



NSW NATIONAL PARKS & WILDLIFE SERVICE

Central Mallee Reserves

Planning Considerations

Incorporating Yathong Nature Reserve, Nombinnie Nature Reserve,
Nombinnie State Conservation Area and Round Hill Nature Reserve



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Cover photo: Complex mallee vegetation, Round Hill Nature Reserve. M Billington/DPIE

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How to use this document

This planning considerations report outlines the matters considered in preparing the Central Mallee Reserves Plan of Management, including the reserves' key values, management principles and management considerations. Further information, including scientific names for common names of species, is provided in the appendices.

It is recommended that readers of this document read the plan of management. The plan of management describes the desired outcomes for the reserves' values, and the actions that the National Parks and Wildlife Service (NPWS) proposes to undertake to achieve these outcomes. It also sets out the recreational activities that are permitted in the reserves and any requirements to undertake these activities, including whether consent must be sought from NPWS to undertake them.

This planning considerations report will be updated when appropriate, for example if we have new information on:

- the values of the parks (e.g. new threatened species)
- management approaches (e.g. new pest management techniques)
- new programs.

Changes will only be made to this document if they are consistent with the plan of management.

Acknowledgements

Yathong Nature Reserve, Nombinnie Nature Reserve, Nombinnie State Conservation Area and Round Hill Nature Reserve are in the traditional Country of the Ngiyampaa People.

Contact us

For more information about this report or Yathong Nature Reserve, Nombinnie Nature Reserve, Nombinnie State Conservation Area and Round Hill Nature Reserve, contact the NPWS Central West Area:

- email npws.centralwest@environment.nsw.gov.au
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Central Mallee Reserves Planning Considerations

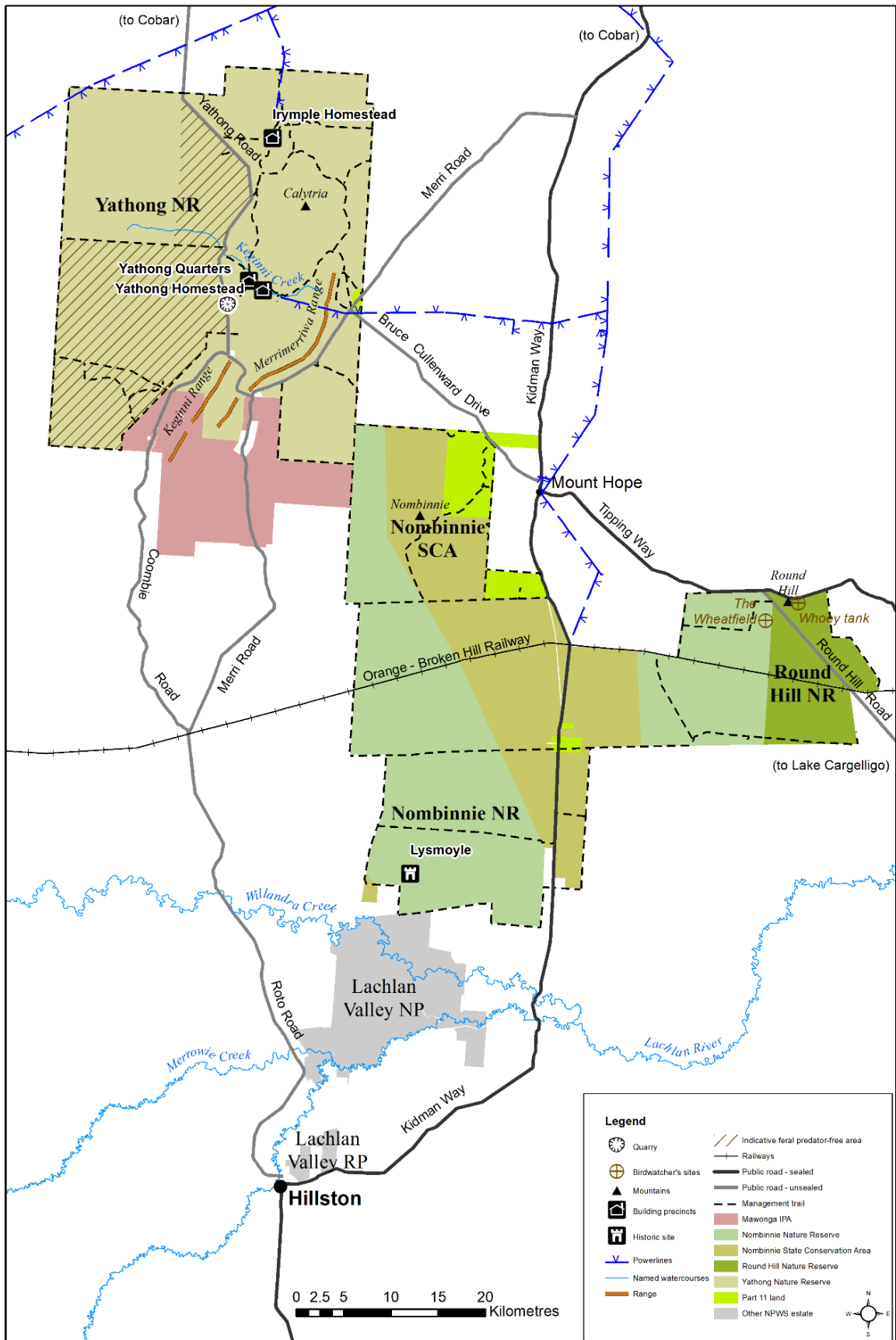


Figure 1 Map of Central Mallee reserves

1. The Central Mallee reserves

The Central Mallee reserves comprise Yathong Nature Reserve, Nombinnie Nature Reserve, Nombinnie State Conservation Area and Round Hill Nature Reserve. They are significant as the largest area of mallee woodland in a protected area in New South Wales. To the south, the reserves adjoin the Hunthawang precinct of Lachlan Valley National Park.

Together the reserves form a sizeable reserved area on the Cobar Penneplain in central-west NSW, in an isolated location roughly halfway between Cobar and Griffith. The nearest settlements are Mount Hope to the east (population: 19), Roto to the west (population: 41), Hillston to the south (population: 1465) and Lake Cargelligo to the south-east (population: 1479) (2016 census).

The total area of 248,435 hectares comprises:

- Yathong Nature Reserve – 118,805 hectares
- Nombinnie Nature Reserve – 70,000 hectares
- Nombinnie State Conservation Area – 46,000 hectares
- Round Hill Nature Reserve – 13,630 hectares.

Round Hill Nature Reserve is one of the oldest reserves in New South Wales, reserved in 1960 under the *Fauna Protection Act 1948*. Yathong Nature Reserve was gazetted in 1971 and Nombinnie Nature Reserve in 1988. Nombinnie State Conservation Area was added in 2005. Minor additions were made to the reserves in 2011 and 2015 (the former Yathong State Forest) and in 2020 (former travelling stock reserves). Approximately 7894 hectares (in 10 parcels) have been acquired under Part 11 of the *National Parks and Wildlife Act 1974* (identified as 'Part 11 land' in Figure 1). These areas of Part 11 land are managed as if they were part of the gazetted reserves.

Unlike the 3 nature reserves, exploration for minerals and mining are allowed to occur in Nombinnie State Conservation Area as per the provisions for this park category under the National Parks and Wildlife Act.

Most of the reserves lie in the Cobar Penneplain Bioregion and the Murray Darling Depression Bioregion (Thackway & Creswell 1995). The Cobar Penneplain Bioregion is one of the most poorly conserved bioregions in New South Wales, with just 2.6% protected in the parks system. Approximately 33% of the Cobar Penneplain Bioregion has been cleared of vegetation, 25% is under intensive agricultural production and 14% is subject to mining (EPA 2015). The amount of protected land in the Murray Darling Depression Bioregion is also low, at 5.8%. Approximately 875 hectares on the south-west margin of Nombinnie Nature Reserve lie in the Riverina Bioregion.

The region is characterised by low relief and a semi-arid climate. Mean daily temperatures range from 15 to 34°C maximum and 2.8 to 18.5°C minimum, and mean annual rainfall is only 350 millimetres.

The landscape consists of flat, red soil, sandy plains and dune fields interspersed by the low hills of Merrimerriva Range. Some clearing occurred in the past in what is now Yathong Nature Reserve. The land surrounding the reserves has also been substantially cleared for sheep grazing and dryland cropping so the reserves provide vital ecosystem services and habitat for a range of native plants and animals.

