The management of wombats has become a highly contentious issue due to the complexities of trying to balance competing interests of stakeholder groups, including but not limited to local government, rural leaseholders, First Peoples and wildlife care groups. Conservation and wildlife care groups are concerned for the welfare of Bare-nosed Wombats and advocate for better protections. Agriculturalists want to manage the species to minimise the damage it can cause to infrastructure, stock and farm personnel. Given the diversity of stakeholder interests, reaching agreement on the best approach to wombat management is a persistent challenge.

This review highlights the legislative, ecological, and stakeholder challenges involved in balancing species conservation with human land use and infrastructure needs. It reviews past and current legislation across the Australian states and territories to inform the conservation and management of wombats in the ACT.

2. Legislation, policy and regulation

2.1 Policy and legislation

Following European settlement and the expansion of agriculture in Australia, all three wombat species have experienced conflicts with humans. Initially, conflicts arose because wombats caused damage to rabbit exclusion fencing and wombat burrows provided refuge for rabbits. As a result, wombats were commonly viewed as pests and were able to be lethally controlled under legislation in most states.

The range of all three species of wombat contracted significantly as a result of large-scale land clearance for agricultural and urban development, and the introduction of European rabbits (*Oryctolagus cuniculus*) (Aitken, 1971, Temby, 1998, Gordon et al., 1985, Buchan and Goldney, 1998, McIlroy, 2008, Cooke, 1998). Over time attitudes towards wombats and concern for their conservation increased and legislation changed to reflect this.

This section provides an overview of the legislative frameworks and policies related to wombat management across various Australian states and territories. These frameworks serve to inform the management approaches in the Australian Capital Territory (ACT) and offer potential insights into improving wombat conservation and management strategies.

2.1.1 Victoria

Legislative history

The Bare-nosed Wombat was declared vermin throughout the state of Victoria in 1906, under provisions of the *Vermin Destruction Act 1890* (Seebeck 1988). In 1925, a bounty was placed on Bare-nosed Wombats under the *Vermin and Noxious Weed Act 1922*, with more than 60,000 bounties paid up until 1955. The bounty was subsequently suspended in 1966 and officially abolished in 1971. Bare-nosed Wombats remained a pest to many and from 1971 to 1986 government officials fumigated their burrows on Crown land.

In 1977, Bare-nosed Wombats were declared protected under the *Wildlife Act 1975* in the region west of the Melbourne to Sydney railway line, where they occurred in low numbers. The vermin status of the species was maintained in eastern Victoria until 1984, when Bare-nosed Wombats were protected under the *Wildlife Act 1975* across all Victoria. Lobbying by farmers led the species to be declared 'unprotected wildlife' in 193 parishes in eastern Victoria under the *Wildlife Act 1975*. The declaration of the species as 'unprotected wildlife' enabled the destruction of Bare-nosed Wombats by landholders, their families, and employees by means of fumigation, trapping or shooting on freehold or leasehold land, and within 1 km of such land on adjoining Crown land. In June 1997, the *Wildlife Act 1975* was modified to enable destruction only on the occupier's property with a high-powered, centre-fire rifle of .222 calibre or larger.

Current legislation and process

In February 2020, an amendment to the *Wildlife Act 1975* revoked the unregulated control of Bare-nosed Wombats across 193 parishes in eastern Victoria. It is now an offence to kill, take, control or harm Bare-nosed Wombats across the entire state of Victoria without authorisation. This includes activities such as destroying or disturbing their burrows. To destroy a wombat without a permit carries a penalty ranging from \$8,261 to \$39,652 and/or six to twelve months in jail. On March 19, 2025 the Victorian Legislative Council voted to review the state's lethal control program for wombats and explore alternative control measures. The review was still underway at the time of writing and no formal legislative changes had been announced.

To destroy a wombat or their burrows landowners need to apply for an authority to control wildlife permit (ATCW) from the Department of Energy, Environment and Climate Action which can be done [online](#), by post or email (Table 1). Applicants are required to demonstrate damage to their property, crops or pasture, impacts on biodiversity values, or risks to human health or safety. Applicants must also demonstrate that all other reasonable options have been considered. A [wombat management methods factsheet](#) outlines "non-lethal" management options for landholders. Forest and Wildlife Officers review applications and may require a property inspection. This process can take up to six weeks to complete.

Each ATCW specifies the species of wildlife that can be controlled and the method of control. Anyone shooting wildlife under the *Wildlife Act 1975* must also comply with the [Firearms Act 1996](#).

Table 1. The number of permits issued to control Bare-nosed Wombats and the number of animals to be harmed in Victoria over the last seven years

Year	Number of permits	Animals authorised to be culled
2023	222	1902
2022	226	1862
2021	207	1675
2020	273	1478
2019	268	3655
2018	252	3830
2017	270	3374

2.1.2 New South Wales

Legislative history

New South Wales was home to all three species of wombat until the last claimed sighting of Northern Hairy-nosed Wombats in 1909. Bare-nosed and Northern Hairy-nosed Wombats had partial protection under the *Native Animals Protection Act* 1903. Under this act both species were protected from destruction during the declared closed season from August to January each year. Bare-nosed Wombats lost these protections when they were not included on the list of protected species under the *Animals and Birds Protection Act* 1918. Bare-nosed Wombats regained legal protection under the subsequent *Fauna Protection Act* 1948. Landholders were required to obtain permits for wombat destruction, except in areas governed by Pasture Protection Boards. At this time, wombats were also regarded as a noxious pest by the Department of Agriculture under the *Pastures Protection Act* 1934. This created a conflict in areas where landholders were required to destroy wombats under the *Pastures Protection Act* 1934, but could be prosecuted for doing so under the *Fauna Protection Act* 1948.

In 1959 the National Parks and Wildlife Service and the Department of Agriculture reached a compromise, leaving Bare-nosed Wombats unprotected but no longer declared noxious. As a result, both species of wombat became fair game for sports shooters and landholders. In March 1973, Bare-nosed Wombats were awarded full protection with provision for destruction for damage control purposes by being removed from the First Schedule (list of unprotected animals) of the *Fauna Protection Act 1948-67*. The following *National Parks and Wildlife Act 1974* provided full protection to Northern Hairy-nosed Wombats, which were classed as endangered. Bare-nosed Wombats were also given protection with a provision for damage control under a permit system.

Current legislation

Wombats are protected under the *NSW Biodiversity Conservation Act 2016*. It is an offence to harm a wombat unless a licence is obtained from the Department of Climate Change, Energy, the Environment and Water.

To obtain a licence landholders must demonstrate animals are a threat to human safety, damaging property and/or causing economic hardship. Where possible, the department seeks to resolve negative interactions using non-destructive methods and recommends non-lethal methods [on their website](#). However, a licence to harm individual animals may be required to mitigate problems. To apply for a licence, landholders must contact their local National Parks and Wildlife Service (NPWS) office to discuss the nature and severity of the issue and any non-lethal measures that may resolve the problem. They can then [download and fill in an application form](#) and lodge it with their local NPWS. The National Parks and Wildlife Service may grant a licence to the owner or occupier of a property to cull wombats. Records of the number of animals harmed need to be kept on a record sheet provided and lodged with the NPWS office within 7 days of the licence expiry. All people operating under the licence must comply with the *Firearms Act 1996* and the Code of Practice for the Humane Destruction of Wombats by Shooting in NSW. Harming wildlife without a permit may receive a maximum fine of \$330,000 with an additional \$33,000 for each animal harmed or two years in jail.

Within the last seven years a small number of permits have been issued (Table 2). The maximum number of Bare-nosed Wombats to be harmed on any one permit was 50 animals. More commonly permits range from 1 – 20 animals for issues including damage to crops, competition with stock, hazard for vehicles, damage to fencing, and causing erosion and disease.

Table 2. The number of permits issued to control Bare-nosed Wombats and the number of animals to be harmed in New South Wales over the last seven years.

Year	Permits issued	Number of wombats to be harmed
2023	34	187
2022	38	219
2021	26	138
2020	42	221
2019	76	501
2018	103	752
2017	40	193

2.1.3 Queensland

Legislative history

The Northern Hairy-nosed Wombat and Bare-nosed Wombat were protected in Queensland under the *Native Animals Protection Act 1906*. However, this and subsequent Acts provided provisions for damage control. By 1982, the Northern Hairy-nosed Wombat was restricted to a single population of approximately 30 animals (Gordon et al., 1985). The *Fauna Conservation Act 1974-1989* provided permanent protection for the Northern Hairy-nosed Wombat with no provision for damage control. Northern Hairy-nosed Wombats were declared endangered under the *Nature Conservation Act 1992*. Bare-nosed Wombats remained protected with provision for damage control under a permit system.

Current legislation

Northern hairy-nosed and Bare-nosed Wombats are protected under the *Nature Conservation Act 1992*, though there are provisions to control Bare-nosed Wombats *for* damage mitigation purposes. A damage mitigation permit is required to take wildlife to minimise damage or loss of property (e.g. crops) or to protect human health and wellbeing. Damage mitigation permits may cover the removal and translocation of problem animals or lethal control.

To obtain a three-year permit to remove and relocate wildlife applicants must demonstrate the following:

- Certificate of completion of a training course concerning the keep, relocation, and safe handling of relevant wildlife.
- A current first aid certificate issued by an approved first aid provider.
- Referee reports from two suitably skilled and qualified persons.
- Statements outlining the ability to handle wildlife, including safety procedures to be applied when handling or moving wildlife and access to appropriate equipment.
- Statements outlining wildlife identification skills.
- A resume including details of qualifications provided with the application.

If an applicant does not have any experience, they are recommended to contact a local damage mitigation permit holder for guidance and possible endorsement under this permit type.

To obtain a permit to lethally control wildlife, applicants must demonstrate damages caused and the economic losses incurred, or any threats to human health (e.g. disease or injury risks). Two non-lethal damage mitigation measures to prevent or minimise damage need to have been attempted prior to application for lethal control. There are no specifications about suitable non-lethal methods to be used or the duration of use. A statement outlining the applicant's relevant knowledge and experience in correctly identifying the relevant species is required. Permits are issued for one-year unless the landholder has an approved property management plan, in which case permits can be issued for three years. The Department of Environment Science and Innovation offers a service to guide applicants through the assessment process. The service includes meeting with a departmental project manager to discuss the information needed for the application. Applicants can email a [downloadable form](#) to the permits and licensing department and may take up to 40 business days to process. Once a permit has been granted, permit holders are required to lodge a return of operations form every three months and within 10 days of the permit expiry detailing how many animals were taken under the permit. The maximum penalty for *controlling protected wildlife without a permit* is \$15,480 (100 penalty units).

2.1.4 Tasmania

Legislative history

Bare-nosed Wombats were not protected in Tasmania until the passing of the *National Parks and Wildlife Act* 1970, which provided partial protection allowing for the declaration of an

open season. The Minister by order, could declare the dates and places on which the taking of any partially protected wildlife may start, stop, be prohibited or permitted and impose any conditions on the order. No open seasons were declared, and destruction for damage control purposes was undertaken by permit.

Current legislation

Bare-nosed Wombats are protected under the *Nature Conservation Act 2002* with provision for damage control.

The Department of Natural Resources and Environment encourages people to use non-lethal management options for mitigating wombat damage and several factsheets can be found on their website for [Living with Wombats](#). A [property protection permit](#) is needed to control protected wildlife, including Bare-nosed Wombats (Table 3). Permits can be applied for by landholders, managers or lessees of land to prevent the destruction of, or injury to any stock, crops and equipment or infrastructure used in crop and/or stock production. Applications must identify the damage caused, the method of control to be used and the number of animals they want to take. The Department of Natural Resources and Environment must be satisfied a financial loss is likely to occur if the crop, stock, equipment or infrastructure is not protected. Applications are assessed on a case-by-case basis, which may include a visit to the applicant's property. The local abundance of Bare-nosed Wombats, the impacts they may have on the property, and whether non-lethal measures will be effective at the site are considered when issuing permits.

The Department of Natural Resources and Environment Tasmania assesses population trends using annual spotlight monitoring of 190 10-km transects across the state. Issued permits specify the number of Bare-nosed Wombats that may be taken and a timeframe of up to 12 months. Permit holders are required to maintain accurate records of animals destroyed and report them within 28 days of the permit expiry. Persons controlling wildlife without a permit or who do not comply with the terms of their permit can receive a penalty of up to \$19,500 (100 penalty units).

Table 3. The number of permits issued to control Bare-nosed Wombats and the number of animals to be harmed in Tasmania from 2016 to 2022. Blank cells indicate a lack of data.

Year	Permits issued	Total quota issued	Wombats culled
2022	9	165	29

2021	6		17
2020	5	51	20
2019	4		107
2018	6	110	
2017	22	160	
2016	52	2171	

2.1.5 Western Australia

Legislative history

Southern Hairy-nosed Wombats were not provided protection under early game acts in Western Australia. The *Game Act* 1912 provided protection to all “non harmful” native fauna, but it is unclear whether this extended to Southern Hairy-nosed Wombats. The *Fauna Protection Act* 1950 was the first to provide blanket protection to all native fauna in the state, including Southern Hairy-nosed Wombats. In 1975 it was re-named the *Wildlife Conservation Act* 1950 and included new provisions for damage control permits.

To prevent Southern Hairy-nosed Wombats from becoming an agricultural threat across the state, the Agricultural Protection Board declared them as vermin in areas of WA outside their known range. In 1973, the declaration was amended to include Southern Hairy-nosed Wombats as a pest species under the *Vermin Control Act* 1918-1970. When the *Vermin Control Act* was replaced by the *Agriculture and Related Resources Protection Act* 1976, the Southern Hairy-nosed Wombat was included as a category seven declared animal. As a category seven species, the Minister had the authority to recommend and approve a species management plan that included management by lethal control.

Current legislation

In 2019 the *Wildlife Conservation Act* 1950 was replaced by the *Biodiversity and Conservation Act* 2016 and the Biodiversity Conservation Regulations 2018. Under the Biodiversity Conservation Regulations 2018, there are provisions for controlling fauna that have been listed as managed species. Fauna may be listed as a managed species if they are determined to be impacting public safety or biosecurity or causing economic or ecological damage. The Southern

Hairy-nosed Wombat is not currently listed as a managed species. There are no records of licence applications or grants for Southern Hairy-nosed Wombat control in Western Australia.

When fauna cause damage to agriculture, native animals may be declared pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Under the BAM Act, every organism except a human being has a legal status assigned through a declaration made by the Minister. If the Minister has not made a declaration, the status automatically remains unlisted. BAM status determines whether a permit is required to import the organism into Western Australia. The Southern Hairy-nosed Wombat is listed as a Permitted species S11 (exempt) on the Western Australian organism [list](#) under the BAM Act. This means they are not a declared pest and can be imported into the state without a permit provided they satisfy import permits and can be kept without a permit.

2.1.6 South Australia

Legislative history

Wombats gained their first legal recognition under the *Animals Protection Act 1912* on the schedule of unprotected animals. Partial protection was achieved under the provision of *Animals and Birds Protection Act 1919* with the declaration of a closed season on wombats from July to December. During the closed season landholders were only permitted to cull wombats for damage control purposes. The Fauna Conservation Act 1964 provided full protection with a provision for controlling wombats for damage mitigation. Under the *National Parks & Wildlife Act 1972*, the Bare-nosed Wombat was listed as 'Vulnerable' with full protection. The Southern Hairy-nosed Wombat was permitted to be controlled for damage mitigation purposes.

Current legislation

The Bare-nosed Wombat and Southern Hairy-nosed Wombat are protected under the National Parks and Wildlife Act 1972 (NPW Act). It is an offence to catch, interfere with, harass, or kill both species without a permit. The Department for Environment and Water recommends using non-lethal means for managing wombats prior to resorting to culling and has a "Living with Wombats" [factsheet](#). The Department of Environment Water can issue destruction permits in circumstances where wombats cause damage or threaten human safety (*section 53.1c of the SA National Parks and Wildlife Act 1972*). Permit application forms are available [online](#) and can be emailed, posted or dropped off at the nearest regional office. Applications are considered by National Parks and Wildlife rangers on an individual basis. Consideration is

given to whether non-lethal means may resolve the problem, the extent of the damage and threats to safety. There is a code of practice for the humane destruction of wombats which permit holders must abide by. The penalty for killing a wombat without a permit is a \$2,500 fine or six months in prison.

An amendment was made to the National Parks and Wildlife Act in 2023 prohibiting the destruction, damage or disturbance of wombat burrows without a permit, with a maximum penalty of \$5 000 or imprisonment for 12 months. Permits are not required if:

- you are the owner of the land where the burrow is located,
- you are authorised to destroy, damage or disturb the burrow by the owner of the land where the burrow is located; and
 - the burrow is located outside of a Wombat Burrow Protection Zone; and
 - the burrow is causing, or is likely to cause, damage to crops, stock, machinery or infrastructure (including tracks and built structures) or may constitute a safety risk or hazard to people.

If a burrow is located within a declared Wombat Burrow Protection Zone a person must not, without a permit, destroy, damage or disturb the burrow. No Wombat Burrow Protection Zones currently exist so a permit is not presently needed to destroy a wombat burrow. There is a protection for wombat burrows factsheet outlining the new changes.

2.1.7 Australian Capital Territory

Legislative history

Bare-nosed Wombats have been fully protected in the ACT since the *Animals & Birds Protection Ordinance* 1918. Successive Commonwealth ordinances and the *Nature Conservation Act* 1980 kept full protection in place.

Current legislation

As native animals under the *Nature Conservation Act 2014*, Bare-nosed Wombats remain protected. Killing a native animal is an offence under section 130 of the Act, which presently carries a maximum penalty of \$16,000 and/or imprisonment of 1 year for an individual, or \$81,000 for a corporation (higher if the species is specially protected). Under sections 128-129 of the Act, it is an offence to interfere with a nest (including burrow) of a native animal. These offences presently carry a range of penalties, up to (in a case involving a wombat) \$16,000 and/or imprisonment of 1 year for an individual, or \$81,000 for a corporation. A range of

offences apply to damaging land in a reserve. The maximum penalty for the most serious of these offences is presently \$400,000 and/or 7 years' imprisonment for an individual, or \$2,025,000 for a corporation. Some activities, including nest destruction, may potentially be carried out under a licence issued by the Conservator of Flora and Fauna. It is the responsibility of the proponent to apply for a licence for any proposed activity that may otherwise be an offence under the Act. The ACT Parks and Conservation Service administers the Act and conservation officers are responsible for conducting compliance activities. These include public education, inspections and investigations to promote and support compliance.

In 2025, the ACT Government strengthened its regulatory framework for wildlife protection during development by introducing the Nature Conservation (Protection of Burrowing Animals During Development) Conservator Guidelines. These guidelines, issued by the ACT Conservator of Flora and Fauna, are a notifiable instrument under the *Nature Conservation Act 2014*, giving them legal force and requiring compliance from developers operating in areas with suitable habitat. The guidelines aim to minimise harm to native burrowing animals, such as Bare-nosed Wombats, by requiring site assessments, avoidance of active burrows, and consultation with the Conservator where disturbance is unavoidable.

2.1.8 Differences between the ACT and other jurisdictions on wombat control

Apart from the ACT, all jurisdictions currently have a specific provision under legislation to enable wombat control for the purpose of damage mitigation. Victoria is currently conducting a review of their lethal control policies for wombats, but this review is still in progress and there have been no legislative changes. Control is regulated by a permit system, and landholders are required to pursue alternative management methods in almost all states before seeking a culling permit.

Tasmania is the only state which considers trends in wombat populations when setting permit allocations. Understanding baseline population data is critical to assessing a program's efficacy and impacts. Controlling too few individuals can be ineffective at reducing damages, while removing too many can have negative conservation outcomes (Taggart et al. 2008).

Most states have an online permit application system or provide a form that can be submitted to the relevant department. Applications typically take 4-6 weeks to process, and landholders may be frustrated by these timeframes (Sparrow, 2011, Stott, 1998, Bunn, 2019). When landholders are faced with wombats burrowing under dams and other infrastructure, they feel

prompt action is required to prevent further damage. Most states require the applicant to have tried 'non-lethal' damage mitigation strategies before applying for a permit, but guidance on 'non-lethal interventions' may not be provided. Further research into the efficacy and animal welfare considerations of common 'non-lethal interventions' is also required.

There has been a substantial reduction in the number of permits and the number of wombats permitted to be culled within the last decade across all states. This is in response to mounting public pressure on government agencies from conservationists and animal welfare advocates. As a result, landholders feel they are unable to reduce the damage caused by wombats on their property. For many farmers, the lengthy application process is not worth the time it takes to apply for a permit if they are only permitted to cull 10-25 wombats. As such some landholders act outside of permit systems and official government registers are considered an underestimate of the true numbers of wombats culled (St John and Saunders, 1989, Taggart et al., 2008).

3. Wombats in the ACT

3.1 Distribution and abundance

Prior to European settlement Bare-nosed Wombats were thought to have a continuous distribution across much of their range including the ACT. Following European settlement, the establishment of farming along with the introduction of rabbits is thought to have had a significant reduction on the distribution and abundance of all three species of wombats (Buchan A and DC, 1998, Cooke, 1998). Dingoes (*Canis familiaris dingo*) have been known to predate on wombats where the two species co-occur, but their effects on overall population numbers is unclear (Thorley and Old, 2020). Current occurrence records from the ACT Wildlife Atlas show Bare-nosed Wombats are widespread across the ACT, particularly along the Murrumbidgee and Molonglo River (Figure 1). Wombats are also known to occur across Namadgi National Park (CED survey data).

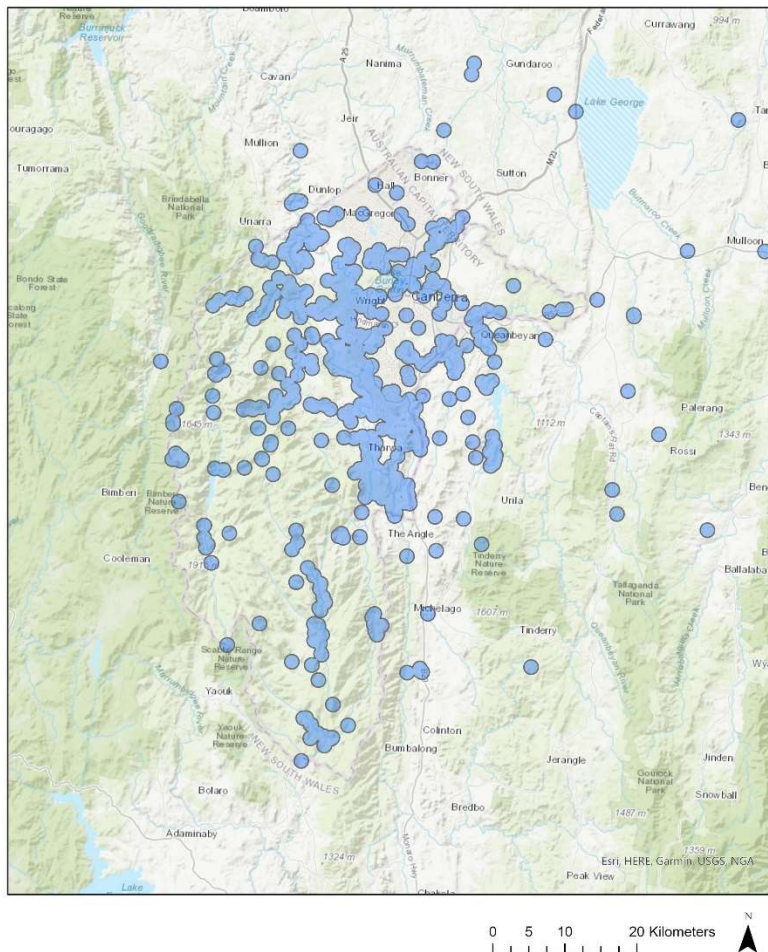


Figure 1. The known distribution of Bare-nosed Wombats (blue) in the Australian Capital Territory, taken from ACT Wildlife Atlas records, CED survey data and the [ACT Wombat Mange Portal Map](#). This data collection system is designed to capture data within the ACT and is likely an underrepresentation of wombat distributions in NSW.

Abundance is likely to vary locally and regionally, depending on a range of factors, such as habitat type, soil type and climatic conditions. Competition from rabbits and kangaroos for food resources also limits Bare-nosed Wombat numbers in many areas (Tamura et al., 2021, Bird et al., 2012, Cooke, 1998).

There are currently no reliable estimates of abundance for Bare-nosed Wombats in the ACT. After an initial likely decline from habitat loss, following the expansion of agriculture and urbanisation, anecdotal reports from leaseholders suggest the distribution and abundance of Bare-nosed Wombats have increased over the last 10-20 years. Anecdotal evidence from park rangers also support an increase in distribution. Reports dating back to 1975 indicate Bare-nosed Wombats were not present on the Canberra plains or in Canberra Nature Park at the time, though they were present in Tidbinbilla and Namadgi National Park. Rabbit control

officers were known to target Bare-nosed Wombats because of the holes they made in rabbit proof fencing (Don Fletcher, pers. comm.; Higgins, 1991).

3.2 ACT Government stakeholder engagement

The Office of Nature Conservation (in CED) initiated a Wombat Working Group in 2021 to bring together stakeholders with interests in Bare-nosed Wombat management in the ACT to share knowledge and discuss management issues. The group consisted of wildlife carers, ACT Government, agriculturalists and researchers. The group met several times virtually, but lack of attendance meant that it was disbanded. A Wombat Mange Management Sub-group also commenced in 2021. The subgroup met quarterly until it was scaled back and eventually paused in 2024. For more information on relevant stakeholders in the ACT see Section 4.

3.3 Monitoring and management

The Office of Nature Conservation conducted line transect surveys across 13 sites to monitor wombat populations in the ACT, but these methods have now been judged insufficient to robustly estimate abundance. For more information on monitoring wombat populations see Section 6.8.

Mange is treated by wildlife care groups under a CED permit for use of moxidectin on public land in the ACT, with strict conditions of its use around waterways due to its toxicity to aquatic species. For more information on the prevalence and treatment of sarcoptic mange in the ACT see Section 5.2.1.

3.4 Rescue and rehabilitation

There are two wildlife rescue organisations within the ACT that care for and rehabilitate sick and injured Bare-nosed Wombats. Wombat Rescue is solely dedicated to Bare-nosed Wombats, and ACT Wildlife cares for all injured wildlife. Wombat Rescue operates under a licence to take, rehabilitate and release wildlife in the ACT issued under Section 273 of the *Nature Conservation Act 2014*. Both groups work closely with each other and NSW care groups to coordinate resources for the care of Bare-nosed Wombats.

Wombat Rescue reports responding to several call outs a day. In the last 6 months Wombat Rescue have taken 19 Bare-nosed Wombats into care. Records indicate up to 50 wombats are taken into care annually by Wombat Rescue and ACT Wildlife cares for 20-30. What most individuals take into care are pouch young orphaned as a result of road vehicle collisions. To a

lesser extent Bare-nosed Wombats with severe mange are taken into care for treatment, with carers preferring to treat mange in situ where possible.

Of the approximately 50-60 Bare-nosed Wombats taken into care each year fewer than 10 animals are released in the ACT. In 2024, 28 wombats from the ACT were taken into care and only five were released into the ACT. Animals that come into care from New South Wales must be released in NSW. Release sites are resource intensive to find. For wombats these may include a large enough area that is free from mange, away from roads, has available food and water, and a low density of resident wombats. ACT Wildlife procures empty burrows to release animals by evicting resident Bare-nosed Wombats with the use of one-way gates. Wombat Rescue creates artificial starter burrows to release animals by digging a 70 cm deep L-shaped tunnel in flat ground. They place a 45 cm diameter trench liner half pipe over the hole before filling it back in to make a tunnel. When creating tunnels on private land they use soft release techniques, fencing the burrow and providing supplemental food. Animals released into parks and reserves are not provided supplemental food or fenced burrows. Carers monitor released individuals for a few weeks using wildlife cameras, but released animals rarely stay in the release area.