The majority of the reserves are in Cobar Shire, with the southern part of Nombinnie State Conservation Area in Carathool Shire. The reserves lie within the administrative area of Western Local Land Services (LLS). With regard to Aboriginal interests, the majority of the reserves fall within the unconstituted area and have no local Aboriginal land council. However, the portion of the reserves east of the Kidman Way are in the area of the Murrin Bridge Local Aboriginal Land Council.

2. Protecting the natural environment

2.1 Geology, landform and hydrology

The reserves straddle the boundaries of two major biogeographic regions: the Cobar Peneplain and the Murray Darling Depression (IBRA n.d.).

The eastern half of Yathong Nature Reserve and northern parts of the Nombinnie reserves and Round Hill Nature Reserve lie on the southern edge of the Cobar Peneplain. The Cobar Peneplain is a prominent topographical landscape based on Palaeozoic rocks, formed on the north-westerly extension of the Lachlan Fold Belt, and easily distinguished from most of the surrounding bioregions which are relatively flatter landscapes. During the Tertiary and Quaternary (50–60 million years ago) and possibly as recently as 5 million years ago, marine sediments were deposited in the Murray (Geological) Basin, with the coastline being the south-western edge of the Cobar Peneplain. In the Quaternary, after these shallow seas receded, sands were mobilised by wind to form dunes and sandplains that advanced onto the peneplain.

A drainage system of wide, shallow valleys with a few lakes also developed despite the low rainfall and low gradients. Surface water is now largely absent in the landscape. Creeks respond to local rainfall but only occasionally flow into the Bogan or Darling rivers.

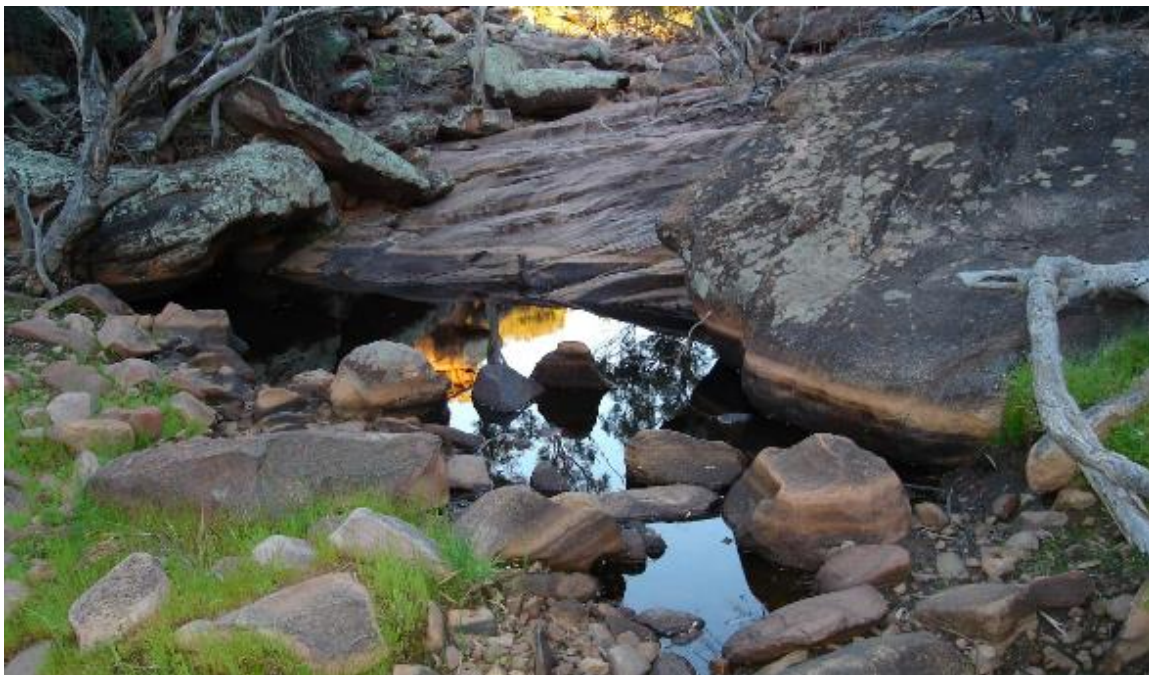


Photo 1 One of several Merrimerriwa Range rock pools holding water during the Millennium Drought (2006). Laura Douglas/DPIE

The rolling downs and flat plains punctuated by stony ridges of the reserves are characteristic of the Cobar Peneplain landform. Bedrock is mainly of resistant Devonian rocks of quartzite, conglomerate and sandstone. Igneous rocks (Silurian feldspar and porphyry) outcrop at Mount Nombinnie and at Shepherds Hill in Round Hill Nature Reserve. Nearby Mount Hope was formerly the site of a small copper mine. Yathong Nature Reserve contains most of the Merrimerriwa Range which rises to 425 metres above sea level at Mount Merri and is a major landscape feature in the area. The Keginni Range in the central southern area of Yathong is less prominent. Soils are sandy lithosols on the ridges and red earths and gravel on the lowlands. Drainage tracts are incised on the ridges and poorly

defined on the lowlands, apart from Keginni Creek which flows north-west from the Merrimerrriwa Range and disappears in the sandplain. The creek floods adjacent land after heavy rain.

Most of the Nombinnie reserves, Round Hill and the western part of Yathong consist of level to gently undulating plains of the Darling Depression within the Murray Darling Depression Bioregion. The landscape reflects the movement of shallow seas back and forth across the plains, which left traces of parallel beach ridges and limestone sediments under the dunefields. Rock outcrops are absent in the Murray Darling Depression. The soils consist of brown calcareous soils, with Quaternary alluvial and aeolian (windblown) material forming flat plains of calcareous red earths and solonized brown soils overlain by dunes of silicious and sandy red earths. East–west dune fields to 10 metres relief occur in the central western part of Yathong. Drainage on the plains is generally unorganised, with rainfall being absorbed locally. Old lakes and depressions in Nombinnie and Round Hill have grey silty clay soils. The dune fields were formed in previous, more arid climates, and the lakes and depressions also indicate climatic change during the Quaternary with both pluvial and arid conditions.

The extreme south-west corner of Nombinnie Nature Reserve lies in the Riverina Bioregion on the edge of the riverine plain and in noticeable contrast to the majority of the reserves, is occasionally affected by large floods from Willandra Creek. For example, flooding of nitre goosefoot in this area in late 2016/early 2017 supported breeding by a variety of waterbirds including straw-necked ibis, plumed whistling ducks, banded stilts, red-kneed dotterels, grebes, pink-eared ducks etc. (see Photo 2).



Photo 2 Flooding of nitre goosefoot along the south-west margin of Nombinnie Nature Reserve, late 2016. D Egan/DPIE.

Microbiotic soil crusts (also known as cryptogamic, microphytic or microbiotic crusts) are an important feature of the semi-arid ecosystems present in the Central Mallee reserves. These assemblages of non-vascular plants such as algae, lichen and mosses play a vital role in soil dynamics in the arid and semi-arid zones of Australia (Eldridge & Greene 1994; Leys & Eldridge 1998) which cover about 70% of the country (DAWE n.d. a). During dry periods and droughts, these crusts often provide the only biological form of soil cover. Microbiotic soil crusts contribute to soil stability against water and wind erosion, as well as nitrogen and

carbon fixation and soil fertility. During small rainfall events, microbiotic crusts enhance infiltration but for most rainfall events their relatively non-porous surface may limit water entry unless the soil surface has previously been disturbed.

The presence of large numbers of hard-hoofed feral goats in the Central Mallee reserves can have a serious impact on microbiotic crusts. Damage can also result from fire or vehicle movements. Where crusts are damaged, they are exposed to sheet erosion and can break down rapidly. Little is known about natural rates of growth of microbiotic crusts, except that they are slow (Eldridge & Greene 1994). Crusts can tolerate some damage, but recovery is very slow following severe damage (ANBG 2012).

2.1.1 Management considerations and opportunities

A gravel pit (quarry) is located in Yathong Nature Reserve over an area of 1.6 hectares adjoining Yathong Road. Gravel from the pit is used periodically by NPWS for maintenance of park management trails. Cobar Shire Council accessed the site in the past and stockpiled gravel in the pit. Removal of the stockpiled gravel, followed by reshaping and subsequent rehabilitation of the pit, could generate improved biodiversity conservation outcomes at the site.



Photo 3 Quarry in Yathong Nature Reserve. M Billington/DPIE

There is a disused quarry on the eastern side of the Kidman Highway, partly in Nombinnie State Conservation Area. This is presently Part 11 land and is occasionally checked for erosion potential.

Once exposed, the sandy soils of the reserves are vulnerable to erosion, particularly from short-lived but intense rain events which occasionally occur. Some small areas of erosion may be due to wind sheeting and occasional surface flows, but there are also some eroded gullies in Yathong Nature Reserve associated with poor drainage of original roads and past overgrazing. Vehicle movements along exposed boundaries can also contribute to erosion. Destocking and continuing pest management efforts to reduce feral grazing pressure are contributing to a more stable environment. Road drainage works are also undertaken to minimise erosion.

2.2 Native plants

Vegetation in the Central Mallee reserves is characteristic of the low-fertility soils and semi-arid climate of central west NSW and is of significant conservation value. A total of 489 native plants have been identified in Yathong Nature Reserve (DPIE 2019b) and 576 in the Nombinnie – Round Hill reserves (DPIE 2021a).

Vegetation survey and mapping was completed for the Nombinnie reserves and Round Hill Nature Reserve by Cohn (1995) and for Yathong Nature Reserve by Department of Planning, Infrastructure and Environment (DPIE 2019b). Nineteen vegetation communities were mapped for the Nombinnie – Round Hill reserves and 12 for Yathong (listed in Appendix C).

These 2 datasets were compiled using different methodologies. Mapping by plant community types according to the statewide Vegetation Information System has not been completed. However, the mapped communities equate to 27 unique plant community types which occur in the following 6 classes (Keith 2004):

- dune mallee woodlands
- inland rocky hill woodlands
- north-west plain shrublands
- sand plain mallee woodlands
- semi-arid plain woodlands
- western peneplain woodlands.

The vegetation on the plains comprises a complex of mallee communities, bumble box woodlands, pine woodlands, gum coolibah and pine woodlands, belah and wilga woodland, western rosewood and derived grasslands (following previous clearing/disturbance). There are also shrub communities that are dominated variously by emu-bush (*Eremophila*) and hopbush (*Dodonaea*) species. The derived grasslands are an artefact of previous disturbance related to overgrazing, changed fire regimes and recruitment during periods of high rainfall (Westbrooke 1998). However, these areas provide habitat for a range of animals, including threatened species (Ayers et al. 2001). The flat plains in the north-western corner of Yathong protect a small population of ironwood. This population is significant as it is within the southern distributional limit for this species (DPIE 2019b).

The ridges and ranges of Yathong are covered with a complex of green mallee, grey mallee, Dwyer's red gum, mulga and pine woodlands. A patch of brigalow occurs on the Merrimerrriwa Range, approaching the southern extent of the range for this species (DPIE 2019b).

On the alluvial flood plains of Nombinnie Nature Reserve, 2 restricted communities are found: black roly-poly shrubland and black box woodland (Cohn 1995). While restricted in extent in Nombinnie, these 2 communities are contiguous with more extensive areas in the adjoining Lachlan Valley National Park.

On the rolling downs and lowlands of Nombinnie and Round Hill nature reserves, there is a complex mix of pine and bumble box woodlands, gum coolibah and pine woodlands, and green mallee shrubland (Cohn 1995).

The Central Mallee reserves contain approximately 175,200 hectares of mallee woodland (68% of the reserves, D Egan in litt.). This is the largest area of mallee woodland in a NSW protected area and is therefore of high conservation significance. The term 'mallee' refers to a distinctive ecosystem in the southern semi-arid zone of Australia where the canopy comprises multi-stemmed mallee eucalypts. Mallee has a restricted east–west distribution from central western New South Wales to Western Australia (see Figure 2), though the mallee form occurs in several other diverse habitats.

Since European settlement, extensive clearing of mallee has occurred for broadacre cropping. In 1995, it was estimated that as much as 90% of the original mallee communities in the Cobar Peneplain Bioregion had been cleared (Morton et al. 1995, cited in NPWS 2003a). Throughout semi-arid NSW, the original vegetation has been substantially altered, particularly by introduced herbivores and altered fire regimes. This has resulted in an increase in woody shrubs, the development of a flora dominated by perennial and annual species, and an increase in areas affected by wind and water erosion (Eldridge & Greene 1994).

Mallee eucalypts in the reserves grow to about 10 metres and include: green mallee, grey mallee, red mallee, white mallee and yorrell. The distribution of these species in the reserves can be related to subtle soil differences. Co-dominant species which occur with mallee include *Callitris*, *Melaleuca*, *Acacia* and *Hakea*. Porcupine grass is often present in the understorey. Grey mallee shrubland and green mallee communities are relatively under-represented in the NSW parks system (Groves & Parsons 1989). The variety of mallee age classes present in the Central Mallee reserves provides essential habitat for several threatened species, including malleefowl, striated grasswren and other mallee specialists (see Section 2.3).



Figure 2 Distribution of mallee woodlands and shrublands in Australia.

2.2.1 Threatened plant species

Five threatened plant species are recorded in the reserves (see Table 1). Approximately 20 other plant species are considered to be of high conservation significance (Cohn 1995; DPIE 2019b). The Central Mallee reserves also have significant populations of orchids, some of which are not yet described (Kosky 2019).

Strategies for the conservation of threatened species, populations and ecological communities have been set out in a statewide *Biodiversity Conservation Program* (DPIE 2019a). Actions listed in each of these strategies are prioritised and supported through the *Saving our Species* program, which aims to maximise the number of threatened species that are secured in the wild in New South Wales for 100 years.

Many recovery plans for NSW threatened species have previously been prepared and provide useful information. However, they are no longer the primary source of actions for the conservation of threatened species in New South Wales. Recovery plans may be prepared for nationally listed threatened species under the (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999*.

Table 1 Threatened plant species recorded in the reserves

Common name	Scientific name	Status	Reserve
Bitter quandong	<i>Santalum murrayanum</i>	Endangered, BC Act	Yathong
Cobar rustyhood orchid	<i>Pterostylis cobarensis</i>	Vulnerable, BC Act	Yathong
Curly-bark wattle	<i>Acacia curranii</i>	Vulnerable, BC Act Vulnerable, EPBC Act	Yathong, Nombinnie SCA
Holly-leaf grevillea	<i>Grevillea ilicifolia</i> subsp. <i>ilicifolia</i>	Critically endangered, BC Act	Round Hill
	<i>Osteocarpum pentapterum</i>	Presumed extinct (Records: 1980, 1985)	Yathong

BC Act = Biodiversity Conservation Act 2016; EPBC Act = Environment Protection and Biodiversity Conservation Act 1999.

Box 1: Managing threatened plant species

Holly-leaf grevillea

Holly-leaf grevillea is a critically endangered species in New South Wales. Although widespread in Victoria and South Australia, its occurrence in this State is restricted to several individual plants at Round Hill Nature Reserve.

Though the species is not threatened throughout its range in Australia, the Round Hill population is geographically isolated from those in other States, so there is no connectivity to ensure its survival in New South Wales. This population is likely to be a living floristic relict of past glacial climate regimes. The NSW population is a sand mallee specialist, though it could occur in other mallee conditions in the State where there have been unconfirmed records. The species has been in continuous decline from threats such as clearing. A previous population of the species in Nericon (near Griffith) is now extinct.

In 2015 and 2018, propagated plants from seed collected in the reserve were introduced along Cargelligo Road in the reserve in a collaboration between NPWS, the Australian Botanical Gardens, TAFE and Murrumbidgee Field Naturalists. However, despite positive early signs, both of these replanting projects were unsuccessful. Persistent dry conditions are likely to have been a contributing factor.

Following wetter conditions in 2020, consideration is being given to another replanting, again using plants propagated by the Australian Botanical Gardens.

Curly-bark wattle

In New South Wales, the majority of this species' distribution lies in the Mount Hope – Lake Cargelligo-Hillston region, including populations in the Central Mallee reserves. There are about 20 populations with fewer than 5000 individuals and one population with an estimated 150,000 individuals (Wright & Clark 2015, cited in DPIE 2019b). The species is also known in Queensland where there are 2 populations totalling several hundred individuals. The recovery effort for this species in New South Wales involves establishing priority management sites on private land and reserved land, including Yathong Nature Reserve and Gundabooka National Park.

In the Central Mallee reserves, curly-bark wattle occurs on rocky ranges typically among white cypress/Dwyer's gum vegetation. Yathong conserves the greatest number

of plants. At approximately 25 hectares, it is the largest known conserved site in New South Wales. Monitoring over the last 20 years has seen a thinning of the population and marked decrease in regeneration due to predation by feral goats and drought. In 2015, no recruitment was observed at any of the sites surveyed, but in 2017 the overall health of the curly-bark wattle plants at Yathong appeared to have improved. There was also evidence of recruitment occurring, although feral animal activity and moisture stress were apparent. Most recently, the breaking of the drought in 2020 has seen a positive ecological response (Genevieve Wright, pers. comm., February 2021).