More recently, there has been request from Wombat Rescue that ACT Government provide land for a pre-release wombat sanctuary or haven to prepare rehabilitated wombats for wild release. Areas would need to be designated and fenced for this purpose, and policy or guidelines developed around effective and safe release of wombats. The feasibility and need for a wombat sanctuary, and the role of the ACT Government in providing such a facility, is still in discussion.

4. Stakeholder consultation and interviews

This section lists the primary stakeholders invested in Bare-nosed Wombat management in the ACT, and their interests in this issue (Table 4). It is important to note this is not a comprehensive review of stakeholder opinions on Bare-nosed Wombat management in the ACT and only expresses the views and opinions of a small number of people from each stakeholder group. Views and opinions are likely to vary within stakeholder groups. A formal review of stakeholder views is recommended.

Table 4. Identified stakeholders within the ACT with an interest in Bare-nosed Wombat management

Group	Organisation/name	Role in relation to Bare-nosed Wombats
ACT Government	Office of the Conservator of Flora and Fauna, City and Environment Directorate	Acts on issues that affect the conservation matters covered in the <i>Nature Conservation Act 2014</i> , particularly protecting native plants and animals
	Office of Nature Conservation Policy, City and Environment Directorate	Updates policy and legislation under the <i>Nature Conservation Act 2014</i>
	Office of Nature Conservation, City and Environment Directorate	Undertake a range of nature conservation programs in the ACT, including research on local flora and fauna, preparing scientific advice on ecological and natural resource management, conducting ecological surveys, biodiversity monitoring
	City Services, City and Environment Directorate	Deliver a range of services, including shop and playground upgrades, road and path maintenance, domestic animal services, and the management of urban open spaces including tree planting and grass mowing that may be impacted by Bare-nosed Wombat behaviour
	ACT Natural Resource Management, City and Environment Directorate	Integrated management of ACT's natural resources, including biodiversity, sustainable agriculture and cultural history
	ACT Parks and Conservation Service, City and Environment Directorate	Land management of the conservation estate, vertebrate pest and weed control, and managing visitor experiences.
	Licensing and Compliance, City and Environment Directorate	Licensing and compliance under the <i>Nature Conservation Act 2014</i>
	Urban Wildlife, ACT Parks and Conservation Service, City and Environment Directorate	Manage the outcomes of human-wildlife conflict, including nuisance animals, vehicle strikes and sick and injured animals

	Veterinarians, City and Environment Directorate	Administering treatment and care of animals including wildlife within the ACT
Industry	Icon Water	Responsible for maintaining supply of water and sewage services in the ACT. These services may be impacted by Bare-nosed Wombat activity on occasion and require management
	Developers	Construction of new developments within the ACT in compliance with Conservator Guidelines for Burrowing Animals
Agriculturalists	Rural leaseholders	Land management and agricultural production which may be impacted by Bare-nosed Wombat behaviour
	ACT Rural Landholders Association	Advocacy for farmers and best practice farming within the ACT
Wildlife carers	Wombat Rescue	Caring for injured wombats and treating mange infected populations within the ACT. Advocate for wombat conservation and welfare
	ACT Wildlife	
Researchers	Prof Scott Carver	Conducting research on wombat ecology, biology and management
Ngunnawal	Dhawura-Ngunnawal Caring for Country Committee (DNCCC)	The representative body for ACT Government for traditional custodians of the Country in and around the ACT

4.1 Rural leaseholders

Rural leaseholders are frustrated by their current ability, or lack thereof, to manage Bare-nosed Wombats on their properties. Streambank erosion and reduced water quality as a result of wombat burrowing near waterways have been raised as a concern by landholders in correspondence with the ACT Government. Burrows and tunnels are becoming a big safety concern, with some paddocks described as 'Swiss cheese'. Staff and stock are frequently injured by falling into burrows (see section 9.2.1). Rabbits have become difficult to control, as they shelter in Bare-nosed Wombat burrows and cannot be treated. Landholders have expressed interest in the development of an authorised control program like the kangaroo management program in the ACT.

The management of mange on private properties is a cause of concern for rural leaseholders. Some leaseholders have reported their dogs have contracted mange from the burrows of infected animals. This has resulted in expensive vet bills and distress to both dogs and their owners. Wildlife carers have also been caught trespassing on private property to treat mange. Landholders are concerned carers may be applying toxic chemicals without their knowledge. Furthermore, some leaseholders have experienced pressure from lobby groups in relation to kangaroo management and are apprehensive of similar dynamics with wombat carer groups.

Rural landholders within the ACT are frustrated by the current level of engagement with ACT Government on wombat management issues. Those involved in the Wombat Working Group have expressed concern that the group was heavily focused on conservation and mange treatment and did not adequately address the difficulties of managing wombats on rural properties. Their view is that rural landholders should be engaged directly to better understand the management issues they are facing, and to develop damage mitigation strategies to improve co-existence with wombats. Concerns about sick wombats on rural lands were raised. For these strategies to be successfully implemented, they must be accepted by landholders as feasible and effective options. Additionally, continuing discussions between researchers, ecologists and landholders on the ecological value of wombats may improve landholder tolerance of wombats and facilitate effective management (Schumann et al, 2012).

It is important to note, there are 381 farmers within the ACT and only three rural leaseholders were consulted in the writing of this review. The views presented here do not necessarily represent the views of all rural leaseholders within the ACT.

4.2 Wildlife carers

ACT Wildlife and Wombat Rescue are two groups rehabilitating Bare-nosed Wombats in the ACT. Wombat Rescue are often called out to assess the condition of injured or mange-affected animals by the ACT Parks and Conservation Service (PCS) and the public. Wombat Rescue has approximately 20 active members who respond to calls and their resources are strained. They are concerned about the level of awareness and training rangers have in assessing mange cases and determining if treatment or euthanasia is needed. While carers acknowledge assessing the severity of mange is subjective, they would like mange training courses to be mandatory for all rangers to attend. To address this issue in part, the ACT Chief Veterinary Officer developed the 'Assessment of sarcoptic mange in wombats: A guide for rangers' as a decision sheet for PCS rangers assessing mange severity and the need for humane euthanasia. Additionally, carers are concerned about the lack of suitable release sites for rehabilitated

animals in the ACT, leading to most releases occurring in NSW. Both care groups worry about post-release survival and are exploring GPS tracking to monitor outcomes.

Wombat Rescue leads efforts to treat mange across populations, while ACT Wildlife limits treatment to intended release areas (see section 9.3.1). Despite ongoing efforts, carers lack the resources to eliminate mange from populations and believe more needs to be done to control the disease. Wombat Rescue also notes that some leaseholders are reluctant to allow property access to wildlife carers to treat mange affected Bare-nosed Wombats, increasing tension between the stakeholder groups.

Urban development in the ACT is encroaching on Bare-nosed Wombat habitats, likely forcing them into river corridors and increasing population density (see section 9.3.2). While carers have positive relationships with some developers, they are concerned others neglect proper wombat management. Carers fear Bare-nosed Wombats are being pushed into narrow river corridors which will place a strain on resources and result in more aggressive territorial behaviour. They would like to see buffer zones placed around new developments to minimise impacts to Bare-nosed Wombats, but no context was provided.

4.3 Community

Bare-nosed Wombats frequently interact with areas used by the broader community. As urban sprawl encroaches on Bare-nosed Wombat habitat there will likely be increases in human-wombat interactions and potential conflicts in urban areas. The broader community was not consulted as part of this review, and their opinions remain unknown.

Many people who do not live with wombats on their properties are often unaware of the issues these animals can cause, which contributes to resistance toward their management. Increasing public education about Bare-nosed Wombat biology, ecology, and the challenges they present can improve acceptance of species management strategies (Reiter et al., 1999). Including educational material on wombat ecology, impacts and management options on the CED website could be a valuable resource for the community. This would be similar to the information that is currently provided for other managed species (e.g. kangaroos). By fostering understanding through a well-structured information campaign, communities can better support responsible Bare-nosed Wombat conservation and reduce human-wombat conflicts across urban and rural settings.

4.4 Ngunnawal

Bare-nosed Wombats were widely used by First Nations people in many parts of southeast Australia. Much of the traditional knowledge has been disrupted due to the impacts of colonisation. Unfortunately, limited access to relevant contacts has constrained our ability to assess the importance of Bare-nosed Wombats to the Ngunnawal community at this stage. Reviving and incorporating First Nations perspectives into contemporary conservation efforts can help honour cultural importance and provide holistic approaches to managing Bare-nosed Wombat populations in the ACT.

4.5 Office of Nature Conservation (ONC)

The management of Bare-nosed Wombats is becoming an emerging and complex issue for ONC. ONC initiated a Wombat Working Group to work with stakeholders and better understand the complexities and conflicting viewpoints in this space, but reported they had trouble engaging leaseholders within the working group. The working group came to an end when there was no new information to guide decision-making. ONC faces pressure from wildlife groups to manage munge and has worked with researchers and wildlife carers to mitigate munge impacts. This includes the creation of the Wombat Munge and Monitoring Group, a subgroup of the Wombat Working Group focused on monitoring wombat populations and assessing munge. While there is a desire within ONC to effectively manage this species, a range of knowledge gaps and resource allocation has proven to be a significant hurdle.

Ecologists in ONC are also responsible for the monitoring and conservation of a range of threatened riparian and aquatic species in the ACT. There are concerns that munge treatments such as moxidectin are highly toxic to aquatic life, and the negative consequences this may have on threatened aquatic species.

4.6 ACT Parks and Conservation Service (PCS)

Rangers find it challenging to manage community frustrations surrounding wombat burrow management in ACT parks and reserves. Walking and cycling trails are often re-routed along sub-optimal routes due to the presence of Bare-nosed Wombat burrows. As conservation officers, rangers are permitted to interfere with wombat burrows where necessary and are required to adhere to the Conservator Guidelines for the Protection of Burrowing Animals. Rangers would like support to manage burrows, particularly short starter burrows that are not used as a primary refuge.

Rangers have also raised concerns around streambank erosion and damage caused by wombats burrowing near waterways, particularly along the Murrumbidgee River.

4.7 ACT Natural Resource Management

The primary issues ACT Natural Resource Management (ACT NRM) encountered with Bare-nosed Wombat management were a result of conflicts with farmers. Anecdotally Bare-nosed Wombat numbers have increased in the last 15-20 years, and subsequently the number of conflicts has increased. Among landholders there is an appetite to declare Bare-nosed Wombats overabundant and allow lethal controls as a management tool. ACT NRM would be reluctant to implement lethal control as there are multiple knowledge gaps around current population levels and minimum viable populations. ACT NRM also highlighted the lack of resourcing for non-lethal options for managing conflict between landholders and Bare-nosed Wombats. Subsidising exclusion fencing in hotspot areas may be a feasible option for conflict resolution. One-way gates, another management option, may remove conflict in one area but relocate wombats and conflict to another area.

4.8 Icon Water

Bare-nosed Wombats have damaged Icon water essential services infrastructure (see section 9.2.1). Icon Water sought advice from ecologists on damage mitigation strategies but had difficulties finding skilled ecologists with capacity to assess the problem and implement recommendations. As a result, Icon Water now manages wombat damage independently based on online consultation with ecologists. They have adopted a variety of management strategies, but they require monitoring and management investments. Icon Water currently has sufficient resources to continue implementing their management program.

4.9 Licensing and Compliance

The Licensing and Compliance team is supportive of developing a CNSMP for wombats and indicated that this is preferable to issuing licenses for control. They recommended that if the ACT government was to permit lethal control of Bare-nosed Wombats it should be part of an evidence-based controlled native species management plan (CNSMP), similar to macropods. Additionally, the Licensing and Compliance team noted that a CNSMP should include clear guidelines around when control is appropriate, and the criteria that must be met for control to occur. For example, the existing CNSMP for Eastern Grey Kangaroos clearly defines when control occurs, the number of animals to be removed, and benchmarks for shooter proficiency.

A CNSMP for wombats should also be paired with a new code under the *Animal Welfare Act* that defines how wombats are to be controlled humanely. Currently there have been no formal complaints to the licencing department about Bare-nosed Wombats.

4.10 Office of the Conservator for Flora and Fauna

In recent years, wildlife carers have been concerned about the impacts of new development on Bare-nosed Wombats. In response, the Office of the Conservator for Flora and Fauna developed the Conservator Guidelines for the Protection of Burrowing Animals during development (Protection of Burrowing Animals During Development) Conservator Guidelines 2025 notified under the Legislation Act 2001). There are currently two licences issued to interfere with Bare-nosed Wombat burrows.

4.11 Scientists

The only scientist consulted during this review was Dr. Scott Carver, who specialises in researching wildlife disease ecology. Dr. Carver was a member of CED's Wombat Working Group and has worked with the ACT and Tasmanian governments on mange-related projects. He felt the Wombat Working Group effectively achieved its intended purpose. Similar to the Tasmanian wombat working group, the CED-led group came to a natural end when participants ran out of new information to bring to the table.

Dr. Carver has worked extensively with wildlife carers on mange treatment. He noted that within the stakeholder group there is disagreement over best practice treatment methods and determining when euthanasia is appropriate. He noted that conversations in this space can escalate quickly, and more research is necessary. A recent study by the Wombat Protection Society and associated researchers trialled increasing the dose of moxidectin from 20 ml to 100 ml to treat mange in wombats. Dr. Carver noted that this is a large increase in dosage, and studies gradually increasing the treatment dose to determine the lowest effective amount would be key to preventing excessive use of moxidectin.

Dr. Carver acknowledged leaseholders had conflicts with Bare-nosed Wombats and more research was necessary in this space, but it was outside his area of expertise.

4.12 Chief Veterinary Officer

The ACT Government Chief Veterinary Officer (CVO) was primarily concerned Bare-nosed Wombats treated for mange *in situ* are not getting the proper care they need. Ideally animals would be diagnosed by a qualified veterinarian prior to being given treatment, although the CVO did acknowledge that this was not possible when treating wild animals *in situ*. They raised concern that the indiscriminate application of moxidectin at all burrows within an area can lead to accidental overdosing of individual Bare-nosed Wombats. Conversely, some wombats may not receive a full dose if the chemical splashes as they are exiting a burrow or they move away from the treatment area. Healthy animals within the population will also unnecessarily receive treatments, which could lead to the development of chemical-resistant mites.

The drugs being used to treat Bare-nosed Wombats have the potential to cause harmful side effects in other species. Dogs that ingest moxidectin can experience neurotoxic effects and possible mortality. Faecal matter from treated animals contains traces of moxidectin, which can wash into waterways and affect aquatic systems. Responsible use of mange treatment drugs is critical to ensuring the negative impacts on ecological function are minimised.

4.13 Developers

The ACT population is projected to grow to 696,000 by 2050. Over the next few decades urban expansion is likely to further encroach on areas where Bare-nosed Wombats reside, resulting in management issues for urban developers. No developers were spoken to during this review. Consultation with developers is recommended to ensure urban expansion can be managed with minimal impacts on Bare-nosed Wombats.

5. Complexities of wombat management

The management of wombats is highly contentious, with challenges arising from the need to balance the competing interests of diverse stakeholder groups, including local government, leaseholders, First Nations, and wildlife care organisations (see Table 4). Conservation and wildlife care groups advocate for stronger protections for Bare-nosed Wombats, while agriculturalists and developers seek to manage the species to reduce damage to infrastructure, livestock, and personnel. This section seeks to bring together diverse stakeholder perspectives on a range of issues to highlight the complexities involved in reaching a management solution.

It is unlikely that all stakeholder groups will agree on a single approach to wombat management. However, participatory planning can improve communication and foster mutual understanding. Involving stakeholders in decision-making processes can lead to greater ownership of outcomes, enhance program credibility and transparency, and support the achievement of long-term goals (Hewitt and Messmer, 1997). Stakeholders are less likely to adopt or support management practices if they feel their opinions have not been taken into consideration and may take management actions into their own hands.

To date, there is no known research specifically examining the complexities of stakeholder relationships in wombat management. However, studies have explored landholder relationships with Southern Hairy-nosed Wombats (O'Brien, 2019, Sparrow, 2011, St John and Saunders, 1989, Stott, 1998) and Bare-nosed Wombats (Marks, 1998c). Additionally, the 5th IUCN World Parks Congress in 2004 brought together conservation experts to discuss human-wildlife conflict. Insights from this workshop, summarised by Madden (2004) provide a useful guiding resource for managing human-wildlife conflict.

5.1 Common causes of damage

5.1.1 Burrowing behaviour

Wombats are one of the largest burrowing herbivores in the world and create warren complexes that vary in complexity from single entrance burrows to a collection of interconnected burrows (warren). Burrows can vary in depth (0.4-2.8 m) and length (0.5-20 m), as such the spoil mound can be anywhere from 2.5-8 m² (Triggs, 2009, McIlroy, 1973). A Bare-nosed Wombat can use up to 11 burrows within their home range, though they typically favour the use of 1-2 burrows (Evans, 2008). Though their burrowing provides essential ecosystem services it often leads to conflicts with people. Bare-nosed Wombat burrows can undermine infrastructure such as roads, buildings, water tanks, fencing, dams which can result in substantial damage, financial costs and safety concerns.

One of the main points of contention for rural leaseholders with Bare-nosed Wombats on their properties in the ACT is the damage and occupational health and safety risks burrows can cause. This includes damage to fencing, dams, roads, buildings and erosion. Wombat damage to fencing can result in stock escaping from paddocks, posing a safety risk to both stock and people. Livestock may become injured or lost once they escape from the safety of a property resulting in financial losses to the rural leaseholders. Where properties adjoin parks and reserves there is a risk escaped stock may damage parks and reserves and incur fines for the

landholder. Furthermore, rural leaseholders have a legal responsibility to ensure their stock does not stray from their property and can be held liable for any damages if they escape. Fence damage can also allow access to properties from undesirable pest species such as pigs.

Rural leaseholders and Icon Water have reported issues with Bare-nosed Wombats burrowing into the sides of dams or reservoirs. This is not only a safety concern for people but also the Bare-nosed Wombat. If a dam wall breaks it has the potential to release large volumes of water, threatening farm water supplies and downstream properties. In addition, it could cause increased erosion and sediment washing into the Murrumbidgee River and other major waterways. This places a significant financial burden on the rural leaseholders who are responsible for appropriately maintaining their dams. Icon Water have been managing Bare-nosed Wombats burrowing around dams by using one-way gates to force animals to leave the burrow and filling the hole with cement once they have been evicted.

Icon Water, rural landholders and PCS rangers have reported safety concerns with Bare-nosed Wombats burrowing under roads and tracks and within paddocks. The weight of a vehicle driving over a tunnel can cause the tunnel to collapse, causing damage to vehicles and necessitating vehicle and road maintenance. For rural leaseholders, burrows pose a significant safety risk to people and stock. Landholders using quadbikes and buggies can incur significant injuries if their vehicle falls into a burrow, which can lead to lengthy recovery times and a loss of income. Rural leaseholders have reported vehicles falling in tunnels as frequently as once a month with estimated damages costing ~\$1,000. This risk is increased in summer when grasses and other vegetation obscure burrow entrances. Landholders can also be liable for injuries to contractors and other staff working on their property, and landholders have been sued by injured contractors. Stock falling into wombat burrows can negatively affect animal welfare and lead to financial losses. One rural leaseholder has had to remove high value stock from a paddock with high levels of Bare-nosed Wombat activity. When wombat burrows limit accessibility of paddocks landholders may not be able to carry out other management tasks such as weed control. While burrow entrances can be mapped to reduce the risk, it would need to be updated regularly to account for new burrows. This is not feasible for rural landholders at a large scale.

Bare-nosed Wombats burrow under other infrastructure, such as buildings, water tanks and wastewater treatment drying beds. They can be removed with the use of one-way gates and burrows can be backfilled, but it is possible wombats will re-excavate the site. Rural leaseholders have tried using mesh to prevent re-excavation, but this treatment only lasts up

to six months. Icon Water use a range of methods to prevent Bare-nosed Wombats re-excavating under infrastructure including the installation of cement skirts, placement of large rocks or mesh skirting. This requires ongoing maintenance and monitoring to keep animals out of undesirable areas. Burrows can also harbour rabbits, which creates an added layer of complexity in rabbit control. If rabbits are found using Bare-nosed Wombat warrens, Icon Water install one-way gates to remove the wombat before fumigating the burrow.

5.1.2 Grazing competition and crop damage

Within the ACT there are 20,869 ha of agricultural land, the majority of which is stock grazing land, with a small amount of cropping. Though competition for food resources between wombats and livestock has been reported as an issue of concern in other states (O'Brien, 2019, Stott, 1998, Marks, 1998c), rural leaseholders in the ACT have not reported it as an issue. The density of wombats on properties can vary at local and regional scales and may influence reports of grazing competition. For example, within the Murraylands of South Australia, Southern Hairy-nosed Wombats have an estimated DSE (dry sheep equivalent) of 0.5, comparatively sheep have a 1.2 DSE. Dry sheep equivalent is a unit of measure used to assess the nutritional needs of livestock and assess the carrying capacity of a farm. It equates to the amount of feed required by a two-year-old 50 kg Merino wether per day. Landholders have had to reduce their stocking rate by 20%, to account for the impacts of growing Southern Hairy-nosed Wombat populations, threatening the viability of some farms. Due to the differing climatic conditions in the ACT Bare-nosed Wombats might not have a substantial grazing impact. However, only three rural leaseholders were consulted in the writing of this document. Further consultation with rural leaseholders is recommended to understand the extent of the problems they are facing within the ACT before ruling grazing competition or crop damage out as a potential cause of conflict.

5.1.3 Erosion

Along waterways wombat burrows are often perceived to increase erosion in creeks and gullies (O'Brien, 2019); however, the extent of damage has not been quantified. Past land clearance may have resulted in increased soil instability, facilitating wind and water erosion of creek lines over time. When Bare-nosed Wombats burrow into steep banks, they undercut and destabilise them, the effects of which are exacerbated in unstable soils where there is a lack of vegetation. Eroding soils are transferred into waterways with environmental implications for aquatic systems, including loss of fish habitat, aquatic barriers and increased nutrient loads.

Targeted monitoring in areas suffering from erosion is necessary to determine the extent and underlying cause of erosion and inform best practice management actions.

Rural leaseholders have used fencing to prevent stock from accessing creek lines and contributing to erosion risks. They are unable to prevent Bare-nosed Wombats from digging into creek banks and damaging the stock exclusion fencing. One rural leaseholder remediated the creek line of his property to reduce the erosion and subsequent damage to the surrounding aquatic environment with the help of ACT NRM and community groups (Figure 2). It took significant effort getting the necessary approvals on top of the time and costs of the



Figure 2. Top - the eroding creek line on a leaseholder's property prior to remediation works. Bottom - the creek line after remediation works.

work itself, totalling over \$50,000. This work was undertaken as part of a grant program and would otherwise have been infeasible for the rural leaseholder. The rural leaseholder reported difficulty in dealing with 'red tape' associated with the project and would not have completed it without the help of the ACT NRM.

5.1.4 Land clearance for urban development

Recent expansion of urban development has caused concern among wildlife groups for wombats. Though Bare-nosed Wombats are a protected species they are not threatened and thus do not need to be considered when assessing a site for development approval. As such, developments have been planned, approved and construction commenced in areas where Bare-nosed Wombats occur without considering the impacts. Though it is an offence to kill or interfere with a Bare-nosed Wombat under the *Nature Conservation Act 2014*, burrows have reportedly been destroyed during earthworks by developers, potentially burying Bare-nosed Wombats alive (pers. Comm., wildlife carers 2024). Wildlife carers have reported increased numbers of call outs in areas where urban development has or is occurring. This has highlighted the need for a greater understanding of the impacts of development on Bare-nosed Wombats.

As a response to potential impacts from development on Bare-nosed Wombats and other burrowing animals, the Conservator of Flora and Fauna has developed Conservator Guidelines for Burrowing Animals. The purpose of the guidelines is to improve consideration of burrowing animals during development and provide direction to developers on best practice methods to minimise harm. The guidelines will apply to any new developments within the ACT. During planning stages, developers will need a suitably qualified ecologist to identify burrow and shelter sites, monitor them for activity and ensure they are vacant or avoid developing over them wherever practicable. Wombat Rescue and ICON Water have highlighted the difficulties of conducting appropriate assessments due to the lack of capacity among suitably skilled ecologists in the ACT. Wombat Rescue are often called by ecologists seeking advice on how to manage wombats (pers. Comm., Wombat Rescue 2024). Where avoidance of burrows is not possible developers can apply for a licence to destroy burrows and must follow the guidelines to ensure this is done with minimal disturbance to animals.

The guidelines don't take into consideration the potential for new developments to fragment and isolate populations, limiting dispersal and resulting in genetic differentiation over time. Prior to any new land use zoning, consideration should be given to whether wildlife populations will be disconnected resulting in small and isolated populations that over time could result in inbreeding. There is concern development is pushing Bare-nosed Wombats into narrow river corridors where increased densities could result in increased competition for resources and creating stressful conditions for animals. Without a more detailed

understanding of the abundance of Bare-nosed Wombats and carrying capacity in the ACT it is difficult to determine the impacts of increasing development and expansion. Furthermore, the carrying capacity of Bare-nosed Wombats is unknown and likely to vary from region to region based on habitat and resource availability.

If Bare-nosed Wombat densities are reaching a critical limit with food resources it can increase stress, competition and ultimately population declines. Increased stress and high Bare-nosed Wombat densities are often associated with increased mange prevalence (Sengupta, 2019). Areas closer to fresh water are also predicted to have the highest suitability for mange (Ringwaldt *et al.*, 2023). Urban areas abutting river corridors where Bare-nosed Wombats occur could result in increased human-wombat interactions. Dispersing Bare-nosed Wombats may wander into urban areas where conflicts can occur (e.g. burrow damage) and be more susceptible to road vehicle collisions. There could also be increased interactions between wombats and pets, resulting in injuries to domestic dogs and wombats. Dogs have been known to enter burrows where they may contract mange, get stuck or become injured. Increased public education on the implications of living near Bare-nosed Wombats will be essential.

It is important to note no developers were consulted in the preparation of this report. Consultation with developers is recommended to improve Bare-nosed Wombat management in areas under development.

5.2 Conservation concerns

5.2.1 Mange

Sarcoptic mange is a skin condition caused by the *Sarcoptes scabiei* mite. Mange initially presents as skin reddening and hair thinning. As the disease progresses, visible signs of itching, alopecia and epidermal crusting appear (Pence and Ueckermann, 2002). Mange has strong animal welfare implications as affected individuals can suffer a slow and agonising death, usually through secondary infection, blindness and/or starvation (WHA, 2021). Prevention of mange in Australia is considered almost impossible, as all disease transmission pathways would need to be interrupted, including transmission from host species such as foxes (WHA, 2021).

Ideally mange should be diagnosed and treated by qualified veterinarians so the condition is correctly identified, and animals can receive appropriate treatment. This is not feasible for wildlife populations. Mange in wombats is typically diagnosed and treated by wildlife carers and volunteer groups with varied levels of training, experience and coordination. Diagnosing

the disease in its early stages can be difficult without catching and examining animals. The same symptoms can be caused by malnourishment from low quality feed, creating the potential for misdiagnosis (Fraser et al., 2018).

The distribution of mange and its impacts on wombat populations is poorly understood. Bare-nosed Wombat populations often persist in the presence of mange, and prevalence is usually $\leq 15\%$ (Carver et al., 2021). During outbreaks, mange prevalence can rise to $> 50\%$, with near 100% mortality of infected individuals (WHA, 2021). In some cases, mange outbreaks have resulted in $> 90\%$ decline in local Bare-nosed Wombat abundance (Skerratt 2005; Martin et al. 2018a). Research suggests population decline and range retraction can occur when mange prevalence is $> 25\%$ (Carver et al., 2023). Additional research is needed to understand which environmental variables may lead to mange outbreaks.

Increased rates of mange are often associated with high wombat densities and periods of drought or high stress (e.g. seasonal stress in winter) (Sengupta, 2019). Burrows are thought to be the predominant mode of sarcoptic mange transmission in wombats (Evans, 2008, Martin et al., 2019, Beeton et al., 2019). The humid and cool microclimate within wombat burrows provides favourable conditions to maximise mites off-host survival, particularly in cooler months (16.4 days in winter and 5.96 days in summer). Mites can survive in burrows longer than the minimum known frequency of wombat burrow switching 4- 10 days. Transmission is exacerbated by patterns of burrow use and sharing (Evans, 2008; Martin et al., 2019b).

Regulation of veterinary chemicals used to treat mange in Australia

The Australian Pesticides and Veterinary Medicines Authority (APVMA) is responsible for the regulation and control of agricultural and veterinary chemicals in Australia. Under legislation, the APVMA can evaluate, approve and register agricultural and veterinary chemicals, regulate supply, undertake compliance and issue permits for use. There are currently four active permits (valid in all states and territories of Australia) and three active permit holders approved for veterinary chemicals use for the treatment of mange in wombats.

The Wombat Protection Society holds two permits for the use of a Cydectin (active constituent Moxidectin). One permit allows for a dose 4 ml per kg of body weight with a maximum single dose of 100 ml on an adult wombat (>15 kg) with five days between doses and no more than five doses. The efficacy and toxicity associated with this dose rate has not been fully evaluated and users must observe wombats for any signs of toxicity. Any wombats that die after treatment must be reported to a veterinarian and a detailed postmortem carried out.

A second permit held for the use of Cydectin allows 0.8 ml dosage per kg of body weight with a maximum dose of 20 ml applied once weekly for 15 weeks. This permit is also held by Mange Management Incorporated. Cydectin can be delivered directly or by topical application using a pole and scoop to pour a dose onto the wombat's back, or indirectly by using a burrow flap that doses the wombat when passing underneath.

Intervet Australia holds a permit for use of Bravecto (active constituent Fluralaner) for mange treatment. The dose is 25 mg/kg with a maximum of three doses one month apart on wombats > 5 kg. Bravecto must be applied by topical application directly or by using a pole and scoop to pour a dose onto the wombat's back.

A condition of all these permits is that 'the product must only be used by persons who have appropriate experience in identifying mange infection and toxicity signs in wombats'. It is the permit holder's responsibility to ensure people operating under the permit are trained in the identification and treatment of mange in wombats. This is particularly relevant for care groups, where mange treatments may be administered by a range of volunteers. The permit holder must record any adverse experience associated with the use of the product and report them to the APVMA as soon as possible.

While there are no conditions on any of the APMVA permits with regards to Cydectin use near waterways, an environmental protection warning on the product states 'Moxidectin is extremely toxic to aquatic species. Do not contaminate dams, rivers, streams or other waterways with the chemical or used container.' This statement applies to use of the product under all APVMA permits.

Applying moxidectin indiscriminately across all burrows in an area may lead to unintentional overdosing of individual wombats over time, either from inaccurate dosage or from wombats relocating to treated burrows. Some wombats may not receive a full dose if the chemical splashes as they are exiting a burrow or they move away from the treatment area. Healthy animals within the population will also unnecessarily receive treatments. This could lead to the development of mite resistance arising from inappropriate chemical concentrations being administered.

There is also a risk non-target animals are treated, as wombat burrows are known to be used by a range of other native species (Linley et al., 2024, Thornett et al., 2016) and the impacts of moxidectin on these species is unknown. The broadscale use of these chemicals can result in chemical residues within the environment which can have negative impacts on native fauna,

including invertebrates and aquatic species. Application with a pole and scoop though more time consuming can specifically target wombats with mange and promotes good chemical stewardship.

Some carers believe other products are safer or more effective and use a range of alternative treatments or supplementary products to relieve itching and treat secondary infection. Less invasive approaches include the one-off or repeated administration of a topical acaricide. However, topical treatments may not reach mites due to a failure to penetrate parakeratotic scale crust or be adequately absorbed systemically due to a thickened epidermis. Even among experienced carers there is wide disagreement about how best to treat mange (O'Sullivan, 2018).

Current treatment of mange in the ACT

In the ACT, Bare-nosed Wombats are primarily treated for mange by Wombat Rescue volunteers, and to a lesser extent ACT Wildlife carers. Volunteers operate under APVMA permits PER89982 and PER90837 issued under section 112 of the Agricultural and Veterinary Chemicals Code 1994. The first permit allows for the treatment of Bare-nosed Wombats with mange using up to 20 ml of Cydectin via burrow flap or pour on/pole and scoop application methods. The second permit allows for the treatment of Bare-nosed Wombats with Bravecto using pour on methods only. Volunteer groups must also apply for a licence under the *Nature Conservation Act 2014* to use a vehicle within a reserve.

In addition, Wombat Rescue has a TCCS permit for use of Cydectin on public lands to undertake population treatments, with strict conditions of its use around waterways due to its toxicity to aquatic species. Cydectin must not be used when there is a medium chance or greater (>40 %) of heavy rain (>10 mm) forecast and all treatments within 5-15 m of a permanent waterway must be removed within 24 hours in the catchment area. A treatment area cannot exceed 1km of river reach, can only be treated at the population level once annually and no more than 6 treatment areas can be treated annually along the Murrumbidgee and Molonglo Rivers. Population level treatment by burrow flap application must not be used within 15 m of permanent waterways but is permitted for treating a maximum of 5 individuals at any one time. Cydectin cannot be used within 5 m of the water's edge or within 5 m from the centre of drainage lines and intermittent gullies, including unnamed drainages at any time. No treatments are to be applied in the Cotter Catchment above Cotter Dam, Namadgi National Park or Tidbinbilla Nature Reserve. The location and

dosage details of all treatments, particularly those within 5-15 m of a permanent waterway, must be entered into a shared spatial layer once treatment has commenced.

Mange-affected Bare-nosed Wombats are treated both individually and at a population level. Population level treatments are conducted by Wombat Rescue and occur mainly in riparian areas along river corridors. Due to the substantial time it takes to install burrow flaps on every burrow, and permit restrictions, volunteers are only able to treat burrows along a 1 km stretch of the river at a time. Mange can be successfully eliminated in isolated areas, but where connected populations of Bare-nosed Wombats occur along river corridors, it is difficult to eradicate mange as infected individuals from outside the treatment zone can wander in following the course of treatment. Access of carer groups to rural lands at a broad scale is not supported by many rural landholders due in part to safety and security concerns, which means treatment of mangy wombats on rural leases is limited. This has welfare implications for animals severely affected by mange.

ACT Wildlife only administers mange treatments in areas where rehabilitated Bare-nosed Wombats are to be released if there has been isolated incidence of mange to maximise their chances of survival.

Wombat Rescue regularly responds to call outs to treat and rescue mangy Bare -nosed Wombats from concerned members of the public and ACT Parks and Conservation Service.

Mange distribution

To gain a better understanding of the distribution of mange in the ACT, CED have developed an online portal to enable the community to report sightings of mange-affected Bare-nosed Wombats. Sightings are also reported on WomSAT, an online application developed by researchers at the University of New South Wales. This data helps inform the national distribution and prevalence of mange in wombats. Users of WomSAT create an account and sightings must include a photo for verification. While applications of this nature enable capture of data across broad regions, reporting is typically skewed towards areas of high human activity and therefore may not accurately represent the presence/absence of mange (Figure 3).

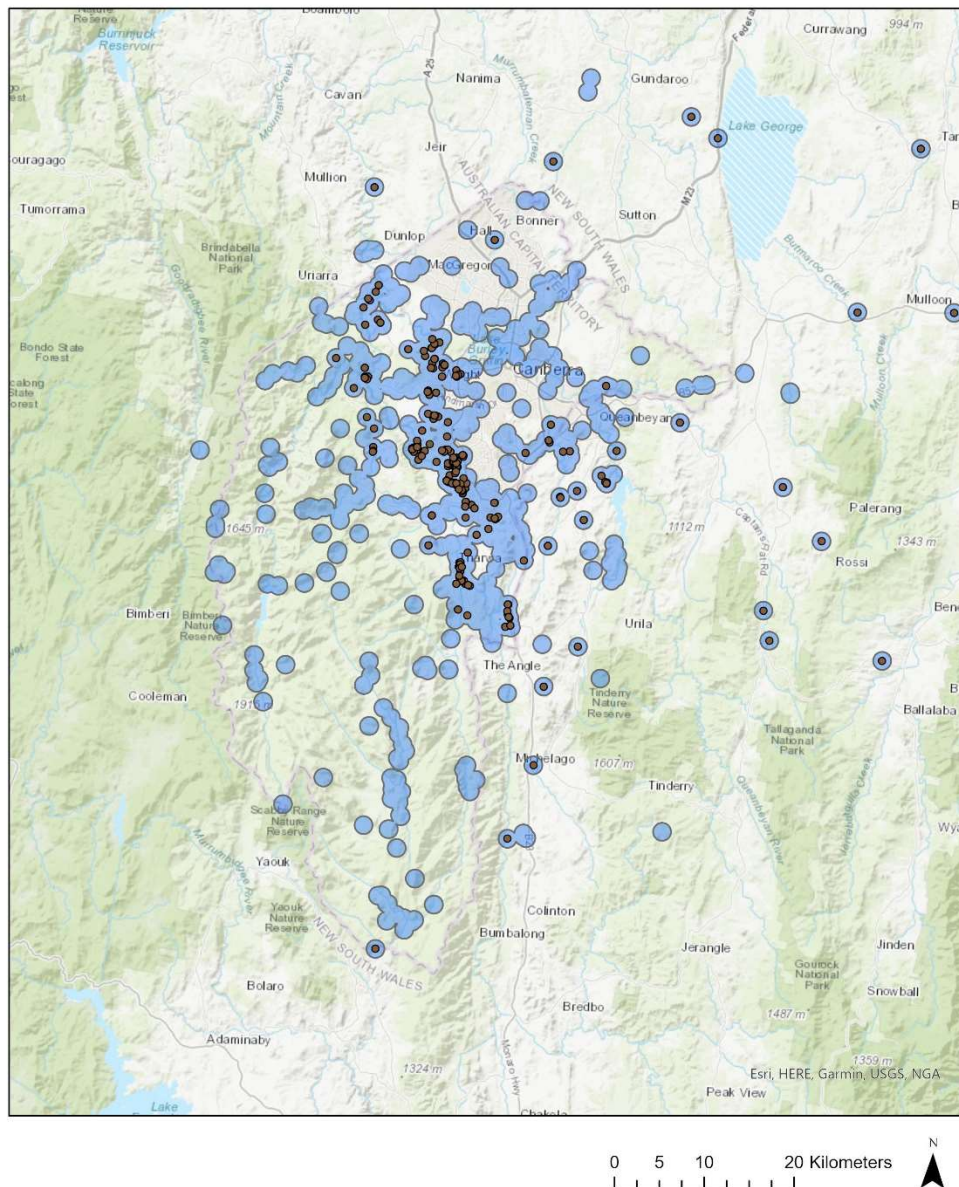


Figure 3. The known records of mange in Bare-nosed Wombats (red dots) in the ACT taken from CED survey data and ACT Wildlife Atlas wombat records and mange portal data.

Wombat Mange and Monitoring Group

To progress treatment of mange and improve monitoring of Bare-nosed Wombats in the ACT, CED convened the Wombat Mange and Monitoring Group (initiated March 2021). This group was formed as a subgroup of the Wombat Working Group. Members included two community wildlife care groups (Wombat Rescue and ACT Wildlife), Prof. Scott Carver of the University of Georgia USA (formerly of the University of Tasmania) and CED staff. The group took a collaborative approach to addressing mange and coordinates activities of the community and ACT Government. Previous activities of the Wombat Mange and Monitoring Group include:

- Trialling the use of Bravecto, as a potentially longer-lasting, more effective, and target-specific treatment for mange.
- Developing a collaborative monitoring program to provide data on wombat populations, distribution, and mange prevalence across the ACT.
- Support mange treatment in public reserves while minimising risks associated with using Cydectin near waterways.
- Undertake collaborative research on the impacts of mange treatment chemicals on aquatic ecosystems.
- Develop and promote a publicly accessible web-based communication portal to enable community members to report Bare-nosed Wombat sightings and incidences of mange.

5.2.2 Road vehicle collisions

Collisions with vehicles are a source of mortality or injury for Bare-nosed Wombats and a safety concern for people. Roadkill records reported in the WomSAT app between 2015-2019 are relatively low in the ACT in comparison to other states (Figure 4, Mayadunnage et al., 2024). WomSAT relies on citizen scientists to report sightings and thus data may not be representative of all road kills occurring in the ACT. Roadkill records are collected by the Urban Wildlife Team, and it is worth reviewing them to gain a better understanding of the frequency of collisions and identify hotspot areas where intervention may help to reduce collisions.

The frequency of vehicle collisions is likely to vary depending on traffic levels, vehicle speed, Bare-nosed Wombat population density, climate and season (Mayadunnage et al., 2024, Ramp et al., 2005). Bare-nosed Wombat road mortalities are higher in winter and early spring (Roger et al., 2011, Mayadunnage et al., 2024, Nguyen et al., 2022). This could be linked to seasonal changes in the activity periods of Bare-nosed Wombats or more cars being on the road at dawn and dusk due to shorter winter days. High Bare-nosed Wombat road mortalities have been linked to areas of dense forest cover and the greenest ground cover in areas where wombat burrows are present (Roger and Ramp, 2009).

Within the ACT, most Bare-nosed Wombats (approximately 50 a year) come into care because of injuries from road vehicle collisions or being orphaned due to a vehicle collision. The relatively small number of Bare-nosed Wombats taken into care does not represent the total number of wombats killed.

Wombats can cause substantial damage to vehicles, the cost of which is unknown. Analysis of 17,000 animal collision claims between 1 January – 31 December 2023 by Suncorp Group revealed the most common animals drivers collide with are kangaroos, wallabies, wombats, deer, dogs, cows and emus (AAMI, 2024). The average cost of an animal collision insurance claim is greater than \$5,000 and 16% of vehicles were written off in claims that involved wildlife. The study revealed 76% of Australians believe kangaroos would cause the most damage to a car if involved in a collision, followed by wombats (16%).

Even if roadkill is not causing widespread declines of Bare-nosed Wombats, wildlife-vehicle collisions should be reduced where possible. Measures to reduce wildlife vehicle collisions include installing wildlife warning signs, installing underpasses or overpasses, and using deterrent devices (see section 10.5 for more information).

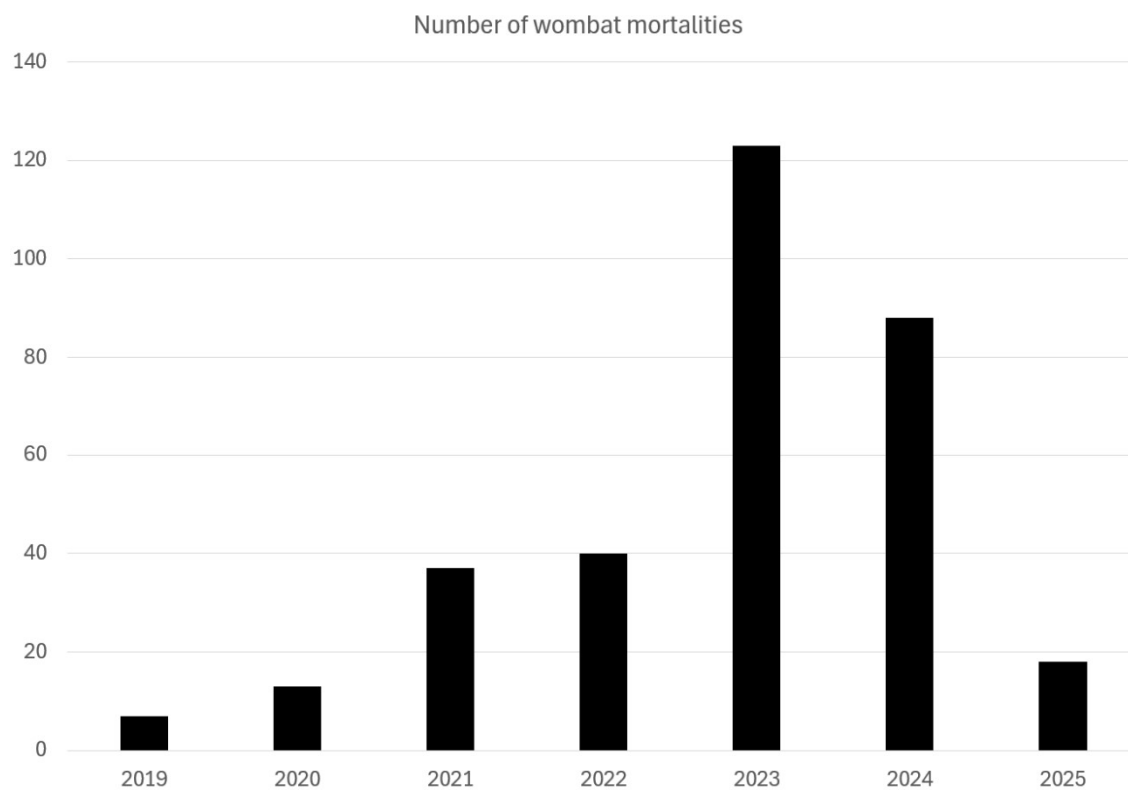


Figure 4. Temporal distribution of wombat roadkill records reported by the ACT Urban Wildlife Team between July 2019 and July 2025. For 2019, data is limited to July-December of that year; for 2025, data is limited to January-July of that year.

5.2.3 Habitat loss

The expansion of urban development has caused concern for the safety of Bare-nosed Wombats. The ACT is around 236,000 hectares, which is roughly 43.6 conservation estate, 10% highly modified urban land, and 15% highly modified rural and broadacre lands. The exact

division of land may be different as land zoned for urban areas may still be undeveloped or rezoned to another land use prior to development. Between 2006 and 2022, the ACT's urban area grew by 9% (2,760 ha). Most development has been in Gungahlin (Taylor, Throsby, Jacka and Moncrieff), West Belconnen (Ginninderry) and the Molonglo Valley (Whitlam and Denman Prospect). The increase in urban land has been driven by strong and sustained population growth over the last decade. The ACT population is projected to grow to 696,000 by 2050. The *ACT Planning Strategy 2018* aims to accommodate this growth while limiting urban spread by setting a target of 70% of new housing being built within existing urban areas. The impact of urban expansion of Bare-nosed Wombat populations is poorly understood. Urban development is thought to be pushing Bare-nosed Wombats into river corridors where their densities are high, resulting in increased stress from resource competition and territoriality (pers. comm wildlife carers 2024). In contrast, reports from other stakeholder groups indicate the distribution and abundance of wombats is increasing. The distribution of Bare-nosed Wombats across different land use zones is unknown and worth investigating to properly understand the potential impacts of further development on populations.

6. Wombat management methods and options

Conflicts with wombats have traditionally been resolved using lethal controls, but there is increasing advocacy for the development of alternative 'non-lethal' management options. Creating policy around alternative 'non-lethal' management options are hindered by a lack of quantitative evidence on their effectiveness and humaneness. Management options perceived as non-lethal can have negative ecological or animal welfare impacts, sometimes resulting in death. For example, translocation often has low survival rates but is perceived as a non-lethal management option because it does not involve the direct killing of animals. The term 'non-lethal' has not been used to classify management options in this review.

Research into damage mitigation techniques has not yielded conclusive results or sustained long-term benefits (Barlow et al., 2010, Koehler AE, 1990, Mason, 1998). Given the nature of conflicts vary greatly, no single management technique will alleviate all conflicts. A variety of damage mitigation techniques are needed that can be tailored to the ecological, social, cultural and economic realities in which conflicts occur (Dubois et al., 2017). Land managers also require data on the distribution and abundance of wombats, as well as the type and extent of damage, to effectively implement a management strategy.

This section reviews current research on wombat management and damage mitigation strategies.

6.1 Fencing

Exclusion fencing is a popular tool for eliminating damage to high value resources. While it is perceived as non-lethal it can have negative impacts on target and non-target species by prohibiting natural movement patterns or inhibiting access to important resources. Prior to installing exclusion fencing, careful consideration needs to be given to the ecological impacts on excluding species from their habitat.

6.1.1 Foot netting

Excluding wombats from areas where they are causing damage such as to high value infrastructure or resources can help to reduce damages and increase landholder tolerance towards wombats. Several wombat exclusion fence designs have been trialled. Attaching foot netting to the bottom of fences has been found to temporarily reduce the number of holes dug in fencing by 35-63% for up to 3 weeks (Marks, 1998b). Borchard et al. (2009b) trialled using hinged joint wire (80 cm wide x 15 cm spacings) attached to the outside of existing fencing and flattened along the ground and secured with tent pegs every 1 m along a 100 m section of fence and silt fencing (770 mm wide) laid out in the same manner and secured every 30 cm. In both designs hinge wire foot netting was placed on the inside of the fence at wombat breach points. The foot netting trial resulted in a mean exclusion rate of 35% for a one month. In the absence of aversive stimuli wombats quickly learned to chew through the silt fence or dig under the wire netting.

6.1.2 Electric fencing

Electric fencing has been shown to exclude wombats from areas where their behaviour conflicts with human land use (Marks, 1998b; St John and Saunders, 1989). The electrification of the dog fence along the Nullarbor Plain in south east Australia has reduced damage to the fence caused by Southern Hairy-nosed Wombats, damage that allows Dingoes (*Canis familiaris dingo*) to pass through (St John and Saunders, 1989). On the outside of the dog fence, an additional two strands of wire 15 and 30 cm above the ground, positioned approximately 30 cm away from the original dog fence were constructed. The fence is patrolled regularly by dog baiters who assess the fence for signs of damage. Most damage occurs from Southern Hairy-nosed Wombats inside the fence attempting to travel north. Electrifying the fence has prevented Southern Hairy-nosed Wombats from travelling north, resulting in them moving

south of the highway into crop land where they had not previously been, resulting in conflicts with wombats and crop farmers (Sparrow, 2011). Marks (1998a) found electric fencing produced variable results, for Bare-nosed Wombats with electric fencing reducing the number of holes by 0-92% over 13 weeks. Landholders who used electric fencing to exclude Southern Hairy-nosed Wombats from their properties reported it to be unsuccessful as the electrified strands were often shorted out by vegetation or debris and it was too time intensive to check (O'Brien, 2019). Electric fencing is costly and time consuming to maintain on a small scale. Landholder perceptions of success may not be influenced solely by damage reduction, but also by the time and costs associated with implementing and maintaining control measures.

The use of electric fencing to reduce wombat damage is best suited to protecting small areas with important assets inside wombat free areas. Electric fencing will require regular inspections to ensure the fence hasn't been damaged or shorted out and involves construction costs and ongoing costs to run.

6.2 Wombat gates

Swinging gates have been recommended to reduce fence damage by wombats in Australia (Breckwoldt, 1983, Triggs, 2009) which can allow stock to escape paddocks or other unwanted animals from entering crop fields. Wombats can make numerous breaches in fencing and the installation of gates at every breach point may be impractical. The placement of gates would depend on the density of wombats in the area and the number of access points being used. Gates should be installed at the most well-used breaches and exclusion netting can be used to 'train' wombats to use the gates. Anecdotal evidence suggests Bare-nosed Wombats will use gates placed up to 800 m apart without making new holes (Triggs, 2009). Breckwoldt (1983) recommends gates of a timber construction which is likely to require regular maintenance. Newer fence designs consist of heavy-duty weld mesh gates weighing at least 2-3kg if trying to exclude other animals such as wallabies (Statham and Statham, 2009, Driessen et al., 2020). If Bare-nosed Wombats could not see through gates they would dig a hole next to it rather than use it (Statham and Statham, 2009). Gates weighing between 4.5-16 kg have also been reported to be used by Bare-nosed Wombats (Coates, 2013). Borchard et al. (2009a) found Bare-nosed Wombats continued to breach the foot netting of fencing for the first few months while they learned to use the gates requiring ongoing repairs. Driessen et al. (2020) wired gates open for two weeks to allow Bare-nosed Wombats a habituation period but did not report on fence breaches throughout the study.

The decision to use wombat gates or a combination of gates and exclusion fencing will depend on the extent of the problem, the cost of the damage and the cost to purchase, erect and maintain the length of fence required. The installation of gates can be laborious and will likely require ongoing maintenance. The installation of gates in fencing may prevent damage to fencing but it does not prevent wombats from accessing areas where their behaviour may cause further damage on the property, thus not all property managers will readily accept the use of swinging gates or view it as a successful damage mitigation strategy (Borchard and Collins, 2001).

6.3 Mapping wombat burrows

There are a variety of methods for surveying and mapping the location of wombat burrows. While it is not a direct damage mitigation method it may prove useful for choosing the most appropriate management action for burrows in unfavourable locations. Mapping the locations of tunnels can help to prevent accidents such as vehicles or machinery falling down tunnels which can collapse under their weight, by avoiding driving over them. However, in areas with a high density of tunnels this may be unavoidable.

6.4 Burrow collapsing

As wombats are known to use multiple burrows within their home range, the opportunity exists to remove problem burrows through collapsing them, moderating their burrowing activity with minimal impact on the wombats. However, widespread burrow destruction is not recommended as it can lead to the displacement of wombats. It is also important to consider the impact of burrow collapsing on young at foot who may not be able to travel long distances. Historically burrow collapsing has been used following fumigation to prevent neighbouring Southern Hairy-nosed Wombats from recolonising the area, however, it was rarely successful as burrows were re-excavated (Marks, 1998a). Burrow collapsing in combination with other methods to exclude wombats from areas where they are causing damage may prove more effective.

The gradual collapsing of burrows over three days in combination with the use of deterrents has been trialled as a management option for Southern Hairy-nosed Wombats (Sparrow et al., 2016, O'Brien, 2018). This method involves collapsing the first 1-2 m of the tunnel on day one, followed by another several meters on day two. The tunnel is left open, providing a clear exit point for wombats. The disturbance of the burrow over the first two days is 93% effective in getting Southern Hairy-nosed Wombats to exit the burrow before ripping the tunnel on day

three (O'Brien, 2018). On day three the tunnel is carefully ripped with a backhoe, stopping every few meters to check the direction of the tunnel and look for signs of occupancy. If a wombat is still within the tunnel, it can be left for another day to see if they will leave. On one occasion a Southern Hairy-nosed Wombat failed to leave on the fourth day and had excavated a further 7 m of tunnel overnight despite the presence of alternate inactive burrows nearby ($\leq 50\text{m}$ away). The failure of burrow disturbance to get the Southern Hairy-nosed Wombat to leave may reflect the importance of the burrow. Although Southern Hairy-nosed Wombats may use up to 10 different warrens within their home range, they usually use 1-2 warrens on most occasions to which they display high site fidelity (Shimmin *et al.* 2002; Finlayson *et al.* 2005).

Two studies trialled the effectiveness of dingo urine and faeces in deterring Southern Hairy-nosed Wombats from re-excavating collapsed tunnels and produced mixed results (O'Brien *et al.*; Sparrow *et al.* 2016). Sparrow *et al.* (2016) found untreated collapsed burrows on the Nullarbor plain in South Australia were recolonised within 75 days while those treated with dingo scents showed minimal activity. In contrast, O'Brien *et al.* found that in the Murraylands of South Australia deterrents didn't play a significant role in the time taken for recolonisation to occur. The differences in results between the two studies could be attributed to variances in the methods used or environmental factors such as predator densities at the sites or burrow availability and importance and warrants further investigation. Although burrow collapsing is considered non-lethal its impacts on evicted wombats has not been studied and warrants further investigation. Studying the impact of burrow collapsing on wombats may help to answer questions about the reasons for its success or failure. Burying steel mesh at the location of the collapsed burrow is untested but may prevent wombats from re-excavating.

Alternate methods could trap and relocate wombats or empty burrows using one-way gates placed in burrow entrances prior to collapse. Trapping is more time consuming and costly as traps need to be checked every morning and it requires careful planning and trained personnel to handle and relocate the wombat(s) but removing animals from the area may provide longer term relief from conflict. One-way gates can be installed and left in place until the burrow is empty, though regular assessment of the gate is recommended as wombats have been known to dig around or under them. Motion sensor cameras can be used to determine if a burrow is empty. Low-cost methods such as raking the soil to assess for footprints or the placing of sticks in a burrow entrance can be used to determine if a burrow is empty however, it is not always possible to determine if a wombat has gone into the burrow or exited.