Ongoing management of the curly-bark wattles, including protective fencing and control of rabbits and goats as the most severe herbivorous threats, has seen the population reach a point of stability. However, in future years consideration of the threat posed by kangaroo grazing may be needed. Consideration should be given to ecological burning of some patches to stimulate regeneration and remove the risk of a major fire event impacting the population.

Cobar rustyhood orchid

Also known as Cobar greenhood orchid, this species grows chiefly from Nyngan to Bourke district and is one of the most drought-tolerant orchids in Australia. The individual plants found in Yathong Nature Reserve are the most south-easterly. Its preferred habitat is in rocky places and in mallee where run-off occurs. The orchid was named from a specimen collected near Cobar in 1989.

Cobar rustyhood orchid is threatened by feral goats, rabbits and pigs through grazing, browsing and associated erosion. The habitat of this orchid is also vulnerable to clearing and weed infestation. It is being supported on two priority management sites under the *Saving our Species* program. In the Central Mallee reserves, the main management action being applied is control of rabbits and goats.

2.2.2 Management considerations and opportunities

In recent years NPWS has sought to improve knowledge of species biodiversity in targeted western NSW reserves, including Yathong, Nombinnie and Round Hill nature reserves (DPIE 2019b). A network of permanent monitoring plots has been established in the reserves to assist in documenting the reserves' flora and provide baseline information for future monitoring. This will provide information on the health and persistence of biodiversity values and the effectiveness of management strategies.

In the semi-arid environments of Australia, native vegetation plays a key role in intercepting and retaining scarce resources such as moisture and nutrients. Widespread loss of perennial plants, often arising after overgrazing, simplifies the structure of both the vegetation and soil, reducing the diversity of habitats and the capacity to sustain native plants and animals (Keith 2004).

The native vegetation in parts of the reserves (particularly Yathong) was heavily modified by over 100 years of livestock grazing and associated pastoral development before the reserves' establishment. Significant areas of derived grassland and open woodland developed as the combined result of land clearing, fire, overgrazing and the introduction of rabbits. In the years since acquisition, ongoing grazing pressure from rabbits, kangaroos, and feral goats have limited native plant regeneration in the reserves, particularly during drought and after fire. Native plants germinating after seasonal rains have often been heavily browsed, and even existing perennial native vegetation has had little relief from browsing pressure.

Vegetation monitoring in Yathong Nature Reserve over the last 20 years has documented a serious decline in the condition of native vegetation. At the time of the Yathong vegetation survey in September 2014 and 2015 (DPIE 2019b), recruitment of plant species in Yathong Nature Reserve was decreasing, and for some species had ceased altogether. Impacts in Round Hill and Nombinnie nature reserves are not as noticeable due to the presence of relatively intact mallee vegetation and the absence of surface water, a critical resource for goats to survive the hot summers. Fire is also a major agent of change for mallee communities in the reserves. The impacts of recurring drought and climate change are other factors contributing to the decline of native vegetation condition.

Semi-arid ecosystems are, however, able to make unexpected responses following wetter conditions. For example, in 2020 native hollyhock was observed, a species which had not been seen for many years (Laura Douglas pers. comm., 2021).

The greatest threat to semi-arid plants and communities in New South Wales is persistent grazing and browsing by feral goats. Control of feral goats is recognised as a major issue for vegetation management in the reserves. In recent years, changes in control methods and renewed management effort have had some encouraging results (see Section 2.4). Ongoing monitoring of native and non-native herbivore activity and vegetation will continue as part of an adaptive management approach.

2.3 Native animals

The almost unbroken expanse of conserved vegetation in the Central Mallee reserves forms an important refuge for native animals. The various landforms and associated vegetation communities provide a diversity of habitats for both generalist and specialist species. The mallee woodland of the rolling downs and plains, interspersed by the sparser upland vegetation of rocky ridges and outcrops on the Merrimerrriwa Range, support a relatively varied fauna. In this region, water availability is a significant population driver. 'Boom and bust' responses are discernible in many plant and animal populations, though not as marked in regions with an arid climate.

Important habitat features found in the reserves but largely absent in much of the surrounding landscape include:

- a plentiful layer of ground litter needed by malleefowl to build mounded ground nests
- loose stripping bark for use by birds and mammals as nesting materials
- old-age trees which contain cracks, spouts and hollows for use by reptiles, birds, micro-bats and other arboreal mammals
- mixed-age, patchy spinifex hummocks which provide ground cover needed by reptiles and ground mammals
- open canopy above a moderately dense but patchy scrub layer for secretive small birds.

While there have been no comprehensive fauna surveys for the four reserves, numerous surveys have targeted individual species, including malleefowl, red-lored whistler, Eastern Ranges rock-skink (EnviroKey 2017), as well as various insects, frogs and other reptiles. NPWS also undertook a program of systematic biodiversity surveys in Western NSW in 1997–98. Historically the Cobar Peneplain Bioregion is known to support about 470 animal species and during the 1997–98 surveys 204 species were recorded (NPWS 2001).

An indication of animal diversity and the value of animal habitat provided by the Central Mallee reserves can be obtained from the BioNet Atlas (DPIE 2021a) which records a total of 310 native animal species across the four reserves. However, this figure is a reflection of disparate survey effort over many years and is intended as a guide only. The most abundant species recorded are reptiles and woodland birds. Micro-bats also form a significant component of the reserves' fauna. The predominance of mallee vegetation accounts for the

presence of various threatened species such as malleefowl, striated grasswren, southern ningau and red-lored whistler.

Surveys targeting reptiles have recorded a high level of species diversity in the reserves with a total of 50 species (Sass 2006). This includes two threatened species listed under the *Biodiversity Conservation Act 2016*: western blue-tongued lizard and marble-faced delma (referred to as the marble-headed snake-lizard by Sass 2006). The high species diversity is paired with low population densities usually observed in arid and semi-arid environments of Australia (Henle 1987). The reptile records include a number of common species, but 19 of the 33 species recorded in 2003 (reported in Sass 2006) were found only within a specific vegetation community.

A recently described new species also occurs in Yathong Nature Reserve: the eastern mallee dragon (Sadler et al. 2019). The Western Fire Trail is the type locality for this species, which is reliant on *Triodia* grass hummocks.

The reptile record underscores the habitat value of the large area of relatively continuous vegetation in the reserves, and the importance of complex mallee interspersed with rocky ridges of semi-arid woodlands. Sass (2006) found that mallee vegetation supported the highest number of habitat specialists and, overall, mallee consistently recorded a higher number of species than other communities. Mallee with a *Triodia scariosa* (porcupine grass) understorey supported a greater diversity and abundance of reptiles than areas of mallee without it. Bimble box – pine woodland also recorded a high level of reptile species diversity.

Several woodland birds which are considered to be declining in New South Wales are present in the reserves, including grey-crowned babbler, speckled warbler, varied sittella and hooded robin. The most commonly recorded species during recent bird surveys in the mallee woodlands were white-eared honeyeater, weebill, grey-fronted honeyeater, crested bellbird, southern scrub-robin (threatened) and grey butcherbird (David Egan, pers. comm., 2021).

Box 2: Central NSW Mallee Important Bird Area

Important Bird Areas (IBAs) are recognised as internationally important for bird conservation, however, they are not formally protected areas. Birds Australia* identified 314 IBAs in Australia between 2005 and 2009. Bird populations are declining at most IBAs, and all except for 9 experience significant threats including grazing, logging, agricultural pressure, invasive species, too frequent fire and development pressure.

The Central Mallee reserves together make up the Central NSW Mallee IBA, which is one of only 4 IBAs covering mallee species in the State. The Central NSW Mallee IBA was identified because it supports isolated populations of malleefowl and red-lored whistler. It is also at the centre of the NSW distribution for other mallee bird species, including the shy heathwren, striated grasswren, southern scrub-robin and chestnut quail-thrush.

* In 2012, Birds Australia merged with Bird Observation & Conservation Australia to form BirdLife Australia.

The loss of mammals, particularly small- to medium-sized ground-dwelling mammals is evident across the Central Mallee reserves; of those remaining, a large number are listed as threatened. Among the commonly occurring mammals are echidnas, dunnarts, antechinus and micro-bats. Red kangaroos, eastern grey kangaroos and western grey kangaroos are often observed and, less frequently, common wallaroos. In the past, kangaroos benefited from water available in ground tanks in the reserves and artificially high numbers of kangaroos undoubtedly contributed to grazing pressure, together with goats and rabbits (Leigh et al. 1989; Mills et al. 2020). Tanks considered excess to NPWS requirements have been decommissioned, and those required for domestic water supply have exclusion fencing (see Section 5).

2.3.1 Threatened animal species

The fauna records for the reserves include 44 threatened species listed under the NSW Biodiversity Conservation Act and/or the Commonwealth Environment Protection and Biodiversity Conservation Act (see Table 2). A single kultarr was recorded by remote camera in 2015, the first sighting of this species for 20 years. It has since been recorded in 2018 and 2019. Like many small native mammals, the main threats to kultarrs are habitat destruction and predation by feral cats and foxes.

Several threatened species are being supported under the *Saving our Species* program, including the malleefowl and red-lored whistler. A national recovery plan is also in place for malleefowl (Benshemesh 2007), red-lored whistler (DELWP 2016) and kultarr (NPWS 2002).

Malleefowl

The malleefowl is a large, distinctive ground-dwelling bird which was formerly widespread and abundant throughout much of southern and central mainland Australia, however, the species is now severely depleted over its range. Remaining populations are small and isolated, and prospects for long-term conservation are poor (Benshemesh 2007). The total breeding population of malleefowl in New South Wales was estimated to be 745 pairs in 1985 (Brickhill 1987), however, as discussed below, estimating current population levels is difficult.

Table 2 Threatened animals recorded in the Central Mallee reserves

Common name	Scientific name	Status BC Act	Status EPBC Act	Yathong NR	Nombinnie NR	Nombinnie SCA	Round Hill NR
Frogs							
Sloane's froglet	<i>Crinia sloanei</i>	V	E				X
Reptiles							
Marble-faced delma	<i>Delma australis</i>	E		X	X	X	X
Western blue-tongued lizard	<i>Tiliqua occipitalis</i>	V		X	X	X	X
Birds							
Australian bustard	<i>Ardeotis australis</i>	E		X			
Barking owl	<i>Ninox connivens</i>	V			X		
Black-breasted buzzard	<i>Hamirostra melanosternon</i>	V			X		X
Black-chinned honeyeater (eastern subspecies)	<i>Meliphreptus gularis gularis</i>	V					X
Black falcon	<i>Falco subniger</i>	V		X	X		X
Brolga	<i>Grus rubicunda</i>	V		X			X
Chestnut quail-thrush	<i>Cinclosoma castanotum</i>	V		X	X	X	X

Central Mallee Reserves Planning Considerations

Common name	Scientific name	Status BC Act	Status EPBC Act	Yathong NR	Nombinnie NR	Nombinnie SCA	Round Hill NR
Diamond firetail	<i>Stagonopleura guttata</i>	V					X
Dusky woodswallow	<i>Artamus cyanopterus cyanopterus</i>	V		X	X	X	X
Flame robin	<i>Petroica phoenicea</i>	V		X			
Freckled duck	<i>Stictonetta naevosa</i>	V			X		X
Gilbert's whistler	<i>Pachycephala inornata</i>	V		X	X	X	X
Glossy black-cockatoo	<i>Calyptorhynchus lathami</i>	V			X		X
Grey-crowned babbler (eastern subspecies)	<i>Pomatostomus temporalis temporalis</i>	V		X	X	X	X
Grey falcon	<i>Falco hypoleucos</i>	E			X	X	X
Hooded robin (south-eastern form)	<i>Melanodryas cucullata cucullata</i>	V		X	X	X	X
Little eagle	<i>Hieraaetus morphnoides</i>	V		X	X	X	X
Little lorrikeet	<i>Glossopsitta pusilla</i>	V					X
Major Mitchell's cockatoo	<i>Lophochroa leadbeateri</i>	V		X	X	X	X
Malleefowl	<i>Leipoa ocellata</i>	E	V	X	X	X	X
Painted honeyeater	<i>Grantiella picta</i>	V	V	X	X		X
Pied honeyeater	<i>Certhionyx variegatus</i>	V		X	X	X	X
Red-lored whistler	<i>Pachycephala rufogularis</i>	CE	V	X	X	X	X
Shy heathwren	<i>Hylacola cautus</i>	V		X	X	X	X
Southern scrub-robin	<i>Drymodes brunneopygia</i>	V		X	X	X	X
Speckled warbler	<i>Chthonicola sagittata</i>	V		X	X	X	X
Spotted harrier	<i>Circus assimilis</i>	V		X	X		X
Square-tailed kite	<i>Lophoictinia isura</i>	V		X			
Striated grasswren	<i>Amytornis striatus</i>	V		X			
Superb parrot	<i>Polytelis swainsonii</i>	V	V	X			X
Swift parrot	<i>Lathamus discolor</i>	E	CE		X		X
Turquoise parrot	<i>Neophema pulchella</i>	V					X

Common name	Scientific name	Status BC Act	Status EPBC Act	Yathong NR	Nombinnie NR	Nombinnie SCA	Round Hill NR
Varied sittella	<i>Daphoenositta chrysoptera</i>	V		X	X	X	X
White-fronted chat	<i>Epthianura albifrons</i>	V		X	X		X
Mammals							
Brush-tailed rock-wallaby	<i>Petrogale penicillata</i>	E	V	#			
Corben's long-eared bat	<i>Nyctophilus corbeni</i>	V	V	X			
Inland forest bat	<i>Vespadelus baverstocki</i>	V		X			X
Kultarr	<i>Antechinomys laniger</i>	E		X	X		X
Little pied bat	<i>Chalinolobus picatus</i>	V		X	X	X	X
Southern ningau	<i>Ningau yvonneae</i>	V		X	X	X	X
Yellow-bellied sheath-tail-bat	<i>Saccolaimus flaviventris</i>	V		X			

X = present in reserve; # = previously recorded but now considered locally extinct

BC Act = *Biodiversity Conservation Act 2016*; V = vulnerable; E = endangered.

EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*; V = vulnerable; CE = critically endangered.

Malleefowl populations are threatened by the following factors (OEH 2017):

- habitat fragmentation and degradation
- fire which removes litter for mound construction, shelter from predators and food sources, especially seeds (mounds are not usually constructed in an area within 15–20 years after a fire and it may be 40 years before maximum densities are attained)
- predation, mainly by foxes and cats, but also by birds of prey (which target eggs and chicks) and feral pigs (which are also known to predate on malleefowl eggs)
- vehicle strikes when birds cross roads or feed on spilt grain beside roads
- climate change, which in the long term may alter habitat characteristics preferred by the species such that its capacity to support viable populations is reduced
- competition for food and disturbance to nesting mounds by feral goats
- disturbance to nesting mounds by feral pigs and goats
- sheep grazing of habitat on private land.

Once found in a variety of habitats, malleefowl are now confined largely to semi-arid areas containing mallee vegetation communities (Marchant & Higgins 1993, cited in Priddel & Wheeler 1997). Optimal habitat for malleefowl is characterised by an unbroken canopy and dense understorey, as a dense and diverse shrub layer can provide malleefowl with a continual source of food and also protection from predators (Priddel & Wheeler 1997).

The population in central NSW has been significantly reduced, and the species now occurs in the Central Mallee reserves at very low densities (Brickhill 1985). Monitoring in early 2021 indicated there was in the order of 190 mounds, but only a very small proportion have been found to be active in any one year (less than 5%). In some years, no active mounds have

been recorded. Breeding success also varies from year to year. Therefore, it has not been possible to determine the size of the malleefowl population in the Central Mallee reserves with any certainty. Long periods of below average rainfall have also been shown to prevent birds from undertaking mound building. The highly variable rainfall in the semi-arid landscape and significant rainfall deficit in recent years has therefore constrained the ability to estimate populations.

The Central Mallee reserves have a long history of malleefowl research and conservation effort. Notably, the first captive breeding and release program was carried out in Yathong in 1990 (24 birds) and 1991 (another 24 birds) accompanied by intensive fox baiting. From the first day after release, radio-tracked malleefowl were found dead, and mortality continued at a rapid rate until none remained alive. None survived beyond 104 days, and predation by foxes was the principal cause of mortality (Priddel & Wheeler 1996). However, the trialling of different baiting regimes under this project contributed valuable information about the frequency, intensity and extent of baiting required as a necessary tool for malleefowl survival even in a conservation reserve, and how the efficacy of baiting must also take into account factors such as habitat type, the proximity of rabbit warrens, the operation of feral cats in the landscape and other variables. (See Section 2.4 for more information about pest control). Since 1991 many additional research projects have been undertaken to better inform malleefowl conservation efforts including further releases of malleefowl, the most recent being in 2006.