The time and costs of burrow collapsing will vary on a case-by-case basis. Some burrows may be simple single entrance tunnels that take 1.5 hrs to rip while other more complex 5 entrance warrens that are 4 m deep can take up to 10 hours (O'Brien, 2018). Soil type and burrow depth will impact the time and costs associated with burrow destruction. Given the time and costs of collapsing burrows along with the low success rate it is not a viable long-term solution to wombat management, but it may prove useful in certain situations. Given Bare-nosed Wombats within the ACT breed year-round consideration needs to be given to the potential for there to be young at foot that may not be able to travel to the next nearest burrow or move through a wombat gate. Though these studies found burrow collapsing did not result in new burrows being dug in other locations it is always possible that it could transfer the conflict to a new location.

6.5 Deterrents

Designed to capitalise on an animal's mechanisms of threat detection, deterrents aim to discourage the use of human resources with aversive stimuli (Ramp et al., 2005, Apfelbach R, 2005, Schakner and Blumstein, 2013). A wide range of deterrents, such as chemical cues, novel objects, and painful stimuli are increasingly being marketed as non-lethal means of reducing human wildlife conflict (Breitenmoser et al., 2005). Although there are numerous studies on the use of deterrents, many devices have not been quantitatively field-tested, and their perceived effectiveness lies in testimonial and anecdotal reports. Controlled lab studies often do not translate to field situations, where numerous uncontrollable environmental factors can influence the way animals detect and respond to threats (Mason, 1998, Koehler AE, 1990, Barlow et al., 2010). Even where devices have been field tested, they often produce conflicting results.

Before deterrents are recommended to mitigate wombat damage, a better understanding of the factors influencing wombat threat perceptions and responses to them is needed. Further research is required to evaluate responses in different environmental conditions such as varying distance to cover, and with different methods of application and placement, to determine the optimal conditions for success. In addition, future studies should consider conducting trials in a closed system with known individuals or capturing and marking individuals prior to commencing trials for ease of identification so individual variation in responses can be taken into consideration.

6.5.1 Olfactory deterrents

Olfaction is known to play an important role in social communication in wombats (Taggart and Temple-Smith, 2008, Triggs, 2009), little is known about its role in threat perception.

Anecdotal, fertilisers such as blood and bone, dog and human urine are thought to deter wombats (O'Brien, 2019).

Dingo urine and faeces has been trialled with mixed results. Field trials found no difference in Southern Hairy-nosed Wombat activity before and after placing a cup of blood and bone in burrow entrances (O'Brien et al., 2021). Captive Southern Hairy-nosed Wombats increased their exploratory behaviour in response to dingo faeces placed inside burrows, followed by increased use of burrows and concealed locations (Descovich et al., 2012). Sparrow et al. (2016) reported Southern Hairy-nosed Wombats showed greater avoidance and prolonged time to recolonisation of collapsed warrens treated with dingo odours than control warrens on the Nullarbor in South Australia. Conversely, the application of dog urine and dingo faeces had no significant impact on the time taken for Southern Hairy-nosed Wombats to recolonise collapsed warrens in the Murraylands of South Australia (O'Brien, 2018) or deter them from using burrows where dingo urine and faeces were placed at the entrance (O'Brien, 2019). No known research has been conducted on the effects of odour deterrents on Bare-nosed Wombats.

The differing results of these studies indicate Southern Hairy-nosed Wombat responses to predator odours may be context dependent, but disparities in experimental design and analyses make it difficult to determine which factors are influencing threat perceptions. Control–impact studies may lead to a misconception of the effectiveness of treatments as they don't consider differences in pre-existing activity levels at treatment sites (Koehler AE, 1990, Parsons and Bondrup, 1996, Rytwinski et al., 2016). Southern Hairy-nosed Wombats may have responded to blood and bone or dingo odours with increased hiding or reduced ranging behaviour in a manner that was not evident from the camera data, or it could have been perceived as a low risk. The use of a greater volume and repeated or more widespread application of deterrents may elicit greater avoidance responses. The application of odours inside burrows or in open areas further from the safety of a burrow may heighten risk perceptions, resulting in greater avoidance responses (Atkinson et al., 1994).

6.5.2 Visual deterrents

Anecdotal evidence suggested wombats are fearful of shiny objects and actively avoid them. Stationary CDs have been found to elicit avoidance responses in Southern Hairy-nosed Wombats, with a decrease in the number of visits to burrows following their application (O'Brien et al., 2021). Visual stimuli produced avoidance responses most likely due to an immediate fear response (neophobia) of an unknown object within their environment (Harris and Knowlton, 2001, Davidson-Nelson and Gehring, 2010, Bruggers et al., 1986). Wombats may respond more readily to visual cues as they are easily detected from further away than olfactory cues, which require closer investigation. Though these preliminary investigations are encouraging, habituation to visual stimuli is a major limiting factor to their long-term use, particularly when unaccompanied by negative reinforcement (Koehler AE, 1990, Gilsdorf et al., 2002). Habituation to CDs was not observed in Southern Hairy-nosed Wombats over the 5-night trial, however, it may occur over a longer time frame.

6.5.3 Virtual fencing

Virtual fencing is a term often used for placing deterrents along roadsides that are activated by approaching vehicle headlights. On activation the device emits a sound, flashing lights or both with the aim of scaring away any animals that may be adjacent to the roadside. Virtual fencing is not a physical barrier and allows animals to move through the landscape. Early trials in Tasmania reported a 50% reduction in roadkill over a three-years (Fox et al., 2018), but the trial had many design flaws and likely had little to no effect on possums, wallabies or wombats (Coulson and Bender, 2019). A study on the impacts of virtual fencing on wombats found a small reduction in the number of wombats killed after the virtual fence was installed (Stannard et al., 2021), however the study design was flawed and widely disputed (Coulson and Bender, 2022, Candy and Englefield). Similarly, other deterrent devices mounted to vehicles like the Shuroo have been found ineffective, as the noise the device makes cannot be heard over the vehicle noise from >50 m away (Bender and Coulson, 2022).

6.6 Translocation

Translocation is a widely used “non-lethal” human-wildlife conflict mitigation measure, but its effectiveness is disputed. The survival of translocated animals is often low, and the conflict may not be resolved or could be transferred to the release site (Bradley et al., 2005, Linnell et al., 1997). Translocation has been trialled on Southern Hairy-nosed Wombats to relieve conflicts with agriculturalists. Southern Hairy-nosed Wombats were translocated from areas of

conflict to a property where species numbers were low and lots of inactive burrows were available to release them into. Animals were fitted with GPS and/or VHS collars to monitor their survival and behaviour in comparison to resident animals. Though translocated Southern Hairy-nosed Wombats had high survival rates and exhibited release site fidelity conflicts were not resolved. Neighbouring Southern Hairy-nosed Wombats moving into vacated burrows at the source site within a matter of weeks. Landholders using culling as a control measure to reduce conflicts with Southern Hairy-nosed Wombats have reported similar results, with neighbouring animals recolonising vacated warrens (St John and Saunders, 1989).

Translocation of a larger number of animals may provide longer relief from conflict. However, Southern Hairy-nosed Wombats evaded traps by remaining underground or digging under fencing, resulting in a low trap rate of 5.95%. Similarly, the trapping success of Bare-nosed Wombats was 7.9% and Northern Hairy-nosed Wombats as low as 1-2%, all species avoid capture by remaining underground for extended periods of time (McIlroy, 1977a; Alan Horsup, pers. comm 2018). Thus, large scale translocation could be labour intensive and cost prohibitive. Furthermore, the ongoing translocation of large numbers of Southern Hairy-nosed Wombats would over time lead to shortages of suitable conflict free release sites with low numbers of conspecifics in the species natural range. Translocation could be used as a tool to repopulate areas where numbers are known to have declined, however, it may result in further deaths if the cause of the decline has not been addressed.

Similarly, the critically endangered Northern Hairy-nosed Wombat has been successfully re-introduced into areas they were extirpated from by releasing them into starter burrows (Horsup, 2004). A study on the survival of rescued and rehabilitated Bare-nosed Wombats reported high survival (94.5%) of animals released onto a private property within the first 42 days following release and 77% survival after eight years (Saran et al., 2011). Survival was not found to be related to age, sex, provision of supplemental food, season or time spent in rehabilitation.

Despite its limitations, translocation may prove useful for removing a small number of individuals from areas of conflict, where alternative measures fail or are unsuitable. When used in combination with burrow collapsing or deterrent use it may yield more promising results in reducing conflict at the source site. Prior to carrying out a translocation careful planning is needed. Translocation plans should adhere to the Conservator Guidelines for the Translocation of Native Flora and Fauna in the ACT. . Important biological and ecological factors need to be taken into consideration, such as capture stress, disease transmission, habitat suitability, and competition with conspecifics. The availability of burrows at the release site is a key

consideration when it comes to translocating wombats, which would require up to date knowledge of wombat distribution and density. Follow up monitoring is imperative to ensure survival of translocated animals.

6.7 Culling

Historically, conflicts with wombats have been managed using lethal controls. In most states, there are provisions to cull wombats causing damage or threatening human safety under permit systems (see section **Error! Reference source not found.**). The lethal control of wombats has become a highly contentious and controversial issue in the last few decades, due to changing public attitudes towards its use and concerns about wombat conservation. Permits to destroy Bare-nosed Wombats have decreased greatly in Tasmania and other states where it is allowed in the last few years due to increasing public pressure. The impacts of culling on wombats populations are poorly understood (Tartowski and Stelmann, 1998, Taggart et al., 2008). If conducted at unsustainable levels it can result in range contractions and population isolation (Powell, 2006, Fuller et al., 1992, Woodroffe et al., 2005). In contrast, killing an insufficient number of animals can fail to reduce damage to an acceptable level (Hone, 2007). In some cases, the removal of animals from a population can encourage population growth and immigration, thereby increasing conflict (Treves et al., 2016). Culling can disrupt social structures that lead to fractured social groups and increases in conflicts (Wallach et al., 2009, Allen et al., 2015). Despite the limitations of culling, there may always be some situations in which it is the best intervention method (Warburton and Norton, 2009).

There is one known study examining the effects of culling on Southern Hairy-nosed Wombats. Changes in the number of active burrows were monitored in an area where culling occurred and an adjacent control zone where no culling took place. Over the two-year term of the study an estimated 12% of the population was culled per year. Despite this there was an estimated 30-40% increase in the number of Southern Hairy-nosed Wombats in the culled area, while in the uncultured area there was an estimated 50-60% increase. The increase in Southern Hairy-nosed Wombat numbers over this time frame could have been a result of increased rainfall and recovery from the 1981-83 drought, the effects are unlikely to be the same on a stable or decreasing population (Tartowski and Stelmann, 1998).

Culling it is often preferred as a conflict reduction tool by landholders, as it is convenient, immediately shows results, satisfies their need for control, and is perceived as cost effective (Horton RR, 1997, Zinn et al., 1998, Treves and Naughton Treves, 2005).

Landholders surveyed in South Australia most widely used culling to reduce conflicts with Southern Hairy-nosed Wombats in South Australia and those who were financially dependent on their property or had experienced damage were more likely to cull wombats (O'Brien, 2019). Despite the widespread use of culling, only half of the landholders using it perceived it to be effective. A lack of data on wombat numbers makes it difficult for state agencies to set balanced culling quotas often resulting in ineffective conflict resolution (Taggart et al., 2008). Many landholders feel they are rarely permitted to cull enough wombats to mitigate damage with recolonisation of burrows being an ongoing problem (Stott, 1998, Taggart et al., 2008, St John and Saunders, 1989). Official government registers are considered an underestimate of the true numbers of wombats culled, as some landholders resort to culling outside the permit system (St John and Saunders, 1989, Taggart et al., 2008). The use of lethal controls needs to be carefully evaluated and managed based on scientific evidence, to ensure conflict reduction without threatening species conservation.

6.8 Wombat monitoring and research

There are significant knowledge gaps in our understanding of Bare-nosed Wombat populations in the ACT. Addressing these gaps will require dedicated monitoring and survey effort to collect fit-for-purpose datasets. This section examines a variety of survey options, and their costs and benefits.

6.8.1 Quantify the frequency and occurrence of wombat damage

Perceptions and tolerance of damage caused by wildlife are often shaped by financial dependence on crops or livestock and previous experiences (Naughton-Treves L, 2005, Van Tassell et al., 2000). Perceived damage can sometimes be disproportionate to actual damages (Dickman, 2010, Knight, 2000, Madden, 2004, Wigley and Garner, 1986). Quantifying the frequency and cost of Bare-nosed Wombat-related damage is crucial to distinguish between real and perceived impacts. This data can help identify high-conflict areas and guide wildlife managers in developing targeted management actions. In regions where damage is minimal or misattributed, educating stakeholders can be crucial to mitigating conflict. Conversely, where significant damage occurs, targeted management interventions to reduce damages may be necessary to alleviate its effects.

Accurately reporting the prevalence and costs of wombat damage from landholders and other relevant stakeholders will require a consistent approach to data collection. This will require

CED to develop a reporting tool for stakeholders to submit information such as: (1) the type of damage; (2) the location of the damage; (3) the financial costs associated with damage; and (4) negative safety outcomes associated with damage. Collecting a consistent set of data in each report will allow for comparison with wombat population data and other key population metrics. This tool will need to be managed by CED or another relevant team within the ACT Government.

6.8.2 Ecological surveys of wombats in the ACT

One of the critical aspects of species management is understanding population dynamics. Currently, Bare-nosed Wombat population monitoring in the ACT is limited, with few systematic surveys to track wombat numbers or distribution. Animal welfare and stakeholder concerns around the prevalence of mange also require systematic surveys that include areas with and without mange treatment applications. High-quality distribution and abundance data paired with standardised impact and mange assessments will provide land managers with the tools for effective management and conflict mitigation.

Current monitoring

CED has commenced a long-term monitoring program at eleven sites within the ACT. The purpose of these surveys is to detect changes in populations over time, and to collect data on mange prevalence and severity. Survey sites were selected based on known presence of Bare-nosed Wombats and ease of accessibility. Surveys are conducted twice annually in winter and consist of walking 1 km transects at a slow pace (45 mins), commencing 30 mins after sunset (Figure 5). Surveys are carried out in teams of at least two people for health and safety reasons. Surveyors use night vision binoculars to reduce disturbance of animals.

When a Bare-nosed Wombat is seen, the surveyor notes their location using a GPS, takes a compass bearing and estimates the distance to the animal. Wombats are given a body condition score (ranked 1-5, with 1 being poor and 5 being excellent) and a mange score using the categories described in Stannard et al. (2020). Observers also record a mange confidence score to reflect how confident the surveyor is in their assessment in the presence or absence of mange, noting that it can be difficult to assess from a distance. Weather variables including temperature, rainfall, wind speed, cloud cover and visibility of the moon are measured at the beginning of each transect. A further two sites in Namadgi National Park are surveyed annually using the same method as above, with the exception that surveys are undertaken from a vehicle.

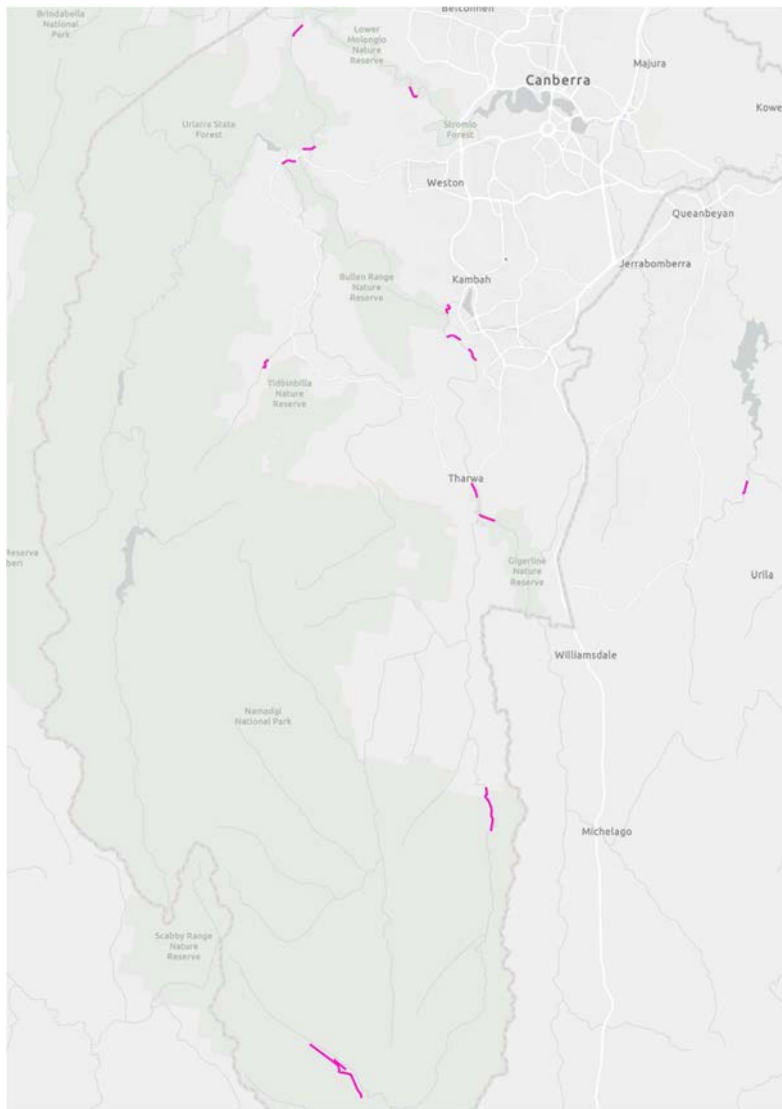


Figure 5. Locations (pink) of the line transect surveys conducted to detect changes in populations over time, and to collect data on mange prevalence and severity.

Bare-nosed Wombat records are also collected using applications such as NatureMapr and the Atlas of Living Australia. These are useful tools that enable public reporting of wombat sightings over large areas that would otherwise be infeasible for ecologists to survey. These incidental sightings are typically biased towards areas of high human activity (i.e., roads or trails) and there are caveats around their value in understanding a species distribution or abundance. Without standardised survey effort, it is difficult to determine whether areas with a lower number of records represent a true absence or a low survey effort. Species and signs of their presence, such as faeces, tracks and burrows, can also be misidentified or difficult to detect. Burrows also present a challenging proxy for wombat occupancy as burrows may remain in an area after an individual has moved on (Tartowski and Stelmann, 1998).

Gaps in current methodology

A comprehensive survey program to inform wombat management in the ACT requires data on (1) wombat density or relative activity across areas of suitable habitat; (2) prevalence of mange across existing wombat populations; and (3) the effect of mange treatments on the prevalence of mange. The current monitoring program captures relative activity data within the conservation estate but is not representative of all Bare-nosed Wombat habitat in the ACT. A more representative selection of sites would require survey transects to be located across conservation estate, rural lands, and other stakeholder areas (i.e., Icon Water). This would require approval from stakeholders for ecologists to access their land for surveys.

The current site selection does not consider whether sites have been actively or historically treated for mange. This makes it difficult to determine whether the abundance or current health of the local population is affected by these treatments. In future, monitoring sites should be evenly stratified into two groups: treated and untreated. Once these sites are selected, treatment conditions should remain consistent throughout the study period.

The current survey methodology as described above is subject to imperfect detection of both mange prevalence and individual wombats. Vegetation and uneven topography can make it difficult to detect individuals and assess mange severity. For more information on alternative survey methodologies that may be more suitable, refer to the section below.

The current monitoring program is conducted across 26 survey nights annually, with two staff or volunteer members required to conduct each survey. In the past this work has been done by CED ecologists and volunteers from Wombat Rescue. Expanding the survey scope to include transects on rural land and other stakeholder properties would increase the survey time required. For consistency and impartiality, this should be done by trained ecologists and not members of any stakeholder group.

Alternative monitoring methods for consideration

Due to the nocturnal and burrowing nature of Bare-nosed Wombats they are difficult to survey. Direct counting using spotlight surveys are labour intensive and not practical over large areas. Spotlight counts are not representative of population numbers as wombats may remain in their burrows and avoid being counted (McIlroy, 1977b).

Mark recapture studies, requiring individuals to be captured on more than one occasion, are challenging as Bare-nosed Wombats are difficult to capture. They can remain underground for

prolonged periods or dig around traps to avoid capture (McIlroy, 1977b, Skerratt et al., 2004). In these surveys, trapping only a portion of burrows can result in imprecise abundance estimates (Banks et al., 2003). Trapping every burrow across a large area is impractical due to the time and labour required.

The number of active burrows has successfully been linked to wombat abundances using mark-recapture methods (McIlroy, 1977a), burrow flap counters (Tiver, 1981) and remote cameras (Swinbourne et al., 2018). A combination of burrow activity levels and the number of active burrows is a relatively low-cost method and has been used to infer population abundances (St John and Saunders, 1989). Burrow activity can be estimated using burrow flap counters or remote cameras. Abundance estimates using these measures will allow land managers to track trends in population levels but will not provide an exact density.

Ground penetrating radar has been used successfully to map Southern Hairy-nosed Wombat burrows (Swinbourne* et al., 2015). It can be used to determine the length, depth and direction of wombat tunnels and help determine if a burrow is a main, secondary or starter burrow. There are various ground penetrating radar systems available, simple units can be hired for between \$200-400 a day and can penetrate up to 8 m depth.

Drones have successfully been used to map wombat burrow locations in New South Wales grasslands (Old et al, 2019). In their study, Old et al. (2019) detected a similar number of burrows using desktop analysis of drone imagery and ground-based surveys. In aerial surveys observer errors can result in inaccurate counts, but standardising the results using a transect with a known number of burrows can help develop a correction factor for the dataset (Tiver, 1981). Recording video footage during aerial surveys can also allow for more accurate and repeatable scores of wombat warrens (McGregor and Wells, 1998). Drone surveys can be affected by vegetation, with reduced efficacy in dense vegetation where burrow entries are obscured (Old et al 2019; Taggart et al, 2008). These aerial surveys provide an alternative to manual searching for burrows and can be used to quickly assess range expansion in local wombat populations. Detecting decreases in distribution based on burrow surveys is more difficult, as warrens remain visible long after they have been vacated.

Integrating drones with thermal sensors has been used effectively to directly survey a range of terrestrial and arboreal species (Beaver et al, 2020; Howell et al, 2021; Witt et al, 2020). These methods have not yet been tested on wombats, but they may provide a suitable alternative to ground-based surveys. While thermal drone surveys may reduce labour inputs and reduced

detection abilities in dense vegetation, they are still subject to the pitfalls of direct count methodologies. Direct counting will still be subject to imperfect detection if individual wombats remain underground during the surveys.

6.8.3 Furthering research by partnering with scientists

There are lots of knowledge gaps that hinder the effective management of Bare-nosed Wombats in the ACT. While it is not necessarily the role of the ACT Government to conduct the research to fill these knowledge gaps, collaboration with scientists may help to overcome some of these knowledge gaps.

Collaboration between the ACT Government and researchers could help fill the knowledge gaps discussed above. Key research areas include developing a deeper understanding of complex stakeholder views and collecting more robust population-level data for wombats in the ACT. Additional topics could include further research into mange treatment and collaborating with landholders to develop effective damage mitigation strategies. Landholders currently lack reliable options for mitigating conflict with wombats. These options need to be well-tested, and the limitations and benefits of each need to be clearly understood.

7. Recommendations

The following steps are recommended to address key stakeholder concerns in a responsible and balanced manner:

- Support non-lethal methods for wombat control by land managers to mitigate damage, which may include the provision of information, resources and training;
- Develop an appropriate mechanism to allow humane euthanasia of wombats on rural lands that are afflicted with severe mange, noting animal welfare considerations;
- Coordination between ONC ecologists and PCS Licensing and Compliance to clearly identify areas within the ACT, and possibly NSW, where rehabilitated wombats can be released. Selection of suitable sites can reduce the likelihood of overabundance and future human-wildlife conflict;
- Review procedures and licensing pathways for the deployment of Cydectin and other mange treatments to ensure appropriate placement that minimises negative impacts on aquatic systems;
- Over the longer term, explore and evaluate options to support holistic management of Bare-nosed Wombats in the ACT through an appropriate policy mechanism, including

for example, a Controlled Native Species Management Plan under the *Nature Conservation Act 2014*.

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Managing wombats

A review of current practice, issues and challenges to inform wombat management in the ACT.

Office of Nature Conservation

DRAFT Technical Report to the Conservator for
Flora and Fauna

October 2025

Acknowledgement of Country

The City and Environment Directorate acknowledges the Ngunnawal people as traditional custodians of the ACT and recognise any other people or families with connection to the lands of the ACT and region.

We respect the Aboriginal and Torres Strait Islander people, particularly our Aboriginal and Torres Strait Islander staff, and their continuing culture and contribution they make to the Canberra region and the life of our city.

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Glossary

- **City and Environment Directorate (CED)** – ACT government department responsible for managing conservation estate and public land.
- **Closed season** – A defined period during which hunting or capturing was prohibited for listed species.
- **Deterrent** – Something that discourages or prevents someone from taking an action due to the perception of negative consequences.
- **Dry sheep equivalent (DSE)** – A unit of measure used to assess the nutritional needs of livestock and the carrying capacity of a farm. It equates to the amount of feed required daily by a two-year-old, 50 kg Merino wether.
- **Leaseholder** – A person or entity granted a Crown lease by the Territory, giving them the right to occupy and use land according to the terms and conditions of the lease.
- **Noxious pest/pest** – An animal, insect, or plant considered harmful to agriculture, the environment, or human health, and officially declared or classified as such under relevant legislation or regulations.
- **Olfaction** – The sense of smell.
- **Open season** – A specific period during which it is legally permissible to hunt, take, or possess certain wildlife species that are otherwise protected. An open season is officially declared by the relevant authority (e.g., the Minister responsible for wildlife or a delegated agency) and specifies:
 - The dates during which hunting or taking of wildlife is allowed.
 - The species to which it applies.
 - Any conditions or restrictions, such as location, bag limits, or methods of hunting.
- **Pasture Protection Board** – Local government bodies established under the *Pastures Protection Act 1934*. The 59 boards in NSW were responsible for managing grazing, controlling pests like rabbits and feral animals, and promoting sustainable land management.
- **Protected species** – Species protected by law that cannot be taken, harmed, or interfered with without appropriate authorisation.
- **Reintroduction** – The movement of wild animals into part of their former range from which they have been extirpated.
- **Translocation** – The deliberate movement of wild animals from one part of their range to another.

- **Vermin** – Species of animals not protected by law and often considered pests due to their negative impacts on agriculture, native species, or the environment.
 - Declared vermin can usually be destroyed or managed at any time, including outside of open seasons, unless other laws (such as firearms laws) apply.
 - The list of vermin is not fixed and can be updated by regulation or proclamation.

Executive summary

The ACT seeks to adopt a holistic and informed approach to wombat management, balancing species conservation with protection of landholder and industry assets. This document reviews relevant information to inform best-practice wombat management and to ensure populations persist in the ACT.

The scope encompasses cross-jurisdictional legislation, stakeholder views, management methods and monitoring approaches. The document also highlights current challenges within the ACT, including the complexities involved in balancing conservation with stakeholder needs.

As native marsupials wombats are integral to the region's ecosystem but present several management issues. These include wildlife-vehicle collisions and conflict with agricultural activities. Wombats may face challenges including urban expansion, habitat loss and the prevalence of sarcoptic mange.

Key findings from the review include:

- **Legislation and Policy:** Unlike other Australian jurisdictions, the ACT does not allow specific provisions for the control of wombats nor provide guidance on non-lethal conflict mitigation. This has led to frustration among leaseholders managing wombat-related damages.
- **Threats to Wombats:** Habitat loss and sarcoptic mange remain the primary threats. Management of sarcoptic mange is complex and is currently conducted by wildlife carers. There is no clear mechanism for the government to limit the application of mange treatments in areas where chemicals may have negative ecological consequences. There are currently no guidelines around the release of rehabilitated wombats, including identified release zones that are ecologically suitable.
- **Stakeholder Conflicts:** The ACT has diverse stakeholders who hold conflicting views on how wombats should be managed. Consultation with stakeholder groups on policy changes is a possible method for reducing tension and increasing stakeholder support. Working groups, such as the Wombat Mange and Monitoring Group, also provide forums for stakeholders to engage on topics relevant to their concerns and interests.
- **Public education:** Development of housing near areas of wombat activity can increase incidences of human-wildlife conflict. Providing informative material and engaging in public communication are strategies to increase awareness in the community.

- **Management Tools:** Fencing, burrow modifications, and deterrents are available to manage wombat damage, but are often resource-intensive and may yield inconsistent results. Many have not been trialled in the ACT and stakeholders may not be aware of the available options. Burrow modification interventions would require additional approvals, and there is currently no streamlined application process to make this available to landholders.
- **Research and collaboration:** The ACT partners with citizen scientists to collect data on wombats through the ACT Wombat Portal, NatureMapr, and WomSAT. Where possible, decision-making should be based on systematic surveys that are scientifically robust and fit for purpose. Leaseholders currently do not have a method of reporting wombat impacts on their property.

Recommendations include:

- Support non-lethal methods for wombat control by land managers to mitigate damage, which may include the provision of information, resources and training;
- Develop an appropriate mechanism to allow humane euthanasia of wombats on rural lands that are afflicted with severe mange, noting animal welfare considerations;
- Coordination between ONC ecologists and PCS Licensing and Compliance to clearly identify areas within the ACT, and possibly NSW, where rehabilitated wombats can be released. Selection of suitable sites can reduce the likelihood of overabundance and future human-wildlife conflict;
- Review procedures and licensing pathways for the deployment of Cydectin and other mange treatments to ensure appropriate placement that minimises negative impacts on aquatic systems;
- Over the longer term, explore and evaluate options to support holistic management of Bare-nosed Wombats in the ACT through an appropriate policy mechanism, including for example, a Controlled Native Species Management Plan under the *Nature Conservation Act 2014*.

1. Introduction

Wombats are iconic Australian marsupials, deeply embedded in the cultural heritage of First Nations Peoples and the national identity (Garvey et al., 2016). There are three extant species: the Bare-nosed Wombat (*Vombatus ursinus*), the Southern Hairy-nosed Wombat (*Lasiiorhinus latifrons*), and the Northern Hairy-nosed Wombat (*Lasiiorhinus krefftii*). Although once likely widespread, all three species have experienced significant declines and range contractions since European settlement (Aitken, 1971, Gordon et al., 1985, Buchan A and DC, 1998, Cooke, 1998, McIlroy, 2008). The clearing of land for agriculture and urban development, coupled with the introduction of European rabbits (*Oryctolagus cuniculus*), has had a profound impact on wombat populations (Aitken, 1971, Cooke, 1998). Rabbits provided competition for food and shelter (Cooke, 1998), and wombat warrens were often destroyed during rabbit control efforts (Triggs, 2009). Increasing conflict with livestock (Crossman et al., 1994) also contributed to population pressures. The Northern Hairy-nosed Wombat suffered the greatest decline, reduced to a single known population of approximately 30 individuals by 1982 (Gordon et al., 1985). It is now listed as endangered under the *Nature Conservation Act 1992*. In contrast, the Bare-nosed Wombat was declared vermin as early as 1906 in Victoria, and considered a pest in other states (Temby, 1998).

Historically wombats were widely regarded as pests, particularly because their burrowing behaviour damaged rabbit exclusion fencing (Aitken, 1971, Temby, 1998). This view contributed to sustained population control efforts and legislative measures in all jurisdictions to reduce their impact. The Australian Capital Territory (ACT) awarded early protection to Bare-nosed Wombats under the *Animals & Birds Protection Ordinance 1918*. Growing public concern over animal welfare, conservation, and sarcoptic mange has pressured other state governments to adopt more protective policies. Though wombats are now protected species in most states, they can be controlled under permit systems where they cause damage.

The management of wombats has become a highly contentious issue due to the complexities of trying to balance competing interests of stakeholder groups, including but not limited to local government, rural leaseholders, First Peoples and wildlife care groups. Conservation and wildlife care groups are concerned for the welfare of Bare-nosed Wombats and advocate for better protections. Agriculturalists want to manage the species to minimise the damage it can cause to infrastructure, stock and farm personnel. Given the diversity of stakeholder interests, reaching agreement on the best approach to wombat management is a persistent challenge.

This review highlights the legislative, ecological, and stakeholder challenges involved in balancing species conservation with human land use and infrastructure needs. It reviews past and current legislation across the Australian states and territories to inform the conservation and management of wombats in the ACT.

2. Legislation, policy and regulation

2.1 Policy and legislation

Following European settlement and the expansion of agriculture in Australia, all three wombat species have experienced conflicts with humans. Initially, conflicts arose because wombats caused damage to rabbit exclusion fencing and wombat burrows provided refuge for rabbits. As a result, wombats were commonly viewed as pests and were able to be lethally controlled under legislation in most states.

The range of all three species of wombat contracted significantly as a result of large-scale land clearance for agricultural and urban development, and the introduction of European rabbits (*Oryctolagus cuniculus*) (Aitken, 1971, Temby, 1998, Gordon et al., 1985, Buchan and Goldney, 1998, McIlroy, 2008, Cooke, 1998). Over time attitudes towards wombats and concern for their conservation increased and legislation changed to reflect this.

This section provides an overview of the legislative frameworks and policies related to wombat management across various Australian states and territories. These frameworks serve to inform the management approaches in the Australian Capital Territory (ACT) and offer potential insights into improving wombat conservation and management strategies.

2.1.1 Victoria

Legislative history

The Bare-nosed Wombat was declared vermin throughout the state of Victoria in 1906, under provisions of the *Vermin Destruction Act 1890* (Seebeck 1988). In 1925, a bounty was placed on Bare-nosed Wombats under the *Vermin and Noxious Weed Act 1922*, with more than 60,000 bounties paid up until 1955. The bounty was subsequently suspended in 1966 and officially abolished in 1971. Bare-nosed Wombats remained a pest to many and from 1971 to 1986 government officials fumigated their burrows on Crown land.

In 1977, Bare-nosed Wombats were declared protected under the *Wildlife Act 1975* in the region west of the Melbourne to Sydney railway line, where they occurred in low numbers. The vermin status of the species was maintained in eastern Victoria until 1984, when Bare-nosed Wombats were protected under the *Wildlife Act 1975* across all Victoria. Lobbying by farmers led the species to be declared ‘unprotected wildlife’ in 193 parishes in eastern Victoria under the *Wildlife Act 1975*. The declaration of the species as ‘unprotected wildlife’ enabled the destruction of Bare-nosed Wombats by landholders, their families, and employees by means of fumigation, trapping or shooting on freehold or leasehold land, and within 1 km of such land on adjoining Crown land. In June 1997, the *Wildlife Act 1975* was modified to enable destruction only on the occupier’s property with a high-powered, centre-fire rifle of .222 calibre or larger.

Current legislation and process

In February 2020, an amendment to the *Wildlife Act 1975* revoked the unregulated control of Bare-nosed Wombats across 193 parishes in eastern Victoria. It is now an offence to kill, take, control or harm Bare-nosed Wombats across the entire state of Victoria without authorisation. This includes activities such as destroying or disturbing their burrows. To destroy a wombat without a permit carries a penalty ranging from \$8,261 to \$39, 652 and/or six to twelve months in jail. On March 19, 2025 the Victorian Legislative Council voted to review the state’s lethal control program for wombats and explore alternative control measures. The review was still underway at the time of writing and no formal legislative changes had been announced.

To destroy a wombat or their burrows landowners need to apply for an authority to control wildlife permit (ATCW) from the Department of Energy, Environment and Climate Action which can be done [online](#), by post or email (Table 1). Applicants are required to demonstrate damage to their property, crops or pasture, impacts on biodiversity values, or risks to human health or safety. Applicants must also demonstrate that all other reasonable options have been considered. A [wombat management methods factsheet](#) outlines “non-lethal” management options for landholders. Forest and Wildlife Officers review applications and may require a property inspection. This process can take up to six weeks to complete.

Each ATCW specifies the species of wildlife that can be controlled and the method of control. Anyone shooting wildlife under the *Wildlife Act 1975* must also comply with the [Firearms Act 1996](#).

Table 1. The number of permits issued to control Bare-nosed Wombats and the number of animals to be harmed in Victoria over the last seven years

Year	Number of permits	Animals authorised to be culled
2023	222	1902
2022	226	1862
2021	207	1675
2020	273	1478
2019	268	3655
2018	252	3830
2017	270	3374

2.1.2 New South Wales

Legislative history

New South Wales was home to all three species of wombat until the last claimed sighting of Northern Hairy-nosed Wombats in 1909. Bare-nosed and Northern Hairy-nosed Wombats had partial protection under the *Native Animals Protection Act* 1903. Under this act both species were protected from destruction during the declared closed season from August to January each year. Bare-nosed Wombats lost these protections when they were not included on the list of protected species under the *Animals and Birds Protection Act* 1918. Bare-nosed Wombats regained legal protection under the subsequent *Fauna Protection Act* 1948. Landholders were required to obtain permits for wombat destruction, except in areas governed by Pasture Protection Boards. At this time, wombats were also regarded as a noxious pest by the Department of Agriculture under the *Pastures Protection Act* 1934. This created a conflict in areas where landholders were required to destroy wombats under the *Pastures Protection Act* 1934, but could be prosecuted for doing so under the *Fauna Protection Act* 1948.

In 1959 the National Parks and Wildlife Service and the Department of Agriculture reached a compromise, leaving Bare-nosed Wombats unprotected but no longer declared noxious. As a result, both species of wombat became fair game for sports shooters and landholders. In March 1973, Bare-nosed Wombats were awarded full protection with provision for destruction for damage control purposes by being removed from the First Schedule (list of unprotected animals) of the *Fauna Protection Act* 1948-67. The following *National Parks and Wildlife Act* 1974 provided full protection to Northern Hairy-nosed Wombats, which were classed as endangered. Bare-nosed Wombats were also given protection with a provision for damage control under a permit system.

Current legislation

Wombats are protected under the *NSW Biodiversity Conservation Act* 2016. It is an offence to harm a wombat unless a licence is obtained from the Department of Climate Change, Energy, the Environment and Water.

To obtain a licence landholders must demonstrate animals are a threat to human safety, damaging property and/or causing economic hardship. Where possible, the department seeks to resolve negative interactions using non-destructive methods and recommends non-lethal methods [on their website](#). However, a licence to harm individual animals may be required to mitigate problems. To apply for a licence, landholders must contact their local National Parks and Wildlife Service (NPWS) office to discuss the nature and severity of the issue and any non-lethal measures that may resolve the problem. They can then [download and fill in an application form](#) and lodge it with their local NPWS. The National Parks and Wildlife Service may grant a licence to the owner or occupier of a property to cull wombats. Records of the number of animals harmed need to be kept on a record sheet provided and lodged with the NPWS office within 7 days of the licence expiry. All people operating under the licence must comply with the *Firearms Act* 1996 and the Code of Practice for the Humane Destruction of Wombats by Shooting in NSW. Harming wildlife without a permit may receive a maximum fine of \$330,000 with an additional \$33,000 for each animal harmed or two years in jail.

Within the last seven years a small number of permits have been issued (Table 2). The maximum number of Bare-nosed Wombats to be harmed on any one permit was 50 animals. More commonly permits range from 1 – 20 animals for issues including damage to crops, competition with stock, hazard for vehicles, damage to fencing, and causing erosion and disease.

Table 2. The number of permits issued to control Bare-nosed Wombats and the number of animals to be harmed in New South Wales over the last seven years.

Year	Permits issued	Number of wombats to be harmed
2023	34	187
2022	38	219
2021	26	138
2020	42	221
2019	76	501
2018	103	752
2017	40	193

2.1.3 Queensland

Legislative history

The Northern Hairy-nosed Wombat and Bare-nosed Wombat were protected in Queensland under the *Native Animals Protection Act 1906*. However, this and subsequent Acts provided provisions for damage control. By 1982, the Northern Hairy-nosed Wombat was restricted to a single population of approximately 30 animals (Gordon et al., 1985). The *Fauna Conservation Act 1974-1989* provided permanent protection for the Northern Hairy-nosed Wombat with no provision for damage control. Northern Hairy-nosed Wombats were declared endangered under the *Nature Conservation Act 1992*. Bare-nosed Wombats remained protected with provision for damage control under a permit system.

Current legislation

Northern hairy-nosed and Bare-nosed Wombats are protected under the *Nature Conservation Act 1992*, though there are provisions to control Bare-nosed Wombats *for* damage mitigation purposes. A damage mitigation permit is required to take wildlife to minimise damage or loss of property (e.g. crops) or to protect human health and wellbeing. Damage mitigation permits may cover the removal and translocation of problem animals or lethal control.

To obtain a three-year permit to remove and relocate wildlife applicants must demonstrate the following:

- Certificate of completion of a training course concerning the keep, relocation, and safe handling of relevant wildlife.
- A current first aid certificate issued by an approved first aid provider.
- Referee reports from two suitably skilled and qualified persons.
- Statements outlining the ability to handle wildlife, including safety procedures to be applied when handling or moving wildlife and access to appropriate equipment.
- Statements outlining wildlife identification skills.
- A resume including details of qualifications provided with the application.

If an applicant does not have any experience, they are recommended to contact a local damage mitigation permit holder for guidance and possible endorsement under this permit type.

To obtain a permit to lethally control wildlife, applicants must demonstrate damages caused and the economic losses incurred, or any threats to human health (e.g. disease or injury risks). Two non-lethal damage mitigation measures to prevent or minimise damage need to have been attempted prior to application for lethal control. There are no specifications about suitable non-lethal methods to be used or the duration of use. A statement outlining the applicant's relevant knowledge and experience in correctly identifying the relevant species is required. Permits are issued for one-year unless the landholder has an approved property management plan, in which case permits can be issued for three years. The Department of Environment Science and Innovation offers a service to guide applicants through the assessment process. The service includes meeting with a departmental project manager to discuss the information needed for the application. Applicants can email a [downloadable form](#) to the permits and licensing department and may take up to 40 business days to process. Once a permit has been granted, permit holders are required to lodge a return of operations form every three months and within 10 days of the permit expiry detailing how many animals were taken under the permit. The maximum penalty for *controlling protected wildlife without a permit* is \$15,480 (100 penalty units).

2.1.4 Tasmania

Legislative history

Bare-nosed Wombats were not protected in Tasmania until the passing of the *National Parks and Wildlife Act* 1970, which provided partial protection allowing for the declaration of an

open season. The Minister by order, could declare the dates and places on which the taking of any partially protected wildlife may start, stop, be prohibited or permitted and impose any conditions on the order. No open seasons were declared, and destruction for damage control purposes was undertaken by permit.

Current legislation

Bare-nosed Wombats are protected under the *Nature Conservation Act 2002* with provision for damage control.

The Department of Natural Resources and Environment encourages people to use non-lethal management options for mitigating wombat damage and several factsheets can be found on their website for [Living with Wombats](#). A [property protection permit](#) is needed to control protected wildlife, including Bare-nosed Wombats (Table 3). Permits can be applied for by landholders, managers or lessees of land to prevent the destruction of, or injury to any stock, crops and equipment or infrastructure used in crop and/or stock production. Applications must identify the damage caused, the method of control to be used and the number of animals they want to take. The Department of Natural Resources and Environment must be satisfied a financial loss is likely to occur if the crop, stock, equipment or infrastructure is not protected. Applications are assessed on a case-by-case basis, which may include a visit to the applicant's property. The local abundance of Bare-nosed Wombats, the impacts they may have on the property, and whether non-lethal measures will be effective at the site are considered when issuing permits.

The Department of Natural Resources and Environment Tasmania assesses population trends using annual spotlight monitoring of 190 10-km transects across the state. Issued permits specify the number of Bare-nosed Wombats that may be taken and a timeframe of up to 12 months. Permit holders are required to maintain accurate records of animals destroyed and report them within 28 days of the permit expiry. Persons controlling wildlife without a permit or who do not comply with the terms of their permit can receive a penalty of up to \$19,500 (100 penalty units).

Table 3. The number of permits issued to control Bare-nosed Wombats and the number of animals to be harmed in Tasmania from 2016 to 2022. N/A cells indicate a lack of data.

Year	Permits issued	Total quota issued	Wombats culled
2022	9	165	29
2021	6	N/A	17
2020	5	51	20
2019	4	N/A	107
2018	6	110	N/A
2017	22	160	N/A
2016	52	2171	N/A

2.1.5 Western Australia

Legislative history

Southern Hairy-nosed Wombats were not provided protection under early game acts in Western Australia. The *Game Act 1912* provided protection to all “non harmful” native fauna, but it is unclear whether this extended to Southern Hairy-nosed Wombats. The *Fauna Protection Act 1950* was the first to provide blanket protection to all native fauna in the state, including Southern Hairy-nosed Wombats. In 1975 it was re-named the *Wildlife Conservation Act 1950* and included new provisions for damage control permits.

To prevent Southern Hairy-nosed Wombats from becoming an agricultural threat across the state, the Agricultural Protection Board declared them as vermin in areas of WA outside their known range. In 1973, the declaration was amended to include Southern Hairy-nosed Wombats as a pest species under the *Vermin Control Act 1918-1970*. When the *Vermin Control Act* was replaced by the *Agriculture and Related Resources Protection Act 1976*, the Southern Hairy-nosed Wombat was included as a category seven declared animal. As a category seven species, the Minister had the authority to recommend and approve a species management plan that included management by lethal control.

Current legislation

In 2019 the *Wildlife Conservation Act* 1950 was replaced by the *Biodiversity and Conservation Act* 2016 and the Biodiversity Conservation Regulations 2018. Under the Biodiversity Conservation Regulations 2018, there are provisions for controlling fauna that have been listed as managed species. Fauna may be listed as a managed species if they are determined to be impacting public safety or biosecurity or causing economic or ecological damage. The Southern Hairy-nosed Wombat is not currently listed as a managed species. There are no records of licence applications or grants for Southern Hairy-nosed Wombat control in Western Australia.

When fauna cause damage to agriculture, native animals may be declared pests under the *Biosecurity and Agriculture Management Act* 2007 (BAM Act). Under the BAM Act, every organism except a human being has a legal status assigned through a declaration made by the Minister. If the Minister has not made a declaration, the status automatically remains unlisted. BAM status determines whether a permit is required to import the organism into Western Australia. The Southern Hairy-nosed Wombat is listed as a Permitted species S11 (exempt) on the Western Australian organism [list](#) under the BAM Act. This means they are not a declared pest and can be imported into the state without a permit provided they satisfy import permits and can be kept without a permit.

2.1.6 South Australia

Legislative history

Wombats gained their first legal recognition under the *Animals Protection Act* 1912 on the schedule of unprotected animals. Partial protection was achieved under the provision of *Animals and Birds Protection Act* 1919 with the declaration of a closed season on wombats from July to December. During the closed season landholders were only permitted to cull wombats for damage control purposes. The Fauna Conservation Act 1964 provided full protection with a provision for controlling wombats for damage mitigation. Under the *National Parks & Wildlife Act* 1972, the Bare-nosed Wombat was listed as 'Vulnerable' with full protection. The Southern Hairy-nosed Wombat was permitted to be controlled for damage mitigation purposes.

Current legislation

The Bare-nosed Wombat and Southern Hairy-nosed Wombat are protected under the National Parks and Wildlife Act 1972 (NPW Act). It is an offence to catch, interfere with, harass, or kill both species without a permit. The Department for Environment and Water recommends

using non-lethal means for managing wombats prior to resorting to culling and has a “Living with Wombats” [factsheet](#). The Department of Environment Water can issue destruction permits in circumstances where wombats cause damage or threaten human safety (*section 53.1c of the SA National Parks and Wildlife Act 1972*). Permit application forms are available [online](#) and can be emailed, posted or dropped off at the nearest regional office. Applications are considered by National Parks and Wildlife rangers on an individual basis. Consideration is given to whether non-lethal means may resolve the problem, the extent of the damage and threats to safety. There is a [code of practice for the humane destruction of wombats](#) which permit holders must abide by. The penalty for killing a wombat without a permit is a \$2,500 fine or six months in prison.

An amendment was made to the National Parks and Wildlife Act in 2023 prohibiting the destruction, damage or disturbance of wombat burrows without a permit, with a maximum penalty of \$5 000 or imprisonment for 12 months. Permits are not required if:

- you are the owner of the land where the burrow is located,
- you are authorised to destroy, damage or disturb the burrow by the owner of the land where the burrow is located; and
 - the burrow is located outside of a Wombat Burrow Protection Zone; and
 - the burrow is causing, or is likely to cause, damage to crops, stock, machinery or infrastructure (including tracks and built structures) or may constitute a safety risk or hazard to people.

If a burrow is located within a declared Wombat Burrow Protection Zone a person must not, without a permit, destroy, damage or disturb the burrow. No Wombat Burrow Protection Zones currently exist so a permit is not presently needed to destroy a wombat burrow. There is a protection for wombat burrows [factsheet outlining the new changes](#).

2.1.7 Australian Capital Territory

Legislative history

Bare-nosed Wombats have been fully protected in the ACT since the *Animals & Birds Protection Ordinance* 1918. Successive Commonwealth ordinances and the *Nature Conservation Act* 1980 kept full protection in place.

Current legislation

As native animals under the *Nature Conservation Act 2014*, Bare-nosed Wombats remain protected. Killing a native animal is an offence under section 130 of the Act, which presently carries a maximum penalty of \$16,000 and/or imprisonment of 1 year for an individual, or \$81,000 for a corporation (higher if the species is specially protected). Under sections 128-129 of the Act, it is an offence to interfere with a nest (including burrow) of a native animal. These offences presently carry a range of penalties, up to (in a case involving a wombat) \$16,000 and/or imprisonment of 1 year for an individual, or \$81,000 for a corporation. A range of offences apply to damaging land in a reserve. The maximum penalty for the most serious of these offences is presently \$400,000 and/or 7 years' imprisonment for an individual, or \$2,025,000 for a corporation. Some activities, including nest destruction, may potentially be carried out under a licence issued by the Conservator of Flora and Fauna. It is the responsibility of the proponent to apply for a licence for any proposed activity that may otherwise be an offence under the Act. The ACT Parks and Conservation Service administers the Act and conservation officers are responsible for conducting compliance activities. These include public education, inspections and investigations to promote and support compliance.

In 2025, the ACT Government strengthened its regulatory framework for wildlife protection during development by introducing the Nature Conservation (Protection of Burrowing Animals During Development) Conservator Guidelines. These guidelines, issued by the ACT Conservator of Flora and Fauna, are a notifiable instrument under the *Nature Conservation Act 2014*, giving them legal force and requiring compliance from developers operating in areas with suitable habitat. The guidelines aim to minimise harm to native burrowing animals, such as Bare-nosed Wombats, by requiring site assessments, avoidance of active burrows, and consultation with the Conservator where disturbance is unavoidable.

2.1.8 Differences between the ACT and other jurisdictions on wombat control

Apart from the ACT, all jurisdictions currently have a specific provision under legislation to enable wombat control for the purpose of damage mitigation. Victoria is currently conducting a review of their lethal control policies for wombats, but this review is still in progress and there have been no legislative changes. Control is regulated by a permit system, and landholders are required to pursue alternative management methods in almost all states before seeking a culling permit.

Tasmania is the only state which considers trends in wombat populations when setting permit allocations. Understanding baseline population data is critical to assessing a program's efficacy and impacts. Controlling too few individuals can be ineffective at reducing damages, while removing too many can have negative conservation outcomes (Taggart et al. 2008).

Most states have an online permit application system or provide a form that can be submitted to the relevant department. Applications typically take 4-6 weeks to process, and landholders may be frustrated by these timeframes (Sparrow, 2011, Stott, 1998, Bunn, 2019). When landholders are faced with wombats burrowing under dams and other infrastructure, they feel prompt action is required to prevent further damage. Most states require the applicant to have tried 'non-lethal' damage mitigation strategies before applying for a permit, but guidance on 'non-lethal interventions' may not be provided. Further research into the efficacy and animal welfare considerations of common 'non-lethal interventions' is also required.

There has been a substantial reduction in the number of permits and the number of wombats permitted to be culled within the last decade across all states. This is in response to mounting public pressure on government agencies from conservationists and animal welfare advocates. As a result, landholders feel they are unable to reduce the damage caused by wombats on their property. For many farmers, the lengthy application process is not worth the time it takes to apply for a permit if they are only permitted to cull 10-25 wombats. As such some landholders act outside of permit systems and official government registers are considered an underestimate of the true numbers of wombats culled (St John and Saunders, 1989, Taggart et al., 2008).

3. Wombats in the ACT

3.1 Distribution and abundance

Prior to European settlement Bare-nosed Wombats were thought to have a continuous distribution across much of their range including the ACT. Following European settlement, the establishment of farming along with the introduction of rabbits is thought to have had a significant reduction on the distribution and abundance of all three species of wombats (Buchan A and DC, 1998, Cooke, 1998). Dingoes (*Canis familiaris dingo*) have been known to predate on wombats where the two species co-occur, but their effects on overall population numbers is unclear (Thorley and Old, 2020). Current occurrence records from the ACT Wildlife Atlas show Bare-nosed Wombats are widespread across the ACT, particularly along the

Murrumbidgee and Molonglo River (Figure 1). Wombats are also known to occur across Namadgi National Park (CED survey data).

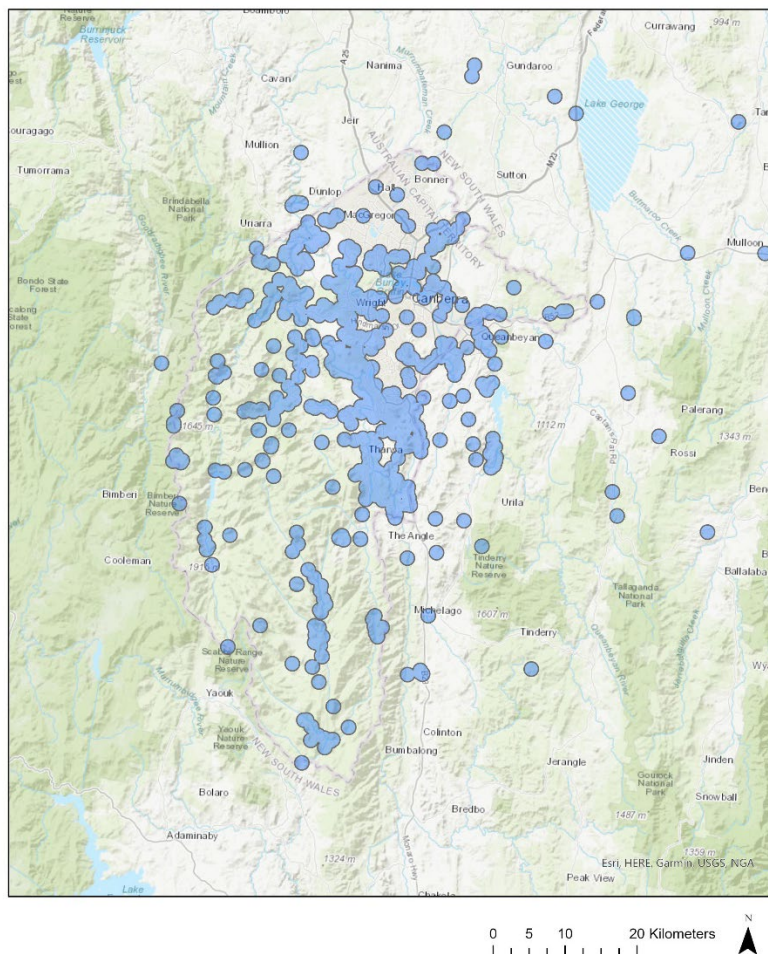


Figure 1. The known distribution of Bare-nosed Wombats (blue) in the Australian Capital Territory, taken from ACT Wildlife Atlas records, CED survey data and the [ACT Wombat Manage Portal Map](#). This data collection system is designed to capture data within the ACT and is likely an underrepresentation of wombat distributions in NSW.

Abundance is likely to vary locally and regionally, depending on a range of factors, such as habitat type, soil type and climatic conditions. Competition from rabbits and kangaroos for food resources also limits Bare-nosed Wombat numbers in many areas (Tamura et al., 2021, Bird et al., 2012, Cooke, 1998).