In New South Wales, malleefowl are supported under the *Saving our Species* program at four priority management sites, across an area of approximately 500,000 hectares in the Central Mallee which encompasses the Central Mallee reserves and surrounding lands.

Ongoing control of feral cats, foxes and feral goats in the Central Mallee reserves is combined with drone, camera traps and on-ground monitoring of malleefowl mounds, to gauge breeding activity, add to understanding of the ecology of the species and inform ongoing conservation and management. Over 30 years of data are now available for malleefowl mound activity in the Central Mallee reserves which is being used to inform research and management actions on the ground. Outcomes from the Cat Project in the north-west corner of Yathong (see Section 2.4) will also inform malleefowl conservation and help improve its survival. The malleefowl is expected to benefit from the establishment of a feral predator-free area.

Red-lored whistler

Red-lored whistlers are mallee specialists occurring in semi-arid parts of New South Wales, Victoria and South Australia. In New South Wales they are now listed as critically endangered. Nombinnie and Round Hill nature reserves form the largest occupied areas for the species in the State. As red-lored whistlers have a patchy distribution in most areas of their occurrence, it is difficult to estimate their numbers. The population in Nombinnie and Round Hill nature reserves was estimated at 500 in 2017–18 (BirdLife in prep.).

As with 80% of Australia's threatened birds, red-lored whistlers are affected by a combination of habitat loss, fragmentation and/or degradation. Predation by feral cats and foxes have an impact as well as inappropriate fire regimes which could reduce or eliminate areas of suitable habitat. The time since fire is important for survival of red-lored whistlers, which have been found to be most abundant in areas burnt less than 45 years previously. The abundance of red-lored whistlers is also strongly influenced by rainfall (BirdLife in prep.).

This species is being supported under the *Saving our Species* program. The key management actions are the control of feral goats and avoiding the risk of adverse fire/wildfire across the Central Mallee reserves. In addition, regular surveys are conducted for red-lored whistler to help determine the condition and persistence of the Central Mallee populations, monitor the condition of its preferred habitat, and contribute to better

understanding of the species' abundance and distribution overall. The red-lored whistler is expected to benefit from the establishment of the feral predator-free area.

Striated grasswren

Yathong Nature Reserve contains one of 2 known sites for the striated grasswren in New South Wales; the other occurring in the Scotia mallee area, which includes Tarawi Nature Reserve and the privately owned Scotia Sanctuary on the New South Wales – South Australia border. Its restricted distribution is likely due to its preference for well-developed porcupine (or hummock) grass in association with mallee eucalypts. Like the red-lored whistler, the striated grasswren relies on unburnt mallee for its habitat and its distribution has significantly contracted.

Maintaining porcupine grass cover is important for the survival of the striated grasswren. The density, height and form of porcupine grass depends on the fire regime and time since fire. Porcupine grass increases from 5-20 years after fire to reach maximum cover 30 years after fire. Beyond this time, the cover remains stable or declines, depending on local site characteristics.

The striated grasswren is threatened by fragmentation and degradation of its remaining habitat, for example, through inappropriate grazing and fire regimes. Intensive grazing and browsing by goats (both feral and semi-domesticated), dorper sheep, rabbits and kangaroos can affect the habitat structure of mallee. Climate change scenarios in this area are likely to increase the frequency and intensity of fires in coming decades. These threatening processes are likely to change the physical and biological makeup of habitat in terms of species composition, structure and diversity or abundance of invertebrate food resources. Predation by feral cats and foxes may also affect population size (Birdlife in prep.).

This species is proposed to be supported under the *Saving our Species* program. Priority management sites have been identified at Yathong Nature Reserve and Scotia Sanctuary. This species is known to be declining, but conservation efforts are hampered by insufficient understanding of its distribution and abundance. The striated grasswren is expected to benefit from the establishment of a feral predator-free area as it will reduce impacts to habitat structure through the exclusion of feral goats.

The Action Plan for Australian Birds (BirdLife in prep.) recognises the population of striated grasswrens at Yathong as a critically endangered subspecies (i.e. *Amytornis striatus striatus*) due to the very low numbers of birds recorded in the reserve. BirdLife identifies the subspecies as Mukarrthippi grasswren in recognition of traditional Ngiyampaa Country and language. *Mukarrthippi* translates as 'small bird of the spinifex (Mukarr)'.

2.3.2 Management considerations and opportunities

Research projects in the Central Mallee reserves are ongoing and will continue to add to our understanding of the significant values of the reserves. There has been no comprehensive fauna survey undertaken to date. Future survey work to target species and habitats as yet unsurveyed would increase knowledge of the native animal species in the reserves and contribute to our understanding of managing the impact of threatening processes. The development of an ecological health and monitoring framework as part of the feral predator-free area project will aim to guide collaboration with existing research, monitoring and evaluation activities and coordinate implementation of new activities.

Australia has the worst record for mammal extinction in the world. Over 30 Australian mammal species have been driven to extinction since European settlement, with cats and foxes the main drivers for at least two-thirds of these losses (Legge et al. 2018). The range and abundance of surviving mammals has also been dramatically reduced. In New South Wales, 59% of all mammal species historically recorded are endangered or extinct (Lunney

et al. 1994). Western New South Wales has seen at least 24 mammal extinctions since European settlement, predominantly medium-sized, ground-dwelling mammals. The number of species considered at risk of extinction continues to rise.

In Western NSW, the introduction of sheep and overgrazing has also played a significant role in the loss of species from the landscape (Lunney 2001). The effects of the rabbit plague, foxes and drought cycles added to that impact.

The introduction of bores and ground tanks to provide water for sheep fundamentally altered the relationship between native animals and non-native pests. These artificial sources of water enabled pest animals to become established in areas that were previously not habitable and resulted in the persistence of larger and more widespread populations of these species than would otherwise be possible.

In a number of cases, the increase in abundance of a species may have significant negative effects on other species (James et al. 1999).

Feral cats are found throughout mainland Australia and are estimated to kill 1.5 billion native animals every year, contributing to most of the small mammal extinctions in Australia over the last 250 years (Woinarski et al. 2018). They continue to have a significant impact on native mammals, reptiles, amphibians and birds. The effective control of cats and foxes in parks is essential for the recovery of many of our threatened and declining native animals, especially small terrestrial mammals and ground-dwelling birds.

The establishment of a network of feral predator-free areas currently commencing in the NSW national parks estate is one strategy to address the major risk to critical weight range species (native animals between 35 and 5500 grams), namely predation by feral cats and foxes. This initiative builds on 3 existing feral predator-free areas in western NSW. Locally extinct mammals are being reintroduced in feral predator-free areas in Sturt and Mallee Cliffs national parks and in Pilliga State Conservation Area following construction of feral predator-proof fences and removal of feral predators. This initiative is recognised as an essential component of an overall strategy to prevent further extinctions of predator-susceptible threatened mammals in the short to medium term (e.g. Woinarski et al. 2018). As such it is one of the State's most significant threatened fauna restoration projects.

The Central Mallee Reserves Plan of Management proposes the establishment of a large feral predator-free area in Yathong Nature Reserve, which will enable the reintroduction of locally extinct and declining species, the eradication of feral cats, foxes and other pest animals from within the fenced area.

Box 3: Feral predator-free areas in New South Wales

A network of feral predator-free areas is an essential part of NPWS's strategy to protect and restore our most vulnerable native species. The feral predator-free area proposed for Yathong Nature Reserve will be up to 40,000 hectares, one of the largest in the southern hemisphere. It will deliver major benefits for the reserve, including:

- the return of locally extinct species
- an increase in populations of extant fauna threatened by cats and/or foxes
- improvements in ecological health through the removal of feral herbivores and the restoration of ecosystem processes such as digging and predation.

The project aims to restore ecosystems to a condition similar to that which was in place before the introduction of feral animals. Feral predator-free areas also provide opportunities for research, education and the participation of traditional owners in caring for Country. There may also be opportunities to contribute to national species exchange and recovery programs.

The feral predator-free area in Yathong Nature Reserve will seek to enable:

- the reintroduction of species currently considered extinct in New South Wales, such as burrowing bettong, brush-tailed bettong, western quoll, greater stick-nest rat, greater bilby, Mitchell's hopping mouse, bridled nailtail wallaby and western barred bandicoot
- the establishment of new populations of one species which is locally extinct, namely the desert mouse
- support for the recovery of up to 19 threatened species such as kultarr, southern ningai, striped-faced dunnart, malleefowl, striated grasswren, red-lored whistler and southern scrub-robin
- all species proposed for reintroduction to feral predator-free areas in New South Wales are subject to detailed assessments and approval in accordance with the Department's *Translocation Operational Policy* (DPIE 2019c) and in consultation with relevant state and national species experts.