There are currently no reliable estimates of abundance for Bare-nosed Wombats in the ACT. After an initial likely decline from habitat loss, following the expansion of agriculture and urbanisation, anecdotal reports from leaseholders suggest the distribution and abundance of Bare-nosed Wombats have increased over the last 10-20 years. Anecdotal evidence from park rangers also support an increase in distribution. Reports dating back to 1975 indicate Bare-nosed Wombats were not present on the Canberra plains or in Canberra Nature Park at the

time, though they were present in Tidbinbilla and Namadgi National Park. Rabbit control officers were known to target Bare-nosed Wombats because of the holes they made in rabbit proof fencing (Don Fletcher, pers. comm.; Higgins, 1991).

3.2 ACT Government stakeholder engagement

The Office of Nature Conservation (in CED) initiated a Wombat Working Group in 2021 to bring together stakeholders with interests in Bare-nosed Wombat management in the ACT to share knowledge and discuss management issues. The group consisted of wildlife carers, ACT Government, agriculturalists and researchers. The group met several times virtually, but lack of attendance meant that it was disbanded. A Wombat Mange Management Sub-group also commenced in 2021. The subgroup met quarterly until it was scaled back and eventually paused in 2024. For more information on relevant stakeholders in the ACT see Section 4.

3.3 Monitoring and management

The Office of Nature Conservation conducted line transect surveys across 13 sites to monitor wombat populations in the ACT, but these methods have now been judged insufficient to robustly estimate abundance. For more information on monitoring wombat populations see Section 6.8.

Mange is treated by wildlife care groups under a CED permit for use of moxidectin on public land in the ACT, with strict conditions of its use around waterways due to its toxicity to aquatic species. For more information on the prevalence and treatment of sarcoptic mange in the ACT see Section 5.2.1.

3.4 Rescue and rehabilitation

There are two wildlife rescue organisations within the ACT that care for and rehabilitate sick and injured Bare-nosed Wombats. Wombat Rescue is solely dedicated to Bare-nosed Wombats, and ACT Wildlife cares for all injured wildlife. Wombat Rescue operates under a licence to take, rehabilitate and release wildlife in the ACT issued under Section 273 of the *Nature Conservation Act 2014*. Both groups work closely with each other and NSW care groups to coordinate resources for the care of Bare-nosed Wombats.

Wombat Rescue reports responding to several call outs a day. In the last 6 months Wombat Rescue have taken 19 Bare-nosed Wombats into care. Records indicate up to 50 wombats are taken into care annually by Wombat Rescue and ACT Wildlife cares for 20-30. What most individuals take into care are pouch young orphaned as a result of road vehicle collisions. To a

lesser extent Bare-nosed Wombats with severe mange are taken into care for treatment, with carers preferring to treat mange in situ where possible.

Of the approximately 50-60 Bare-nosed Wombats taken into care each year fewer than 10 animals are released in the ACT. In 2024, 28 wombats from the ACT were taken into care and only five were released into the ACT. Animals that come into care from New South Wales must be released in NSW. Release sites are resource intensive to find. For wombats these may include a large enough area that is free from mange, away from roads, has available food and water, and a low density of resident wombats. ACT Wildlife procures empty burrows to release animals by evicting resident Bare-nosed Wombats with the use of one-way gates. Wombat Rescue creates artificial starter burrows to release animals by digging a 70 cm deep L-shaped tunnel in flat ground. They place a 45 cm diameter trench liner half pipe over the hole before filling it back in to make a tunnel. When creating tunnels on private land they use soft release techniques, fencing the burrow and providing supplemental food. Animals released into parks and reserves are not provided supplemental food or fenced burrows. Carers monitor released individuals for a few weeks using wildlife cameras, but released animals rarely stay in the release area.

More recently, there has been request from Wombat Rescue that ACT Government provide land for a pre-release wombat sanctuary or haven to prepare rehabilitated wombats for wild release. Areas would need to be designated and fenced for this purpose, and policy or guidelines developed around effective and safe release of wombats. The feasibility and need for a wombat sanctuary, and the role of the ACT Government in providing such a facility, is still in discussion.

4. Stakeholder consultation and interviews

This section lists the primary stakeholders invested in Bare-nosed Wombat management in the ACT, and their interests in this issue (Table 4). It is important to note this is not a comprehensive review of stakeholder opinions on Bare-nosed Wombat management in the ACT and only expresses the views and opinions of a small number of people from each stakeholder group. Views and opinions are likely to vary within stakeholder groups. A formal review of stakeholder views is recommended.

Table 4. Identified stakeholders within the ACT with an interest in Bare-nosed Wombat management

Group	Organisation/name	Role in relation to Bare-nosed Wombats
ACT Government	Office of the Conservator of Flora and Fauna, City and Environment Directorate	Acts on issues that affect the conservation matters covered in the <i>Nature Conservation Act 2014</i> , particularly protecting native plants and animals
	Office of Nature Conservation Policy, City and Environment Directorate	Updates policy and legislation under the <i>Nature Conservation Act 2014</i>
	Office of Nature Conservation, City and Environment Directorate	Undertake a range of nature conservation programs in the ACT, including research on local flora and fauna, preparing scientific advice on ecological and natural resource management, conducting ecological surveys, biodiversity monitoring
	City Services, City and Environment Directorate	Deliver a range of services, including shop and playground upgrades, road and path maintenance, domestic animal services, and the management of urban open spaces including tree planting and grass mowing that may be impacted by Bare-nosed Wombat behaviour
	ACT Natural Resource Management, City and Environment Directorate	Integrated management of ACT's natural resources, including biodiversity, sustainable agriculture and cultural history
	ACT Parks and Conservation Service, City and Environment Directorate	Land management of the conservation estate, vertebrate pest and weed control, and managing visitor experiences.
	Licensing and Compliance, City and Environment Directorate	Licensing and compliance under the <i>Nature Conservation Act 2014</i>
	Urban Wildlife, ACT Parks and Conservation Service, City and Environment Directorate	Manage the outcomes of human-wildlife conflict, including nuisance animals, vehicle strikes and sick and injured animals

Group	Organisation/name	Role in relation to Bare-nosed Wombats
	Veterinarians, City and Environment Directorate	Administering treatment and care of animals including wildlife within the ACT
Industry	Icon Water	Responsible for maintaining supply of water and sewage services in the ACT. These services may be impacted by Bare-nosed Wombat activity on occasion and require management
	Developers	Construction of new developments within the ACT in compliance with Conservator Guidelines for Burrowing Animals
Agriculturalists	Rural leaseholders	Land management and agricultural production which may be impacted by Bare-nosed Wombat behaviour
	ACT Rural Landholders Association	Advocacy for farmers and best practice farming within the ACT
Wildlife carers	Wombat Rescue	Caring for injured wombats and treating mange infected populations within the ACT. Advocate for wombat conservation and welfare
	ACT Wildlife	
Researchers	Prof Scott Carver	Conducting research on wombat ecology, biology and management
Ngunnawal	Dhawura-Ngunnawal Caring for Country Committee (DNCCC)	The representative body for ACT Government for traditional custodians of the Country in and around the ACT

4.1 Rural leaseholders

Rural leaseholders are frustrated by their current ability, or lack thereof, to manage Bare-nosed Wombats on their properties. Streambank erosion and reduced water quality as a result of wombat burrowing near waterways have been raised as a concern by landholders in correspondence with the ACT Government. Burrows and tunnels are becoming a big safety concern, with some paddocks described as ‘Swiss cheese’. Staff and stock are frequently injured by falling into burrows (see section 9.2.1). Rabbits have become difficult to control, as they shelter in Bare-nosed Wombat burrows and cannot be treated. Landholders have

expressed interest in the development of an authorised control program like the kangaroo management program in the ACT.

The management of mange on private properties is a cause of concern for rural leaseholders. Some leaseholders have reported their dogs have contracted mange from the burrows of infected animals. This has resulted in expensive vet bills and distress to both dogs and their owners. Wildlife carers have also been caught trespassing on private property to treat mange. Landholders are concerned carers may be applying toxic chemicals without their knowledge. Furthermore, some leaseholders have experienced pressure from lobby groups in relation to kangaroo management and are apprehensive of similar dynamics with wombat carer groups.

Rural landholders within the ACT are frustrated by the current level of engagement with ACT Government on wombat management issues. Those involved in the Wombat Working Group have expressed concern that the group was heavily focused on conservation and mange treatment and did not adequately address the difficulties of managing wombats on rural properties. Their view is that rural landholders should be engaged directly to better understand the management issues they are facing, and to develop damage mitigation strategies to improve co-existence with wombats. Concerns about sick wombats on rural lands were raised. For these strategies to be successfully implemented, they must be accepted by landholders as feasible and effective options. Additionally, continuing discussions between researchers, ecologists and landholders on the ecological value of wombats may improve landholder tolerance of wombats and facilitate effective management (Schumann et al, 2012).

It is important to note, there are 381 farmers within the ACT and only three rural leaseholders were consulted in the writing of this review. The views presented here do not necessarily represent the views of all rural leaseholders within the ACT.

4.2 Wildlife carers

ACT Wildlife and Wombat Rescue are two groups rehabilitating Bare-nosed Wombats in the ACT. Wombat Rescue are often called out to assess the condition of injured or mange-affected animals by the ACT Parks and Conservation Service (PCS) and the public. Wombat Rescue has approximately 20 active members who respond to calls and their resources are strained. They are concerned about the level of awareness and training rangers have in assessing mange cases and determining if treatment or euthanasia is needed. While carers acknowledge assessing the severity of mange is subjective, they would like mange training courses to be mandatory for all rangers to attend. To address this issue in part, the ACT Chief Veterinary

Officer developed the 'Assessment of sarcoptic mange in wombats: A guide for rangers' as a decision sheet for PCS rangers assessing mange severity and the need for humane euthanasia. Additionally, carers are concerned about the lack of suitable release sites for rehabilitated animals in the ACT, leading to most releases occurring in NSW. Both care groups worry about post-release survival and are exploring GPS tracking to monitor outcomes.

Wombat Rescue leads efforts to treat mange across populations, while ACT Wildlife limits treatment to intended release areas (see section 9.3.1). Despite ongoing efforts, carers lack the resources to eliminate mange from populations and believe more needs to be done to control the disease. Wombat Rescue also notes that some leaseholders are reluctant to allow property access to wildlife carers to treat mange affected Bare-nosed Wombats, increasing tension between the stakeholder groups.

Urban development in the ACT is encroaching on Bare-nosed Wombat habitats, likely forcing them into river corridors and increasing population density (see section 9.3.2). While carers have positive relationships with some developers, they are concerned others neglect proper wombat management. Carers fear Bare-nosed Wombats are being pushed into narrow river corridors which will place a strain on resources and result in more aggressive territorial behaviour. They would like to see buffer zones placed around new developments to minimise impacts to Bare-nosed Wombats, but no context was provided.

4.3 Community

Bare-nosed Wombats frequently interact with areas used by the broader community. As urban sprawl encroaches on Bare-nosed Wombat habitat there will likely be increases in human-wombat interactions and potential conflicts in urban areas. The broader community was not consulted as part of this review, and their opinions remain unknown.

Many people who do not live with wombats on their properties are often unaware of the issues these animals can cause, which contributes to resistance toward their management. Increasing public education about Bare-nosed Wombat biology, ecology, and the challenges they present can improve acceptance of species management strategies (Reiter et al., 1999). Including educational material on wombat ecology, impacts and management options on the CED website could be a valuable resource for the community. This would be similar to the information that is currently provided for other managed species (e.g. kangaroos). By fostering understanding through a well-structured information campaign, communities can better

support responsible Bare-nosed Wombat conservation and reduce human-wombat conflicts across urban and rural settings.

4.4 Ngunnawal

Bare-nosed Wombats were widely used by First Nations people in many parts of southeast Australia. Much of the traditional knowledge has been disrupted due to the impacts of colonisation. Unfortunately, limited access to relevant contacts has constrained our ability to assess the importance of Bare-nosed Wombats to the Ngunnawal community at this stage. Reviving and incorporating First Nations perspectives into contemporary conservation efforts can help honour cultural importance and provide holistic approaches to managing Bare-nosed Wombat populations in the ACT.

4.5 Office of Nature Conservation (ONC)

The management of Bare-nosed Wombats is becoming an emerging and complex issue for ONC. ONC initiated a Wombat Working Group to work with stakeholders and better understand the complexities and conflicting viewpoints in this space, but reported they had trouble engaging leaseholders within the working group. The working group came to an end when there was no new information to guide decision-making. ONC faces pressure from wildlife groups to manage munge and has worked with researchers and wildlife carers to mitigate munge impacts. This includes the creation of the Wombat Munge and Monitoring Group, a subgroup of the Wombat Working Group focused on monitoring wombat populations and assessing munge. While there is a desire within ONC to effectively manage this species, a range of knowledge gaps and resource allocation has proven to be a significant hurdle.

Ecologists in ONC are also responsible for the monitoring and conservation of a range of threatened riparian and aquatic species in the ACT. There are concerns that munge treatments such as moxidectin are highly toxic to aquatic life, and the negative consequences this may have on threatened aquatic species.

4.6 ACT Parks and Conservation Service (PCS)

Rangers find it challenging to manage community frustrations surrounding wombat burrow management in ACT parks and reserves. Walking and cycling trails are often re-routed along sub-optimal routes due to the presence of Bare-nosed Wombat burrows. As conservation officers, rangers are permitted to interfere with wombat burrows where necessary and are required to adhere to the Conservator Guidelines for the Protection of Burrowing Animals.

Rangers would like support to manage burrows, particularly short starter burrows that are not used as a primary refuge.

Rangers have also raised concerns around streambank erosion and damage caused by wombats burrowing near waterways, particularly along the Murrumbidgee River.

4.7 ACT Natural Resource Management

The primary issues ACT Natural Resource Management (ACT NRM) encountered with Bare-nosed Wombat management were a result of conflicts with farmers. Anecdotally Bare-nosed Wombat numbers have increased in the last 15-20 years, and subsequently the number of conflicts has increased. Among landholders there is an appetite to declare Bare-nosed Wombats overabundant and allow lethal controls as a management tool. ACT NRM would be reluctant to implement lethal control as there are multiple knowledge gaps around current population levels and minimum viable populations. ACT NRM also highlighted the lack of resourcing for non-lethal options for managing conflict between landholders and Bare-nosed Wombats. Subsidising exclusion fencing in hotspot areas may be a feasible option for conflict resolution. One-way gates, another management option, may remove conflict in one area but relocate wombats and conflict to another area.

4.8 Icon Water

Bare-nosed Wombats have damaged Icon water essential services infrastructure (see section 9.2.1). Icon Water sought advice from ecologists on damage mitigation strategies but had difficulties finding skilled ecologists with capacity to assess the problem and implement recommendations. As a result, Icon Water now manages wombat damage independently based on online consultation with ecologists. They have adopted a variety of management strategies, but they require monitoring and management investments. Icon Water currently has sufficient resources to continue implementing their management program.

4.9 Licensing and Compliance

The Licensing and Compliance team is supportive of developing a CNSMP for wombats and indicated that this is preferable to issuing licenses for control. They recommended that if the ACT government was to permit lethal control of Bare-nosed Wombats it should be part of an evidence-based controlled native species management plan (CNSMP), similar to macropods. Additionally, the Licensing and Compliance team noted that a CNSMP should include clear guidelines around when control is appropriate, and the criteria that must be met for control to

occur. For example, the existing CNSMP for Eastern Grey Kangaroos clearly defines when control occurs, the number of animals to be removed, and benchmarks for shooter proficiency. A CNSMP for wombats should also be paired with a new code under the *Animal Welfare Act* that defines how wombats are to be controlled humanely. Currently there have been no formal complaints to the licencing department about Bare-nosed Wombats.

4.10 Office of the Conservator for Flora and Fauna

In recent years, wildlife carers have been concerned about the impacts of new development on Bare-nosed Wombats. In response, the Office of the Conservator for Flora and Fauna developed the Conservator Guidelines for the Protection of Burrowing Animals during development (Protection of Burrowing Animals During Development) Conservator Guidelines 2025 notified under the Legislation Act 2001). There are currently two licences issued to interfere with Bare-nosed Wombat burrows.

4.11 Scientists

The only scientist consulted during this review was Dr. Scott Carver, who specialises in researching wildlife disease ecology. Dr. Carver was a member of CED's Wombat Working Group and has worked with the ACT and Tasmanian governments on mange-related projects. He felt the Wombat Working Group effectively achieved its intended purpose. Similar to the Tasmanian wombat working group, the CED-led group came to a natural end when participants ran out of new information to bring to the table.

Dr. Carver has worked extensively with wildlife carers on mange treatment. He noted that within the stakeholder group there is disagreement over best practice treatment methods and determining when euthanasia is appropriate. He noted that conversations in this space can escalate quickly, and more research is necessary. A recent study by the Wombat Protection Society and associated researchers trialled increasing the dose of moxidectin from 20 ml to 100 ml to treat mange in wombats. Dr. Carver noted that this is a large increase in dosage, and studies gradually increasing the treatment dose to determine the lowest effective amount would be key to preventing excessive use of moxidectin.

Dr. Carver acknowledged leaseholders had conflicts with Bare-nosed Wombats and more research was necessary in this space, but it was outside his area of expertise.

4.12 Chief Veterinary Officer

The ACT Government Chief Veterinary Officer (CVO) was primarily concerned Bare-nosed Wombats treated for mange *in situ* are not getting the proper care they need. Ideally animals would be diagnosed by a qualified veterinarian prior to being given treatment, although the CVO did acknowledge that this was not possible when treating wild animals *in situ*. They raised concern that the indiscriminate application of moxidectin at all burrows within an area can lead to accidental overdosing of individual Bare-nosed Wombats. Conversely, some wombats may not receive a full dose if the chemical splashes as they are exiting a burrow or they move away from the treatment area. Healthy animals within the population will also unnecessarily receive treatments, which could lead to the development of chemical-resistant mites.

The drugs being used to treat Bare-nosed Wombats have the potential to cause harmful side effects in other species. Dogs that ingest moxidectin can experience neurotoxic effects and possible mortality. Faecal matter from treated animals contains traces of moxidectin, which can wash into waterways and affect aquatic systems. Responsible use of mange treatment drugs is critical to ensuring the negative impacts on ecological function are minimised.

4.13 Developers

The ACT population is projected to grow to 696,000 by 2050. Over the next few decades urban expansion is likely to further encroach on areas where Bare-nosed Wombats reside, resulting in management issues for urban developers. No developers were spoken to during this review. Consultation with developers is recommended to ensure urban expansion can be managed with minimal impacts on Bare-nosed Wombats.

5. Complexities of wombat management

The management of wombats is highly contentious, with challenges arising from the need to balance the competing interests of diverse stakeholder groups, including local government, leaseholders, First Nations, and wildlife care organisations (see Table 4). Conservation and wildlife care groups advocate for stronger protections for Bare-nosed Wombats, while agriculturalists and developers seek to manage the species to reduce damage to infrastructure, livestock, and personnel. This section seeks to bring together diverse stakeholder perspectives on a range of issues to highlight the complexities involved in reaching a management solution.

It is unlikely that all stakeholder groups will agree on a single approach to wombat management. However, participatory planning can improve communication and foster mutual understanding. Involving stakeholders in decision-making processes can lead to greater ownership of outcomes, enhance program credibility and transparency, and support the achievement of long-term goals (Hewitt and Messmer, 1997). Stakeholders are less likely to adopt or support management practices if they feel their opinions have not been taken into consideration and may take management actions into their own hands.

To date, there is no known research specifically examining the complexities of stakeholder relationships in wombat management. However, studies have explored landholder relationships with Southern Hairy-nosed Wombats (O'Brien, 2019, Sparrow, 2011, St John and Saunders, 1989, Stott, 1998) and Bare-nosed Wombats (Marks, 1998c). Additionally, the 5th IUCN World Parks Congress in 2004 brought together conservation experts to discuss human-wildlife conflict. Insights from this workshop, summarised by Madden (2004) provide a useful guiding resource for managing human-wildlife conflict.

5.1 Common causes of damage

5.1.1 Burrowing behaviour

Wombats are one of the largest burrowing herbivores in the world and create warren complexes that vary in complexity from single entrance burrows to a collection of interconnected burrows (warren). Burrows can vary in depth (0.4-2.8 m) and length (0.5-20 m), as such the spoil mound can be anywhere from 2.5-8 m² (Triggs, 2009, McIlroy, 1973). A Bare-nosed Wombat can use up to 11 burrows within their home range, though they typically favour the use of 1-2 burrows (Evans, 2008). Though their burrowing provides essential ecosystem services it often leads to conflicts with people. Bare-nosed Wombat burrows can undermine infrastructure such as roads, buildings, water tanks, fencing, dams which can result in substantial damage, financial costs and safety concerns.

One of the main points of contention for rural leaseholders with Bare-nosed Wombats on their properties in the ACT is the damage and occupational health and safety risks burrows can cause. This includes damage to fencing, dams, roads, buildings and erosion. Wombat damage to fencing can result in stock escaping from paddocks, posing a safety risk to both stock and people. Livestock may become injured or lost once they escape from the safety of a property resulting in financial losses to the rural leaseholders. Where properties adjoin parks and reserves there is a risk escaped stock may damage parks and reserves and incur fines for the

landholder. Furthermore, rural leaseholders have a legal responsibility to ensure their stock does not stray from their property and can be held liable for any damages if they escape. Fence damage can also allow access to properties from undesirable pest species such as pigs.

Rural leaseholders and Icon Water have reported issues with Bare-nosed Wombats burrowing into the sides of dams or reservoirs. This is not only a safety concern for people but also the Bare-nosed Wombat. If a dam wall breaks it has the potential to release large volumes of water, threatening farm water supplies and downstream properties. In addition, it could cause increased erosion and sediment washing into the Murrumbidgee River and other major waterways. This places a significant financial burden on the rural leaseholders who are responsible for appropriately maintaining their dams. Icon Water have been managing Bare-nosed Wombats burrowing around dams by using one-way gates to force animals to leave the burrow and filling the hole with cement once they have been evicted.

Icon Water, rural landholders and PCS rangers have reported safety concerns with Bare-nosed Wombats burrowing under roads and tracks and within paddocks. The weight of a vehicle driving over a tunnel can cause the tunnel to collapse, causing damage to vehicles and necessitating vehicle and road maintenance. For rural leaseholders, burrows pose a significant safety risk to people and stock. Landholders using quadbikes and buggies can incur significant injuries if their vehicle falls into a burrow, which can lead to lengthy recovery times and a loss of income. Rural leaseholders have reported vehicles falling in tunnels as frequently as once a month with estimated damages costing ~\$1,000. This risk is increased in summer when grasses and other vegetation obscure burrow entrances. Landholders can also be liable for injuries to contractors and other staff working on their property, and landholders have been sued by injured contractors. Stock falling into wombat burrows can negatively affect animal welfare and lead to financial losses. One rural leaseholder has had to remove high value stock from a paddock with high levels of Bare-nosed Wombat activity. When wombat burrows limit accessibility of paddocks landholders may not be able to carry out other management tasks such as weed control. While burrow entrances can be mapped to reduce the risk, it would need to be updated regularly to account for new burrows. This is not feasible for rural landholders at a large scale.

Bare-nosed Wombats burrow under other infrastructure, such as buildings, water tanks and wastewater treatment drying beds. They can be removed with the use of one-way gates and burrows can be backfilled, but it is possible wombats will re-excavate the site. Rural leaseholders have tried using mesh to prevent re-excavation, but this treatment only lasts up

to six months. Icon Water use a range of methods to prevent Bare-nosed Wombats re-excavating under infrastructure including the installation of cement skirts, placement of large rocks or mesh skirting. This requires ongoing maintenance and monitoring to keep animals out of undesirable areas. Burrows can also harbour rabbits, which creates an added layer of complexity in rabbit control. If rabbits are found using Bare-nosed Wombat warrens, Icon Water install one-way gates to remove the wombat before fumigating the burrow.

5.1.2 Grazing competition and crop damage

Within the ACT there are 20,869 ha of agricultural land, the majority of which is stock grazing land, with a small amount of cropping. Though competition for food resources between wombats and livestock has been reported as an issue of concern in other states (O'Brien, 2019, Stott, 1998, Marks, 1998c), rural leaseholders in the ACT have not reported it as an issue. The density of wombats on properties can vary at local and regional scales and may influence reports of grazing competition. For example, within the Murraylands of South Australia, Southern Hairy-nosed Wombats have an estimated DSE (dry sheep equivalent) of 0.5, comparatively sheep have a 1.2 DSE. Dry sheep equivalent is a unit of measure used to assess the nutritional needs of livestock and assess the carrying capacity of a farm. It equates to the amount of feed required by a two-year-old 50 kg Merino wether per day. Landholders have had to reduce their stocking rate by 20%, to account for the impacts of growing Southern Hairy-nosed Wombat populations, threatening the viability of some farms. Due to the differing climatic conditions in the ACT Bare-nosed Wombats might not have a substantial grazing impact. However, only three rural leaseholders were consulted in the writing of this document. Further consultation with rural leaseholders is recommended to understand the extent of the problems they are facing within the ACT before ruling grazing competition or crop damage out as a potential cause of conflict.

5.1.3 Erosion

Along waterways wombat burrows are often perceived to increase erosion in creeks and gullies (O'Brien, 2019); however, the extent of damage has not been quantified. Past land clearance may have resulted in increased soil instability, facilitating wind and water erosion of creek lines over time. When Bare-nosed Wombats burrow into steep banks, they undercut and destabilise them, the effects of which are exacerbated in unstable soils where there is a lack of vegetation. Eroding soils are transferred into waterways with environmental implications for aquatic systems, including loss of fish habitat, aquatic barriers and increased nutrient loads.

Targeted monitoring in areas suffering from erosion is necessary to determine the extent and underlying cause of erosion and inform best practice management actions.

Rural leaseholders have used fencing to prevent stock from accessing creek lines and contributing to erosion risks. They are unable to prevent Bare-nosed Wombats from digging into creek banks and damaging the stock exclusion fencing. One rural leaseholder remediated the creek line of his property to reduce the erosion and subsequent damage to the surrounding aquatic environment with the help of ACT NRM and community groups (Figure 2). It took significant effort getting the necessary approvals on top of the time and costs of the



Figure 2. Top - the eroding creek line on a leaseholder's property prior to remediation works. Bottom - the creek line after remediation works.

work itself, totalling over \$50,000. This work was undertaken as part of a grant program and would otherwise have been infeasible for the rural leaseholder. The rural leaseholder reported difficulty in dealing with 'red tape' associated with the project and would not have completed it without the help of the ACT NRM.

5.1.4 Land clearance for urban development

Recent expansion of urban development has caused concern among wildlife groups for wombats. Though Bare-nosed Wombats are a protected species they are not threatened and thus do not need to be considered when assessing a site for development approval. As such, developments have been planned, approved and construction commenced in areas where Bare-nosed Wombats occur without considering the impacts. Though it is an offence to kill or interfere with a Bare-nosed Wombat under the *Nature Conservation Act 2014*, burrows have reportedly been destroyed during earthworks by developers, potentially burying Bare-nosed Wombats alive (pers. Comm., wildlife carers 2024). Wildlife carers have reported increased numbers of call outs in areas where urban development has or is occurring. This has highlighted the need for a greater understanding of the impacts of development on Bare-nosed Wombats.

As a response to potential impacts from development on Bare-nosed Wombats and other burrowing animals, the Conservator of Flora and Fauna has developed Conservator Guidelines for Burrowing Animals. The purpose of the guidelines is to improve consideration of burrowing animals during development and provide direction to developers on best practice methods to minimise harm. The guidelines will apply to any new developments within the ACT. During planning stages, developers will need a suitably qualified ecologist to identify burrow and shelter sites, monitor them for activity and ensure they are vacant or avoid developing over them wherever practicable. Wombat Rescue and ICON Water have highlighted the difficulties of conducting appropriate assessments due to the lack of capacity among suitably skilled ecologists in the ACT. Wombat Rescue are often called by ecologists seeking advice on how to manage wombats (pers. Comm., Wombat Rescue 2024). Where avoidance of burrows is not possible developers can apply for a licence to destroy burrows and must follow the guidelines to ensure this is done with minimal disturbance to animals.

The guidelines don't take into consideration the potential for new developments to fragment and isolate populations, limiting dispersal and resulting in genetic differentiation over time. Prior to any new land use zoning, consideration should be given to whether wildlife populations will be disconnected resulting in small and isolated populations that over time could result in inbreeding. There is concern development is pushing Bare-nosed Wombats into narrow river corridors where increased densities could result in increased competition for resources and creating stressful conditions for animals. Without a more detailed understanding of the abundance of Bare-nosed Wombats and carrying capacity in the ACT it is

difficult to determine the impacts of increasing development and expansion. Furthermore, the carrying capacity of Bare-nosed Wombats is unknown and likely to vary from region to region based on habitat and resource availability.

If Bare-nosed Wombat densities are reaching a critical limit with food resources it can increase stress, competition and ultimately population declines. Increased stress and high Bare-nosed Wombat densities are often associated with increased mange prevalence (Sengupta, 2019). Areas closer to fresh water are also predicted to have the highest suitability for mange (Ringwaldt *et al.*, 2023). Urban areas abutting river corridors where Bare-nosed Wombats occur could result in increased human-wombat interactions. Dispersing Bare-nosed Wombats may wander into urban areas where conflicts can occur (e.g. burrow damage) and be more susceptible to road vehicle collisions. There could also be increased interactions between wombats and pets, resulting in injuries to domestic dogs and wombats. Dogs have been known to enter burrows where they may contract mange, get stuck or become injured. Increased public education on the implications of living near Bare-nosed Wombats will be essential.

It is important to note no developers were consulted in the preparation of this report. Consultation with developers is recommended to improve Bare-nosed Wombat management in areas under development.

5.2 Conservation concerns

5.2.1 Mange

Sarcoptic mange is a skin condition caused by the *Sarcoptes scabiei* mite. Mange initially presents as skin reddening and hair thinning. As the disease progresses, visible signs of itching, alopecia and epidermal crusting appear (Pence and Ueckermann, 2002). Mange has strong animal welfare implications as affected individuals can suffer a slow and agonising death, usually through secondary infection, blindness and/or starvation (WHA, 2021). Prevention of mange in Australia is considered almost impossible, as all disease transmission pathways would need to be interrupted, including transmission from host species such as foxes (WHA, 2021).

Ideally mange should be diagnosed and treated by qualified veterinarians so the condition is correctly identified, and animals can receive appropriate treatment. This is not feasible for wildlife populations. Mange in wombats is typically diagnosed and treated by wildlife carers and volunteer groups with varied levels of training, experience and coordination. Diagnosing the disease in its early stages can be difficult without catching and examining animals. The

same symptoms can be caused by malnourishment from low quality feed, creating the potential for misdiagnosis (Fraser et al., 2018).

The distribution of mange and its impacts on wombat populations is poorly understood. Bare-nosed Wombat populations often persist in the presence of mange, and prevalence is usually $\leq 15\%$ (Carver et al., 2021). During outbreaks, mange prevalence can rise to $> 50\%$, with near 100% mortality of infected individuals (WHA, 2021). In some cases, mange outbreaks have resulted in $> 90\%$ decline in local Bare-nosed Wombat abundance (Skerratt 2005; Martin et al. 2018a). Research suggests population decline and range retraction can occur when mange prevalence is $> 25\%$ (Carver et al., 2023). Additional research is needed to understand which environmental variables may lead to mange outbreaks.

Increased rates of mange are often associated with high wombat densities and periods of drought or high stress (e.g. seasonal stress in winter) (Sengupta, 2019). Burrows are thought to be the predominant mode of sarcoptic mange transmission in wombats (Evans, 2008, Martin et al., 2019, Beeton et al., 2019). The humid and cool microclimate within wombat burrows provides favourable conditions to maximise mites off-host survival, particularly in cooler months (16.4 days in winter and 5.96 days in summer). Mites can survive in burrows longer than the minimum known frequency of wombat burrow switching 4- 10 days. Transmission is exacerbated by patterns of burrow use and sharing (Evans, 2008; Martin et al., 2019b).

Regulation of veterinary chemicals used to treat mange in Australia

The Australian Pesticides and Veterinary Medicines Authority (APVMA) is responsible for the regulation and control of agricultural and veterinary chemicals in Australia. Under legislation, the APVMA can evaluate, approve and register agricultural and veterinary chemicals, regulate supply, undertake compliance and issue permits for use. There are currently four active permits (valid in all states and territories of Australia) and three active permit holders approved for veterinary chemicals use for the treatment of mange in wombats.

The Wombat Protection Society holds two permits for the use of a Cydectin (active constituent Moxidectin). One permit allows for a dose 4 ml per kg of body weight with a maximum single dose of 100 ml on an adult wombat (>15 kg) with five days between doses and no more than five doses. The efficacy and toxicity associated with this dose rate has not been fully evaluated and users must observe wombats for any signs of toxicity. Any wombats that die after treatment must be reported to a veterinarian and a detailed postmortem carried out.

A second permit held for the use of Cydectin allows 0.8 ml dosage per kg of body weight with a maximum dose of 20 ml applied once weekly for 15 weeks. This permit is also held by Mange Management Incorporated. Cydectin can be delivered directly or by topical application using a pole and scoop to pour a dose onto the wombat's back, or indirectly by using a burrow flap that doses the wombat when passing underneath.

Intervet Australia holds a permit for use of Bravecto (active constituent Fluralaner) for mange treatment. The dose is 25 mg/kg with a maximum of three doses one month apart on wombats > 5 kg. Bravecto must be applied by topical application directly or by using a pole and scoop to pour a dose onto the wombat's back.

A condition of all these permits is that 'the product must only be used by persons who have appropriate experience in identifying mange infection and toxicity signs in wombats'. It is the permit holder's responsibility to ensure people operating under the permit are trained in the identification and treatment of mange in wombats. This is particularly relevant for care groups, where mange treatments may be administered by a range of volunteers. The permit holder must record any adverse experience associated with the use of the product and report them to the APVMA as soon as possible.

While there are no conditions on any of the APMVA permits with regards to Cydectin use near waterways, an environmental protection warning on the product states 'Moxidectin is extremely toxic to aquatic species. Do not contaminate dams, rivers, streams or other waterways with the chemical or used container.' This statement applies to use of the product under all APVMA permits.

Applying moxidectin indiscriminately across all burrows in an area may lead to unintentional overdosing of individual wombats over time, either from inaccurate dosage or from wombats relocating to treated burrows. Some wombats may not receive a full dose if the chemical splashes as they are exiting a burrow or they move away from the treatment area. Healthy animals within the population will also unnecessarily receive treatments. This could lead to the development of mite resistance arising from inappropriate chemical concentrations being administered.

There is also a risk non-target animals are treated, as wombat burrows are known to be used by a range of other native species (Linley et al., 2024, Thornett et al., 2016) and the impacts of moxidectin on these species is unknown. The broadscale use of these chemicals can result in chemical residues within the environment which can have negative impacts on native fauna,

including invertebrates and aquatic species. Application with a pole and scoop though more time consuming can specifically target wombats with mange and promotes good chemical stewardship.

Some carers believe other products are safer or more effective and use a range of alternative treatments or supplementary products to relieve itching and treat secondary infection. Less invasive approaches include the one-off or repeated administration of a topical acaricide. However, topical treatments may not reach mites due to a failure to penetrate parakeratotic scale crust or be adequately absorbed systemically due to a thickened epidermis. Even among experienced carers there is wide disagreement about how best to treat mange (O'Sullivan, 2018).

Current treatment of mange in the ACT

In the ACT, Bare-nosed Wombats are primarily treated for mange by Wombat Rescue volunteers, and to a lesser extent ACT Wildlife carers. Volunteers operate under APVMA permits PER89982 and PER90837 issued under section 112 of the Agricultural and Veterinary Chemicals Code 1994. The first permit allows for the treatment of Bare-nosed Wombats with mange using up to 20 ml of Cydectin via burrow flap or pour on/pole and scoop application methods. The second permit allows for the treatment of Bare-nosed Wombats with Bravecto using pour on methods only. Volunteer groups must also apply for a licence under the *Nature Conservation Act 2014* to use a vehicle within a reserve.

In addition, Wombat Rescue has a TCCS permit for use of Cydectin on public lands to undertake population treatments, with strict conditions of its use around waterways due to its toxicity to aquatic species. Cydectin must not be used when there is a medium chance or greater (>40 %) of heavy rain (>10 mm) forecast and all treatments within 5-15 m of a permanent waterway must be removed within 24 hours in the catchment area. A treatment area cannot exceed 1km of river reach, can only be treated at the population level once annually and no more than 6 treatment areas can be treated annually along the Murrumbidgee and Molonglo Rivers. Population level treatment by burrow flap application must not be used within 15 m of permanent waterways but is permitted for treating a maximum of 5 individuals at any one time. Cydectin cannot be used within 5 m of the water's edge or within 5 m from the centre of drainage lines and intermittent gullies, including unnamed drainages at any time. No treatments are to be applied in the Cotter Catchment above Cotter Dam, Namadgi National Park or Tidbinbilla Nature Reserve. The location and

dosage details of all treatments, particularly those within 5-15 m of a permanent waterway, must be entered into a shared spatial layer once treatment has commenced.

Mange-affected Bare-nosed Wombats are treated both individually and at a population level. Population level treatments are conducted by Wombat Rescue and occur mainly in riparian areas along river corridors. Due to the substantial time it takes to install burrow flaps on every burrow, and permit restrictions, volunteers are only able to treat burrows along a 1 km stretch of the river at a time. Mange can be successfully eliminated in isolated areas, but where connected populations of Bare-nosed Wombats occur along river corridors, it is difficult to eradicate mange as infected individuals from outside the treatment zone can wander in following the course of treatment. Access of carer groups to rural lands at a broad scale is not supported by many rural landholders due in part to safety and security concerns, which means treatment of mangy wombats on rural leases is limited. This has welfare implications for animals severely affected by mange.

ACT Wildlife only administers mange treatments in areas where rehabilitated Bare-nosed Wombats are to be released if there has been isolated incidence of mange to maximise their chances of survival.

Wombat Rescue regularly responds to call outs to treat and rescue mangy Bare -nosed Wombats from concerned members of the public and ACT Parks and Conservation Service.

Mange distribution

To gain a better understanding of the distribution of mange in the ACT, CED have developed an online portal to enable the community to report sightings of mange-affected Bare-nosed Wombats. Sightings are also reported on WomSAT, an online application developed by researchers at the University of New South Wales. This data helps inform the national distribution and prevalence of mange in wombats. Users of WomSAT create an account and sightings must include a photo for verification. While applications of this nature enable capture of data across broad regions, reporting is typically skewed towards areas of high human activity and therefore may not accurately represent the presence/absence of mange (Figure 3).

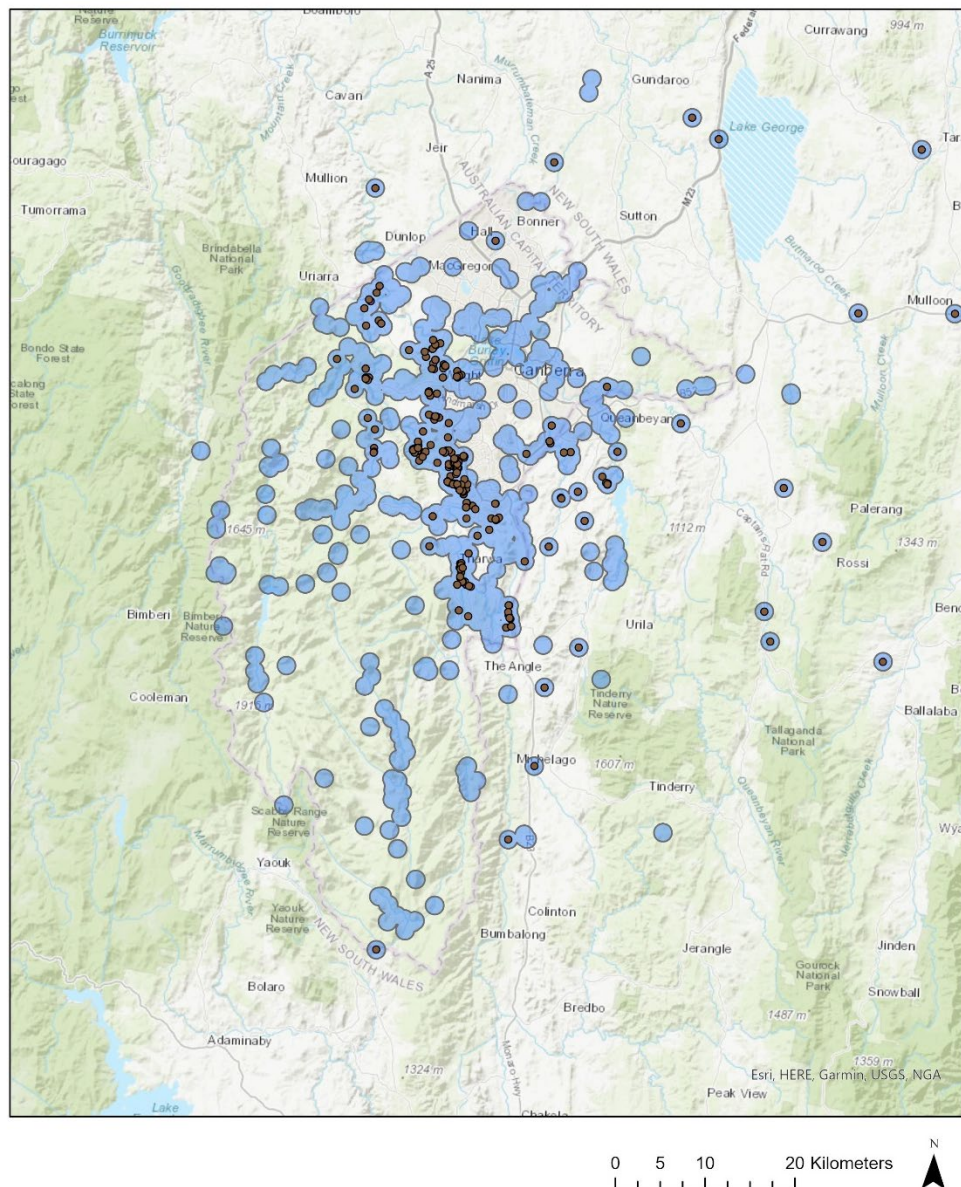


Figure 3. The known records of mangle in Bare-nosed Wombats (red dots) in the ACT taken from CED survey data and ACT Wildlife Atlas wombat records and mangle portal data.

Wombat Mangle and Monitoring Group

To progress treatment of mangle and improve monitoring of Bare-nosed Wombats in the ACT, CED convened the Wombat Mangle and Monitoring Group (initiated March 2021). This group was formed as a subgroup of the Wombat Working Group. Members included two community wildlife care groups (Wombat Rescue and ACT Wildlife), Prof. Scott Carver of the University of Georgia USA (formerly of the University of Tasmania) and CED staff. The group took a collaborative approach to addressing mangle and coordinates activities of the community and ACT Government. Previous activities of the Wombat Mangle and Monitoring Group include:

- Trialling the use of Bravecto, as a potentially longer-lasting, more effective, and target-specific treatment for mange.
- Developing a collaborative monitoring program to provide data on wombat populations, distribution, and mange prevalence across the ACT.
- Support mange treatment in public reserves while minimising risks associated with using Cydectin near waterways.
- Undertake collaborative research on the impacts of mange treatment chemicals on aquatic ecosystems.
- Develop and promote a publicly accessible web-based communication portal to enable community members to report Bare-nosed Wombat sightings and incidences of mange.

5.2.2 Road vehicle collisions

Collisions with vehicles are a source of mortality or injury for Bare-nosed Wombats and a safety concern for people. Roadkill records reported in the WomSAT app between 2015-2019 are relatively low in the ACT in comparison to other states (Figure 4, Mayadunnage et al., 2024). WomSAT relies on citizen scientists to report sightings and thus data may not be representative of all road kills occurring in the ACT. Roadkill records are collected by the Urban Wildlife Team, and it is worth reviewing them to gain a better understanding of the frequency of collisions and identify hotspot areas where intervention may help to reduce collisions.

The frequency of vehicle collisions is likely to vary depending on traffic levels, vehicle speed, Bare-nosed Wombat population density, climate and season (Mayadunnage et al., 2024, Ramp et al., 2005). Bare-nosed Wombat road mortalities are higher in winter and early spring (Roger et al., 2011, Mayadunnage et al., 2024, Nguyen et al., 2022). This could be linked to seasonal changes in the activity periods of Bare-nosed Wombats or more cars being on the road at dawn and dusk due to shorter winter days. High Bare-nosed Wombat road mortalities have been linked to areas of dense forest cover and the greenest ground cover in areas where wombat burrows are present (Roger and Ramp, 2009).

Within the ACT, most Bare-nosed Wombats (approximately 50 a year) come into care because of injuries from road vehicle collisions or being orphaned due to a vehicle collision. The relatively small number of Bare-nosed Wombats taken into care does not represent the total number of wombats killed.

Wombats can cause substantial damage to vehicles, the cost of which is unknown. Analysis of 17,000 animal collision claims between 1 January – 31 December 2023 by Suncorp Group revealed the most common animals drivers collide with are kangaroos, wallabies, wombats, deer, dogs, cows and emus (AAMI, 2024). The average cost of an animal collision insurance claim is greater than \$5,000 and 16% of vehicles were written off in claims that involved wildlife. The study revealed 76% of Australians believe kangaroos would cause the most damage to a car if involved in a collision, followed by wombats (16%).

Even if roadkill is not causing widespread declines of Bare-nosed Wombats, wildlife-vehicle collisions should be reduced where possible. Measures to reduce wildlife vehicle collisions include installing wildlife warning signs, installing underpasses or overpasses, and using deterrent devices (see section 10.5 for more information).

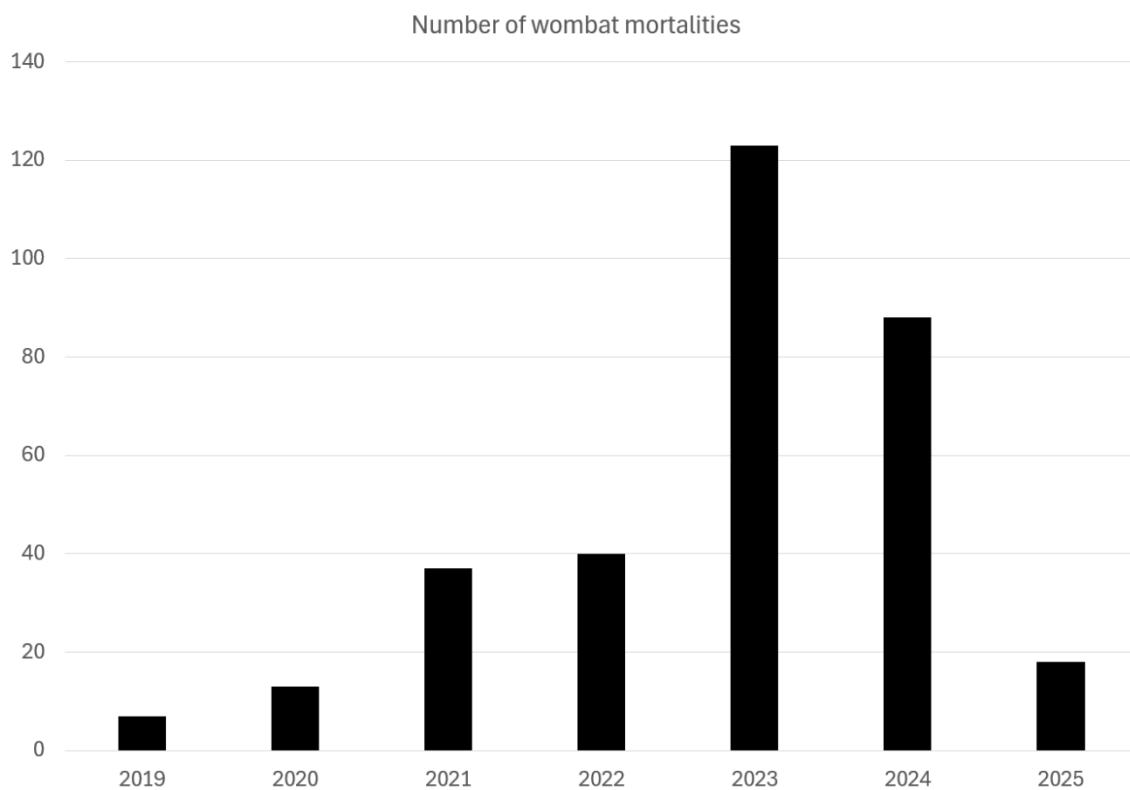


Figure 4. Temporal distribution of wombat roadkill records reported by the ACT Urban Wildlife Team between July 2019 and July 2025. For 2019, data is limited to July-December of that year; for 2025, data is limited to January-July of that year.

5.2.3 Habitat loss

The expansion of urban development has caused concern for the safety of Bare-nosed Wombats. The ACT is around 236,000 hectares, which is roughly 43.6 conservation estate, 10% highly modified urban land, and 15% highly modified rural and broadacre lands. The exact

division of land may be different as land zoned for urban areas may still be undeveloped or rezoned to another land use prior to development. Between 2006 and 2022, the ACT's urban area grew by 9% (2,760 ha). Most development has been in Gungahlin (Taylor, Throsby, Jacka and Moncrieff), West Belconnen (Ginninderry) and the Molonglo Valley (Whitlam and Denman Prospect). The increase in urban land has been driven by strong and sustained population growth over the last decade. The ACT population is projected to grow to 696,000 by 2050. The *ACT Planning Strategy 2018* aims to accommodate this growth while limiting urban spread by setting a target of 70% of new housing being built within existing urban areas. The impact of urban expansion of Bare-nosed Wombat populations is poorly understood. Urban development is thought to be pushing Bare-nosed Wombats into river corridors where their densities are high, resulting in increased stress from resource competition and territoriality (pers. comm wildlife carers 2024). In contrast, reports from other stakeholder groups indicate the distribution and abundance of wombats is increasing. The distribution of Bare-nosed Wombats across different land use zones is unknown and worth investigating to properly understand the potential impacts of further development on populations.

6. Wombat management methods and options

Conflicts with wombats have traditionally been resolved using lethal controls, but there is increasing advocacy for the development of alternative 'non-lethal' management options. Creating policy around alternative 'non-lethal' management options are hindered by a lack of quantitative evidence on their effectiveness and humaneness. Management options perceived as non-lethal can have negative ecological or animal welfare impacts, sometimes resulting in death. For example, translocation often has low survival rates but is perceived as a non-lethal management option because it does not involve the direct killing of animals. The term 'non-lethal' has not been used to classify management options in this review.

Research into damage mitigation techniques has not yielded conclusive results or sustained long-term benefits (Barlow et al., 2010, Koehler AE, 1990, Mason, 1998). Given the nature of conflicts vary greatly, no single management technique will alleviate all conflicts. A variety of damage mitigation techniques are needed that can be tailored to the ecological, social, cultural and economic realities in which conflicts occur (Dubois et al., 2017). Land managers also require data on the distribution and abundance of wombats, as well as the type and extent of damage, to effectively implement a management strategy.

This section reviews current research on wombat management and damage mitigation strategies.

6.1 Fencing

Exclusion fencing is a popular tool for eliminating damage to high value resources. While it is perceived as non-lethal it can have negative impacts on target and non-target species by prohibiting natural movement patterns or inhibiting access to important resources. Prior to installing exclusion fencing, careful consideration needs to be given to the ecological impacts on excluding species from their habitat.

6.1.1 Foot netting

Excluding wombats from areas where they are causing damage such as to high value infrastructure or resources can help to reduce damages and increase landholder tolerance towards wombats. Several wombat exclusion fence designs have been trialled. Attaching foot netting to the bottom of fences has been found to temporarily reduce the number of holes dug in fencing by 35-63% for up to 3 weeks (Marks, 1998b). Borchard et al. (2009b) trialled using hinged joint wire (80 cm wide x 15 cm spacings) attached to the outside of existing fencing and flattened along the ground and secured with tent pegs every 1 m along a 100 m section of fence and silt fencing (770 mm wide) laid out in the same manner and secured every 30 cm. In both designs hinge wire foot netting was placed on the inside of the fence at wombat breach points. The foot netting trial resulted in a mean exclusion rate of 35% for a one month. In the absence of aversive stimuli wombats quickly learned to chew through the silt fence or dig under the wire netting.

6.1.2 Electric fencing

Electric fencing has been shown to exclude wombats from areas where their behaviour conflicts with human land use (Marks, 1998b; St John and Saunders, 1989). The electrification of the dog fence along the Nullarbor Plain in south east Australia has reduced damage to the fence caused by Southern Hairy-nosed Wombats, damage that allows Dingoes (*Canis familiaris dingo*) to pass through (St John and Saunders, 1989). On the outside of the dog fence, an additional two strands of wire 15 and 30 cm above the ground, positioned approximately 30 cm away from the original dog fence were constructed. The fence is patrolled regularly by dog baiters who assess the fence for signs of damage. Most damage occurs from Southern Hairy-nosed Wombats inside the fence attempting to travel north. Electrifying the fence has prevented Southern Hairy-nosed Wombats from travelling north, resulting in them moving

south of the highway into crop land where they had not previously been, resulting in conflicts with wombats and crop farmers (Sparrow, 2011). Marks (1998a) found electric fencing produced variable results, for Bare-nosed Wombats with electric fencing reducing the number of holes by 0-92% over 13 weeks. Landholders who used electric fencing to exclude Southern Hairy-nosed Wombats from their properties reported it to be unsuccessful as the electrified strands were often shorted out by vegetation or debris and it was too time intensive to check (O'Brien, 2019). Electric fencing is costly and time consuming to maintain on a small scale. Landholder perceptions of success may not be influenced solely by damage reduction, but also by the time and costs associated with implementing and maintaining control measures.

The use of electric fencing to reduce wombat damage is best suited to protecting small areas with important assets inside wombat free areas. Electric fencing will require regular inspections to ensure the fence hasn't been damaged or shorted out and involves construction costs and ongoing costs to run.

6.2 Wombat gates

Swinging gates have been recommended to reduce fence damage by wombats in Australia (Breckwoldt, 1983, Triggs, 2009) which can allow stock to escape paddocks or other unwanted animals from entering crop fields. Wombats can make numerous breaches in fencing and the installation of gates at every breach point may be impractical. The placement of gates would depend on the density of wombats in the area and the number of access points being used. Gates should be installed at the most well-used breaches and exclusion netting can be used to 'train' wombats to use the gates. Anecdotal evidence suggests Bare-nosed Wombats will use gates placed up to 800 m apart without making new holes (Triggs, 2009). Breckwoldt (1983) recommends gates of a timber construction which is likely to require regular maintenance. Newer fence designs consist of heavy-duty weld mesh gates weighing at least 2-3kg if trying to exclude other animals such as wallabies (Statham and Statham, 2009, Driessen et al., 2020). If Bare-nosed Wombats could not see through gates they would dig a hole next to it rather than use it (Statham and Statham, 2009). Gates weighing between 4.5-16 kg have also been reported to be used by Bare-nosed Wombats (Coates, 2013). Borchard et al. (2009a) found Bare-nosed Wombats continued to breach the foot netting of fencing for the first few months while they learned to use the gates requiring ongoing repairs. Driessen et al. (2020) wired gates open for two weeks to allow Bare-nosed Wombats a habituation period but did not report on fence breaches throughout the study.

The decision to use wombat gates or a combination of gates and exclusion fencing will depend on the extent of the problem, the cost of the damage and the cost to purchase, erect and maintain the length of fence required. The installation of gates can be laborious and will likely require ongoing maintenance. The installation of gates in fencing may prevent damage to fencing but it does not prevent wombats from accessing areas where their behaviour may cause further damage on the property, thus not all property managers will readily accept the use of swinging gates or view it as a successful damage mitigation strategy (Borchard and Collins, 2001).