NPWS will continue to manage vertebrate pests and fire as key requirements for protecting native biodiversity and maintaining habitat values in the reserves, especially those values important to threatened species. Establishing a feral predator-free area and eradicating feral cats, foxes, and other pest animals within the feral predator-free area will be a priority. The control of feral goats, rabbits and pigs will also remain high priorities (see Section 2.4).

2.4 Weeds and pest animals

The *Biosecurity Act 2015* and its regulations provide specific legal requirements for the response, management and control of biosecurity risks, including weeds and pest animals. These requirements apply equally to public land and privately-owned land. Under this framework, Local Land Services (LLS) has prepared regional strategic weed management plans and regional strategic pest animal management plans for each of its 11 regions.

The *Western Regional Strategic Weed Management Plan 2017–2022* (Western LLS 2017) and *Western Regional Strategic Pest Animal Management Plan 2018–2023* (Western LLS 2018) identify priority weeds and pest animals for the region and appropriate management responses (i.e. prevention/alert, eradication, containment or asset protection).

Previously the NPWS regional pest management strategy for the Western Rivers region (OEH 2013) identified pest species and priority programs for the Central Mallee reserves. A new pest management strategy is being developed for the reserves by NPWS which will be consistent with the priorities of the LLS' regional strategic pest and weed management plans, as well as other important programs such as the *Biodiversity Conservation Program*.

The pest management strategy aims to minimise adverse impacts of introduced species on biodiversity and other reserve and community values while complying with legislative responsibilities. Additional programs may also be undertaken in cooperation with neighbouring land managers in response to emerging issues.

Due to the continuity of the Central Mallee reserves with the Hunthawang section of Lachlan Valley National Park, wherever practical, pest control operations are undertaken simultaneously in this park and the reserves.

2.4.1 Pest animals

With the establishment of vast pastoral holdings in the Western Division from the 1840s onwards, introduced animals brought about dramatic changes to native Australian

ecosystems. Several of these introduced animals have become major 'landscape pests' in the semi-arid zone, including feral cats, foxes, goats, rabbits, feral pigs and deer. Wild dogs are also considered an emerging pest which may require control into the future. Each of these species continues to have impacts on biodiversity, cultural heritage, ecosystem function and landscape values. The main priorities for pest control are feral cats, foxes, goats and rabbits.

The impacts of each of these species are classified as key threatening processes at state and national levels. All are identified as regional priority species under the Western LLS strategic pest animal plan. Significant investment and operational effort are being directed to aerial culling and baiting, ground shooting and mustering of pest species in the reserves. Where possible NPWS works with LLS and neighbours to coordinate NPWS pest control programs.

Prior to reservation, a network of ground tanks was established to supply water for sheep. With the exception of those maintained with stock-proof fencing for domestic water supply, ground tanks have been decommissioned. These strategic measures, when combined with ongoing aerial and ground-based operations, have helped to improve pest management efforts.

Feral cats and foxes

Feral cats and red foxes are the key drivers of the decline in most mammals (Radford et al. 2018; Woinarski et al. 2015). Feral cats and foxes also impact on birds (Garnett et al. 2011; Woinarski et al. 2017), reptiles (Chapple et al. 2019; Woinarski et al. 2018), and amphibian species (Woinarski et al. 2020). In view of their significant impacts, predation by feral cats and predation by the European red fox are listed as key threatening processes under the Biodiversity Conservation Act and the Environment Protection and Biodiversity Conservation Act (DAWE n.d.b; NSW SC 1998,2000c).

Nationally, feral cats alone kill over an estimated 1.5 billion native animals each year, including mammals, birds, reptiles and frogs (TSR Hub 2020). In New South Wales, cats are thought to impact 117 threatened species, more than any other feral animal species (Coutts-Smith et al. 2007).

Foxes suppress native animal populations particularly medium and small-sized ground-dwelling and semi-arboreal mammals, and ground-nesting birds. In the Central Mallee reserves they have had a significant impact on malleefowl preying on malleefowl eggs and birds at all stages of development. Foxes also prey on domestic stock. Fox control has been carried out in the reserves since the early 1990s using baiting, and ground and aerial shooting. A comprehensive baiting facility for both ground and aerial operations is located at the Yathong Shearers Quarters.

There is no effective landscape-scale control for feral cats. This means we are currently unable to materially limit their impact on native wildlife. Foxes are being actively controlled in the reserves in coordination with a majority of landowners in the surrounding region with some success. The best available science recommends that this ongoing effort be supplemented with the expansion of the network of feral predator-free areas across a range of habitats (see Box 3). Control of feral animals will be conducted in line with feral animal control plans and will use a range of conventional techniques, including trapping, shooting and baiting. Control activities will also be undertaken in accordance with relevant codes of practice (including animal welfare requirements) and Environment Protection Authority / Australian Pesticides and Veterinary Medicines Authority (APVMA) permits. Emerging technologies will be considered and may be deployed in an experimental design if appropriate resources are available.

Box 4: Cat Project

Three sites have been identified in the Central Mallee reserves to research feral cats and potential control techniques. The work is being led by the University of New England, in partnership with the Department of Primary Industry (DPI) and NPWS. Six other sites have also been identified for the project elsewhere in New South Wales to help gather data from a diversity of landscapes and ecosystems used by feral cats.

The purpose of the project is to explore solutions to feral cat predation of native fauna. The project will run for at least five years, having commenced in August 2019.

The project involves establishing large-scale monitoring arrays which collect valuable baseline data about native animal responses and feral cat behaviour. The results of this project will inform strategies for the eradication of feral cats from the predator-free area. On completion of the Cat Project, consideration will be given to adding the area in the north-west corner of Yathong Nature Reserve to the adjoining feral predator-free area.

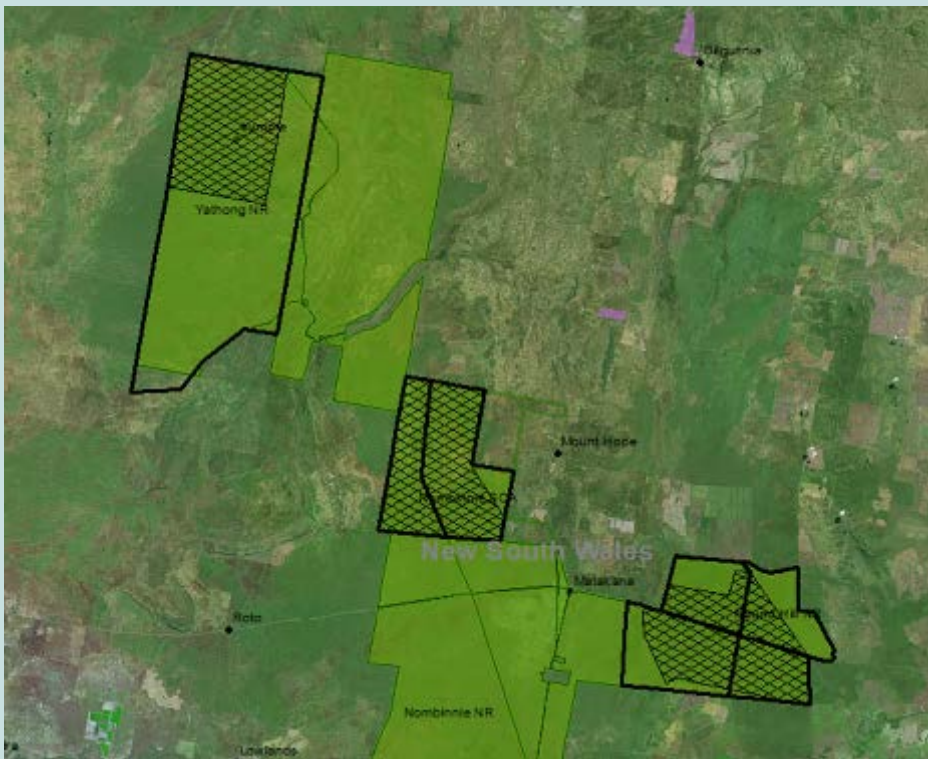


Image showing location of cat research sites (i.e. hatched areas) and malleefowl survey areas (bold-edged areas) (except Nombinnie).

Feral goats

Goats are a significant problem in the semi-arid environment of western NSW, where they can tolerate extended dry conditions and are unimpeded by standard stock fencing. Their foraging habitats are extremely destructive, they can breed rapidly, and they are able to move many kilometres in a day. Grazing by feral goats can severely impact the regeneration of native plant species, particularly where plants are already stressed by drought and other threatening processes. Sustained use of an area by goats reduces ground cover, destabilising the ground surface and resulting in erosion.