6.3 Mapping wombat burrows

There are a variety of methods for surveying and mapping the location of wombat burrows. While it is not a direct damage mitigation method it may prove useful for choosing the most appropriate management action for burrows in unfavourable locations. Mapping the locations of tunnels can help to prevent accidents such as vehicles or machinery falling down tunnels which can collapse under their weight, by avoiding driving over them. However, in areas with a high density of tunnels this may be unavoidable.

6.4 Burrow collapsing

As wombats are known to use multiple burrows within their home range, the opportunity exists to remove problem burrows through collapsing them, moderating their burrowing activity with minimal impact on the wombats. However, widespread burrow destruction is not recommended as it can lead to the displacement of wombats. It is also important to consider the impact of burrow collapsing on young at foot who may not be able to travel long distances. Historically burrow collapsing has been used following fumigation to prevent neighbouring Southern Hairy-nosed Wombats from recolonising the area, however, it was rarely successful as burrows were re-excavated (Marks, 1998a). Burrow collapsing in combination with other methods to exclude wombats from areas where they are causing damage may prove more effective.

The gradual collapsing of burrows over three days in combination with the use of deterrents has been trialled as a management option for Southern Hairy-nosed Wombats (Sparrow et al., 2016, O'Brien, 2018). This method involves collapsing the first 1-2 m of the tunnel on day one, followed by another several meters on day two. The tunnel is left open, providing a clear exit point for wombats. The disturbance of the burrow over the first two days is 93% effective in getting Southern Hairy-nosed Wombats to exit the burrow before ripping the tunnel on day

three (O'Brien, 2018). On day three the tunnel is carefully ripped with a backhoe, stopping every few meters to check the direction of the tunnel and look for signs of occupancy. If a wombat is still within the tunnel, it can be left for another day to see if they will leave. On one occasion a Southern Hairy-nosed Wombat failed to leave on the fourth day and had excavated a further 7 m of tunnel overnight despite the presence of alternate inactive burrows nearby ($\leq 50\text{m}$ away). The failure of burrow disturbance to get the Southern Hairy-nosed Wombat to leave may reflect the importance of the burrow. Although Southern Hairy-nosed Wombats may use up to 10 different warrens within their home range, they usually use 1-2 warrens on most occasions to which they display high site fidelity (Shimmin *et al.* 2002; Finlayson *et al.* 2005).

Two studies trialled the effectiveness of dingo urine and faeces in deterring Southern Hairy-nosed Wombats from re-excavating collapsed tunnels and produced mixed results (O'Brien *et al.*; Sparrow *et al.* 2016). Sparrow *et al.* (2016) found untreated collapsed burrows on the Nullarbor plain in South Australia were recolonised within 75 days while those treated with dingo scents showed minimal activity. In contrast, O'Brien *et al.* found that in the Murraylands of South Australia deterrents didn't play a significant role in the time taken for recolonisation to occur. The differences in results between the two studies could be attributed to variances in the methods used or environmental factors such as predator densities at the sites or burrow availability and importance and warrants further investigation. Although burrow collapsing is considered non-lethal its impacts on evicted wombats has not been studied and warrants further investigation. Studying the impact of burrow collapsing on wombats may help to answer questions about the reasons for its success or failure. Burying steel mesh at the location of the collapsed burrow is untested but may prevent wombats from re-excavating.

Alternate methods could trap and relocate wombats or empty burrows using one-way gates placed in burrow entrances prior to collapse. Trapping is more time consuming and costly as traps need to be checked every morning and it requires careful planning and trained personnel to handle and relocate the wombat(s) but removing animals from the area may provide longer term relief from conflict. One-way gates can be installed and left in place until the burrow is empty, though regular assessment of the gate is recommended as wombats have been known to dig around or under them. Motion sensor cameras can be used to determine if a burrow is empty. Low-cost methods such as raking the soil to assess for footprints or the placing of sticks in a burrow entrance can be used to determine if a burrow is empty however, it is not always possible to determine if a wombat has gone into the burrow or exited.

The time and costs of burrow collapsing will vary on a case-by-case basis. Some burrows may be simple single entrance tunnels that take 1.5 hrs to rip while other more complex 5 entrance warrens that are 4 m deep can take up to 10 hours (O'Brien, 2018). Soil type and burrow depth will impact the time and costs associated with burrow destruction. Given the time and costs of collapsing burrows along with the low success rate it is not a viable long-term solution to wombat management, but it may prove useful in certain situations. Given Bare-nosed Wombats within the ACT breed year-round consideration needs to be given to the potential for there to be young at foot that may not be able to travel to the next nearest burrow or move through a wombat gate. Though these studies found burrow collapsing did not result in new burrows being dug in other locations it is always possible that it could transfer the conflict to a new location.

6.5 Deterrents

Designed to capitalise on an animal's mechanisms of threat detection, deterrents aim to discourage the use of human resources with aversive stimuli (Ramp et al., 2005, Apfelbach R, 2005, Schakner and Blumstein, 2013). A wide range of deterrents, such as chemical cues, novel objects, and painful stimuli are increasingly being marketed as non-lethal means of reducing human wildlife conflict (Breitenmoser et al., 2005). Although there are numerous studies on the use of deterrents, many devices have not been quantitatively field-tested, and their perceived effectiveness lies in testimonial and anecdotal reports. Controlled lab studies often do not translate to field situations, where numerous uncontrollable environmental factors can influence the way animals detect and respond to threats (Mason, 1998, Koehler AE, 1990, Barlow et al., 2010). Even where devices have been field tested, they often produce conflicting results.

Before deterrents are recommended to mitigate wombat damage, a better understanding of the factors influencing wombat threat perceptions and responses to them is needed. Further research is required to evaluate responses in different environmental conditions such as varying distance to cover, and with different methods of application and placement, to determine the optimal conditions for success. In addition, future studies should consider conducting trials in a closed system with known individuals or capturing and marking individuals prior to commencing trials for ease of identification so individual variation in responses can be taken into consideration.

6.5.1 Olfactory deterrents

Olfaction is known to play an important role in social communication in wombats (Taggart and Temple-Smith, 2008, Triggs, 2009), little is known about its role in threat perception.

Anecdotally, fertilisers such as blood and bone, dog and human urine are thought to deter wombats (O'Brien, 2019).

Dingo urine and faeces has been trialled with mixed results. Field trials found no difference in Southern Hairy-nosed Wombat activity before and after placing a cup of blood and bone in burrow entrances (O'Brien et al., 2021). Captive Southern Hairy-nosed Wombats increased their exploratory behaviour in response to dingo faeces placed inside burrows, followed by increased use of burrows and concealed locations (Descovich et al., 2012). Sparrow et al. (2016) reported Southern Hairy-nosed Wombats showed greater avoidance and prolonged time to recolonisation of collapsed warrens treated with dingo odours than control warrens on the Nullarbor in South Australia. Conversely, the application of dog urine and dingo faeces had no significant impact on the time taken for Southern Hairy-nosed Wombats to recolonise collapsed warrens in the Murraylands of South Australia (O'Brien, 2018) or deter them from using burrows where dingo urine and faeces were placed at the entrance (O'Brien, 2019). No known research has been conducted on the effects of odour deterrents on Bare-nosed Wombats.

The differing results of these studies indicate Southern Hairy-nosed Wombat responses to predator odours may be context dependent, but disparities in experimental design and analyses make it difficult to determine which factors are influencing threat perceptions. Control–impact studies may lead to a misconception of the effectiveness of treatments as they don't consider differences in pre-existing activity levels at treatment sites (Koehler AE, 1990, Parsons and Bondrup, 1996, Rytwinski et al., 2016). Southern Hairy-nosed Wombats may have responded to blood and bone or dingo odours with increased hiding or reduced ranging behaviour in a manner that was not evident from the camera data, or it could have been perceived as a low risk. The use of a greater volume and repeated or more widespread application of deterrents may elicit greater avoidance responses. The application of odours inside burrows or in open areas further from the safety of a burrow may heighten risk perceptions, resulting in greater avoidance responses (Atkinson et al., 1994).

6.5.2 Visual deterrents

Anecdotal evidence suggested wombats are fearful of shiny objects and actively avoid them. Stationary CDs have been found to elicit avoidance responses in Southern Hairy-nosed Wombats, with a decrease in the number of visits to burrows following their application (O'Brien et al., 2021). Visual stimuli produced avoidance responses most likely due to an immediate fear response (neophobia) of an unknown object within their environment (Harris and Knowlton, 2001, Davidson-Nelson and Gehring, 2010, Bruggers et al., 1986). Wombats may respond more readily to visual cues as they are easily detected from further away than olfactory cues, which require closer investigation. Though these preliminary investigations are encouraging, habituation to visual stimuli is a major limiting factor to their long-term use, particularly when unaccompanied by negative reinforcement (Koehler AE, 1990, Gilsdorf et al., 2002). Habituation to CDs was not observed in Southern Hairy-nosed Wombats over the 5-night trial, however, it may occur over a longer time frame.

6.5.3 Virtual fencing

Virtual fencing is a term often used for placing deterrents along roadsides that are activated by approaching vehicle headlights. On activation the device emits a sound, flashing lights or both with the aim of scaring away any animals that may be adjacent to the roadside. Virtual fencing is not a physical barrier and allows animals to move through the landscape. Early trials in Tasmania reported a 50% reduction in roadkill over a three-years (Fox et al., 2018), but the trial had many design flaws and likely had little to no effect on possums, wallabies or wombats (Coulson and Bender, 2019). A study on the impacts of virtual fencing on wombats found a small reduction in the number of wombats killed after the virtual fence was installed (Stannard et al., 2021), however the study design was flawed and widely disputed (Coulson and Bender, 2022, Candy and Englefield). Similarly, other deterrent devices mounted to vehicles like the Shuroo have been found ineffective, as the noise the device makes cannot be heard over the vehicle noise from >50 m away (Bender and Coulson, 2022).

6.6 Translocation

Translocation is a widely used “non-lethal” human-wildlife conflict mitigation measure, but its effectiveness is disputed. The survival of translocated animals is often low, and the conflict may not be resolved or could be transferred to the release site (Bradley et al., 2005, Linnell et al., 1997). Translocation has been trialled on Southern Hairy-nosed Wombats to relieve conflicts with agriculturalists. Southern Hairy-nosed Wombats were translocated from areas of

conflict to a property where species numbers were low and lots of inactive burrows were available to release them into. Animals were fitted with GPS and/or VHS collars to monitor their survival and behaviour in comparison to resident animals. Though translocated Southern Hairy-nosed Wombats had high survival rates and exhibited release site fidelity conflicts were not resolved. Neighbouring Southern Hairy-nosed Wombats moving into vacated burrows at the source site within a matter of weeks. Landholders using culling as a control measure to reduce conflicts with Southern Hairy-nosed Wombats have reported similar results, with neighbouring animals recolonising vacated warrens (St John and Saunders, 1989).

Translocation of a larger number of animals may provide longer relief from conflict. However, Southern Hairy-nosed Wombats evaded traps by remaining underground or digging under fencing, resulting in a low trap rate of 5.95%. Similarly, the trapping success of Bare-nosed Wombats was 7.9% and Northern Hairy-nosed Wombats as low as 1-2%, all species avoid capture by remaining underground for extended periods of time (McIlroy, 1977a; Alan Horsup, pers. comm 2018). Thus, large scale translocation could be labour intensive and cost prohibitive. Furthermore, the ongoing translocation of large numbers of Southern Hairy-nosed Wombats would over time lead to shortages of suitable conflict free release sites with low numbers of conspecifics in the species natural range. Translocation could be used as a tool to repopulate areas where numbers are known to have declined, however, it may result in further deaths if the cause of the decline has not been addressed.

Similarly, the critically endangered Northern Hairy-nosed Wombat has been successfully re-introduced into areas they were extirpated from by releasing them into starter burrows (Horsup, 2004). A study on the survival of rescued and rehabilitated Bare-nosed Wombats reported high survival (94.5%) of animals released onto a private property within the first 42 days following release and 77% survival after eight years (Saran et al., 2011). Survival was not found to be related to age, sex, provision of supplemental food, season or time spent in rehabilitation.

Despite its limitations, translocation may prove useful for removing a small number of individuals from areas of conflict, where alternative measures fail or are unsuitable. When used in combination with burrow collapsing or deterrent use it may yield more promising results in reducing conflict at the source site. Prior to carrying out a translocation careful planning is needed. Translocation plans should adhere to the Conservator Guidelines for the Translocation of Native Flora and Fauna in the ACT. . Important biological and ecological factors need to be taken into consideration, such as capture stress, disease transmission, habitat suitability, and competition with conspecifics. The availability of burrows at the release site is a key

consideration when it comes to translocating wombats, which would require up to date knowledge of wombat distribution and density. Follow up monitoring is imperative to ensure survival of translocated animals.

6.7 Culling

Historically, conflicts with wombats have been managed using lethal controls. In most states, there are provisions to cull wombats causing damage or threatening human safety under permit systems (see section 6.1). The lethal control of wombats has become a highly contentious and controversial issue in the last few decades, due to changing public attitudes towards its use and concerns about wombat conservation. Permits to destroy Bare-nosed Wombats have decreased greatly in Tasmania and other states where it is allowed in the last few years due to increasing public pressure. The impacts of culling on wombats populations are poorly understood (Tartowski and Stelmann, 1998, Taggart et al., 2008). If conducted at unsustainable levels it can result in range contractions and population isolation (Powell, 2006, Fuller et al., 1992, Woodroffe et al., 2005). In contrast, killing an insufficient number of animals can fail to reduce damage to an acceptable level (Hone, 2007). In some cases, the removal of animals from a population can encourage population growth and immigration, thereby increasing conflict (Treves et al., 2016). Culling can disrupt social structures that lead to fractured social groups and increases in conflicts (Wallach et al., 2009, Allen et al., 2015). Despite the limitations of culling, there may always be some situations in which it is the best intervention method (Warburton and Norton, 2009).

There is one known study examining the effects of culling on Southern Hairy-nosed Wombats. Changes in the number of active burrows were monitored in an area where culling occurred and an adjacent control zone where no culling took place. Over the two-year term of the study an estimated 12% of the population was culled per year. Despite this there was an estimated 30-40% increase in the number of Southern Hairy-nosed Wombats in the culled area, while in the uncultured area there was an estimated 50-60% increase. The increase in Southern Hairy-nosed Wombat numbers over this time frame could have been a result of increased rainfall and recovery from the 1981-83 drought, the effects are unlikely to be the same on a stable or decreasing population (Tartowski and Stelmann, 1998).

Culling it is often preferred as a conflict reduction tool by landholders, as it is convenient, immediately shows results, satisfies their need for control, and is perceived as cost effective (Horton RR, 1997, Zinn et al., 1998, Treves and Naughton Treves, 2005).

Landholders surveyed in South Australia most widely used culling to reduce conflicts with Southern Hairy-nosed Wombats in South Australia and those who were financially dependent on their property or had experienced damage were more likely to cull wombats (O'Brien, 2019). Despite the widespread use of culling, only half of the landholders using it perceived it to be effective. A lack of data on wombat numbers makes it difficult for state agencies to set balanced culling quotas often resulting in ineffective conflict resolution (Taggart et al., 2008). Many landholders feel they are rarely permitted to cull enough wombats to mitigate damage with recolonisation of burrows being an ongoing problem (Stott, 1998, Taggart et al., 2008, St John and Saunders, 1989). Official government registers are considered an underestimate of the true numbers of wombats culled, as some landholders resort to culling outside the permit system (St John and Saunders, 1989, Taggart et al., 2008). The use of lethal controls needs to be carefully evaluated and managed based on scientific evidence, to ensure conflict reduction without threatening species conservation.

6.8 Wombat monitoring and research

There are significant knowledge gaps in our understanding of Bare-nosed Wombat populations in the ACT. Addressing these gaps will require dedicated monitoring and survey effort to collect fit-for-purpose datasets. This section examines a variety of survey options, and their costs and benefits.

6.8.1 Quantify the frequency and occurrence of wombat damage

Perceptions and tolerance of damage caused by wildlife are often shaped by financial dependence on crops or livestock and previous experiences (Naughton-Treves L, 2005, Van Tassell et al., 2000). Perceived damage can sometimes be disproportionate to actual damages (Dickman, 2010, Knight, 2000, Madden, 2004, Wigley and Garner, 1986). Quantifying the frequency and cost of Bare-nosed Wombat-related damage is crucial to distinguish between real and perceived impacts. This data can help identify high-conflict areas and guide wildlife managers in developing targeted management actions. In regions where damage is minimal or misattributed, educating stakeholders can be crucial to mitigating conflict. Conversely, where significant damage occurs, targeted management interventions to reduce damages may be necessary to alleviate its effects.

Accurately reporting the prevalence and costs of wombat damage from landholders and other relevant stakeholders will require a consistent approach to data collection. This will require

CED to develop a reporting tool for stakeholders to submit information such as: (1) the type of damage; (2) the location of the damage; (3) the financial costs associated with damage; and (4) negative safety outcomes associated with damage. Collecting a consistent set of data in each report will allow for comparison with wombat population data and other key population metrics. This tool will need to be managed by CED or another relevant team within the ACT Government.

6.8.2 Ecological surveys of wombats in the ACT

One of the critical aspects of species management is understanding population dynamics. Currently, Bare-nosed Wombat population monitoring in the ACT is limited, with few systematic surveys to track wombat numbers or distribution. Animal welfare and stakeholder concerns around the prevalence of mange also require systematic surveys that include areas with and without mange treatment applications. High-quality distribution and abundance data paired with standardised impact and mange assessments will provide land managers with the tools for effective management and conflict mitigation.

Current monitoring

CED has commenced a long-term monitoring program at eleven sites within the ACT. The purpose of these surveys is to detect changes in populations over time, and to collect data on mange prevalence and severity. Survey sites were selected based on known presence of Bare-nosed Wombats and ease of accessibility. Surveys are conducted twice annually in winter and consist of walking 1 km transects at a slow pace (45 mins), commencing 30 mins after sunset (Figure 5). Surveys are carried out in teams of at least two people for health and safety reasons. Surveyors use night vision binoculars to reduce disturbance of animals.

When a Bare-nosed Wombat is seen, the surveyor notes their location using a GPS, takes a compass bearing and estimates the distance to the animal. Wombats are given a body condition score (ranked 1-5, with 1 being poor and 5 being excellent) and a mange score using the categories described in Stannard et al. (2020). Observers also record a mange confidence score to reflect how confident the surveyor is in their assessment in the presence or absence of mange, noting that it can be difficult to assess from a distance. Weather variables including temperature, rainfall, wind speed, cloud cover and visibility of the moon are measured at the beginning of each transect. A further two sites in Namadgi National Park are surveyed annually using the same method as above, with the exception that surveys are undertaken from a vehicle.

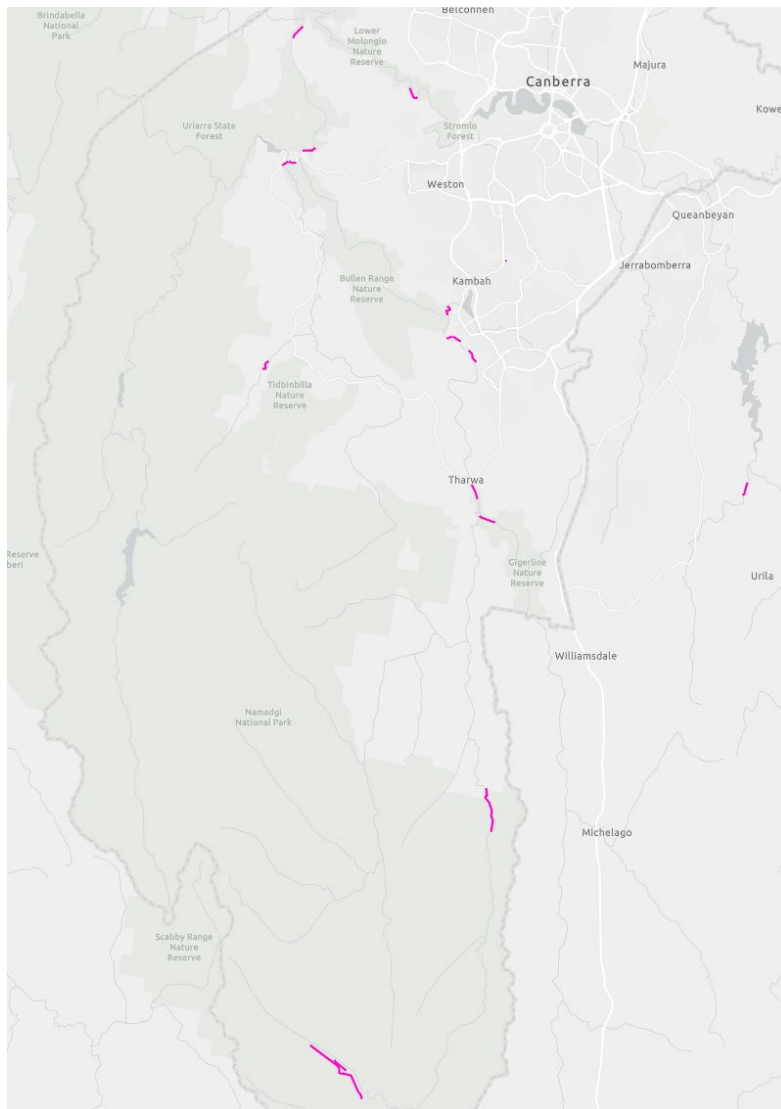


Figure 5. Locations (pink) of the line transect surveys conducted to detect changes in populations over time, and to collect data on mange prevalence and severity.

Bare-nosed Wombat records are also collected using applications such as NatureMapr and the Atlas of Living Australia. These are useful tools that enable public reporting of wombat sightings over large areas that would otherwise be infeasible for ecologists to survey. These incidental sightings are typically biased towards areas of high human activity (i.e., roads or trails) and there are caveats around their value in understanding a species distribution or abundance. Without standardised survey effort, it is difficult to determine whether areas with a lower number of records represent a true absence or a low survey effort. Species and signs of their presence, such as faeces, tracks and burrows, can also be misidentified or difficult to detect. Burrows also present a challenging proxy for wombat occupancy as burrows may remain in an area after an individual has moved on (Tartowski and Stelmann, 1998).

Gaps in current methodology

A comprehensive survey program to inform wombat management in the ACT requires data on (1) wombat density or relative activity across areas of suitable habitat; (2) prevalence of mange across existing wombat populations; and (3) the effect of mange treatments on the prevalence of mange. The current monitoring program captures relative activity data within the conservation estate but is not representative of all Bare-nosed Wombat habitat in the ACT. A more representative selection of sites would require survey transects to be located across conservation estate, rural lands, and other stakeholder areas (i.e., Icon Water). This would require approval from stakeholders for ecologists to access their land for surveys.

The current site selection does not consider whether sites have been actively or historically treated for mange. This makes it difficult to determine whether the abundance or current health of the local population is affected by these treatments. In future, monitoring sites should be evenly stratified into two groups: treated and untreated. Once these sites are selected, treatment conditions should remain consistent throughout the study period.

The current survey methodology as described above is subject to imperfect detection of both mange prevalence and individual wombats. Vegetation and uneven topography can make it difficult to detect individuals and assess mange severity. For more information on alternative survey methodologies that may be more suitable, refer to the section below.

The current monitoring program is conducted across 26 survey nights annually, with two staff or volunteer members required to conduct each survey. In the past this work has been done by CED ecologists and volunteers from Wombat Rescue. Expanding the survey scope to include transects on rural land and other stakeholder properties would increase the survey time required. For consistency and impartiality, this should be done by trained ecologists and not members of any stakeholder group.

Alternative monitoring methods for consideration

Due to the nocturnal and burrowing nature of Bare-nosed Wombats they are difficult to survey. Direct counting using spotlight surveys are labour intensive and not practical over large areas. Spotlight counts are not representative of population numbers as wombats may remain in their burrows and avoid being counted (McIlroy, 1977b).

Mark recapture studies, requiring individuals to be captured on more than one occasion, are challenging as Bare-nosed Wombats are difficult to capture. They can remain underground for

prolonged periods or dig around traps to avoid capture (McIlroy, 1977b, Skerratt et al., 2004). In these surveys, trapping only a portion of burrows can result in imprecise abundance estimates (Banks et al., 2003). Trapping every burrow across a large area is impractical due to the time and labour required.

The number of active burrows has successfully been linked to wombat abundances using mark-recapture methods (McIlroy, 1977a), burrow flap counters (Tiver, 1981) and remote cameras (Swinbourne et al., 2018). A combination of burrow activity levels and the number of active burrows is a relatively low-cost method and has been used to infer population abundances (St John and Saunders, 1989). Burrow activity can be estimated using burrow flap counters or remote cameras. Abundance estimates using these measures will allow land managers to track trends in population levels but will not provide an exact density.

Ground penetrating radar has been used successfully to map Southern Hairy-nosed Wombat burrows (Swinbourne* et al., 2015). It can be used to determine the length, depth and direction of wombat tunnels and help determine if a burrow is a main, secondary or starter burrow. There are various ground penetrating radar systems available, simple units can be hired for between \$200-400 a day and can penetrate up to 8 m depth.

Drones have successfully been used to map wombat burrow locations in New South Wales grasslands (Old et al, 2019). In their study, Old et al. (2019) detected a similar number of burrows using desktop analysis of drone imagery and ground-based surveys. In aerial surveys observer errors can result in inaccurate counts, but standardising the results using a transect with a known number of burrows can help develop a correction factor for the dataset (Tiver, 1981). Recording video footage during aerial surveys can also allow for more accurate and repeatable scores of wombat warrens (McGregor and Wells, 1998). Drone surveys can be affected by vegetation, with reduced efficacy in dense vegetation where burrow entries are obscured (Old et al 2019; Taggart et al, 2008). These aerial surveys provide an alternative to manual searching for burrows and can be used to quickly assess range expansion in local wombat populations. Detecting decreases in distribution based on burrow surveys is more difficult, as warrens remain visible long after they have been vacated.

Integrating drones with thermal sensors has been used effectively to directly survey a range of terrestrial and arboreal species (Beaver et al, 2020; Howell et al, 2021; Witt et al, 2020). These methods have not yet been tested on wombats, but they may provide a suitable alternative to ground-based surveys. While thermal drone surveys may reduce labour inputs and reduced

detection abilities in dense vegetation, they are still subject to the pitfalls of direct count methodologies. Direct counting will still be subject to imperfect detection if individual wombats remain underground during the surveys.

6.8.3 Furthering research by partnering with scientists

There are lots of knowledge gaps that hinder the effective management of Bare-nosed Wombats in the ACT. While it is not necessarily the role of the ACT Government to conduct the research to fill these knowledge gaps, collaboration with scientists may help to overcome some of these knowledge gaps.

Collaboration between the ACT Government and researchers could help fill the knowledge gaps discussed above. Key research areas include developing a deeper understanding of complex stakeholder views and collecting more robust population-level data for wombats in the ACT. Additional topics could include further research into mange treatment and collaborating with landholders to develop effective damage mitigation strategies. Landholders currently lack reliable options for mitigating conflict with wombats. These options need to be well-tested, and the limitations and benefits of each need to be clearly understood.

7. Recommendations

The following steps are recommended to address key stakeholder concerns in a responsible and balanced manner:

- Support non-lethal methods for wombat control by land managers to mitigate damage, which may include the provision of information, resources and training;
- Develop an appropriate mechanism to allow humane euthanasia of wombats on rural lands that are afflicted with severe mange, noting animal welfare considerations;
- Coordination between ONC ecologists and PCS Licensing and Compliance to clearly identify areas within the ACT, and possibly NSW, where rehabilitated wombats can be released. Selection of suitable sites can reduce the likelihood of overabundance and future human-wildlife conflict;
- Review procedures and licensing pathways for the deployment of Cydectin and other mange treatments to ensure appropriate placement that minimises negative impacts on aquatic systems;
- Over the longer term, explore and evaluate options to support holistic management of Bare-nosed Wombats in the ACT through an appropriate policy mechanism, including

for example, a Controlled Native Species Management Plan under the *Nature Conservation Act 2014*.

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