Competition and habitat degradation by feral goats is a key threatening process under both the Biodiversity Conservation Act and the Environment Protection and Biodiversity

Conservation Act (NSW SC 2004 and DAWE n.d.b respectively). The feral goat is identified by the International Union for the Conservation of Nature as one of the 100 worst invasive species in the Global Invasive Species Database (IUCN 2017). In western NSW, goat densities are among the highest for any arid region in Australia (Western LLS 2018) (see Figure 3).

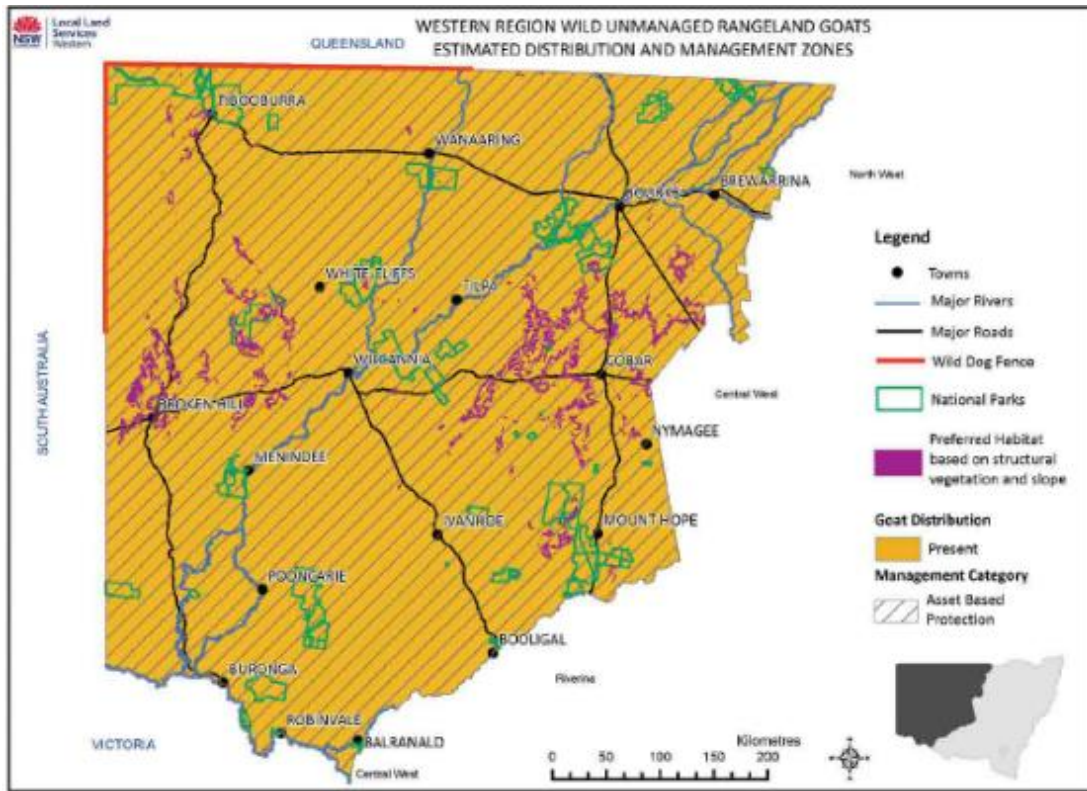


Figure 3 Distribution of ‘wild unmanaged’ rangeland goats in western NSW

Source: Western LLS 2018

Feral goats have had major adverse impacts on natural and cultural values throughout the reserves. Feral goats are implicated in the decline of long-lived canopy species in the reserves such as kurrajong, mulga, and white cypress, as well as several threatened plant species (DPIE 2019b). In the reserves, the rocky terrain of the Merrimberriwa Range provides optimal habitat and refuge for feral goats. Feral goats are water-dependent and are suspected of subsisting on water in permanent rock pools in the range.

Goat populations are actively controlled through ground mustering by licensed contractors, ground shooting and aerial culling. There are a variety of factors affecting the availability and success of these programs, and while more sustained management effort has seen a noticeable reduction in goat numbers over the last five years, goats are ubiquitous in the landscape and goat control is ongoing. Other factors have also helped to reduce goat numbers, including the decommissioning of most of the artificial water points in the reserves, the Millennium Drought (late 1996 to mid-2010), the following drought between 2015 and 2019, and high market prices for goats which lead to reduced off-park populations. However, it is likely that goat numbers will continue to fluctuate.

Goats are a threat to Aboriginal cultural heritage sites. Rubbing against rock surfaces, disturbing dust and fouling caves damage Aboriginal rock art, and increased erosion and trampling disturb surface artefacts. As aerial shooting and helicopter activity is excluded from known and likely rock art sites (to avoid damage from rotor wash and potential ricochet), effective control of goats requires the implementation of other control methods which can target goats in these areas, such as ground shooting.



Photo 4 Rocky terrain of the Merrimurriwa Range. Laura Douglas/DPIE

Rabbits

According to Eldridge et al. (2006), the European rabbit has established itself as the most ecologically damaging feral herbivore in Australia. Unlike native rodents and mammals which play a positive role as 'ecosystem engineers', rabbits have substantial detrimental impacts on soil and vegetation. Rabbits accelerate erosion by removing plant cover and have contributed to the decline of many native species, including cypress pine, *Acacia* spp., *Hakea* spp. and belah/rosewood communities. Prolonged disturbance by rabbits also leads to the persistence of weedy plant species (Tiver & Andrew 1997, cited in Eldridge et al. 2006).

Competition and grazing by the feral European rabbit are listed as a key threatening process under both the Biodiversity Conservation Act and the Environment Protection and Biodiversity Conservation Act (NSW SC 2002 and DAWE n.d.b respectively).

Box 5: Permanent impacts linked to rabbits

Rabbits reached plague proportions in the Western Division in the late 19th century at the same time that there was a rapid build-up in sheep numbers. The resultant grazing pressure, combined with recurring droughts, led to widespread loss of vegetation cover and deterioration of the landscape.

Evidence to the Royal Commission of 1901 into the condition of the Crown tenants of the Western Division of New South Wales blamed rabbits for the disappearance of the edible shrubs which had been a feature of the original vegetation (Condon 2002).

Rabbits are an ongoing issue in the Central Mallee reserves, their populations fluctuating in response to favourable growing conditions. Rabbits have been implicated in modifying habitat and reducing food resources important for malleefowl. Calicivirus (rabbit haemorrhagic disease virus) was released in Yathong Nature Reserve in late 1996, early

1997. However, the main form of rabbit control in the reserves until about 2012 was physical destruction of rabbit warrens by ripping.

Feral pigs

Feral pigs can have a substantial impact on conservation values. They cause major disturbance and damage to soils, roots, sensitive ground flora and wetland environments. Areas disturbed by feral pigs are at risk from subsequent weed invasion and soil erosion. Feral pigs are also a potential host of a number of exotic diseases.

Pigs occur at a much lower incidence in semi-arid environments than many other introduced vertebrate pests, and ongoing dry conditions tend to limit pig numbers in the reserves. They tend to occur in watercourses throughout the reserves, mostly only after wet weather. Substantial numbers of pigs are also known to move up from Hunthawang under favourable conditions. Pig control is carried out across the Central Mallee reserves through a combination of aerial culling, trapping, baiting and ground shooting.

Feral deer

Feral deer have a range of negative environmental impacts, including spreading weeds, destroying native vegetation by browsing, trampling, ringbarking and erosion. They also increase the risk of accidents near roads and railway lines and compete with domestic stock for grazing.

Fallow deer occur in Nombinnie Nature Reserve where numbers are relatively low in comparison to populations in more mesic environments, but can increase following rainfall. In similar conditions, where uncontrolled, deer populations rapidly expand and invade new country, and the risk of this emerging threat to ecological values is considered high. Fallow deer were recently culled by aerial shooting in the south of Nombinnie Nature Reserve where they favour more mesic vegetation types.

2.4.2 Weeds

The reserves have a low level of weediness and overall weeds are not having a major impact on natural and cultural values in the reserves. However, existing and any new weed infestations are monitored and managed as necessary in response to their level of threat to reserve values. Weeds tend to be ephemeral and are therefore more common after rainfall or fire, for example Paterson's curse and Bathurst burr.

The main weeds of concern are African boxthorn around Yathong Homestead, and thornapple in bumble box open woodland and red box woodland in Yathong Nature Reserve. African boxthorn is listed as a priority species for asset protection under the LLS regional weed management plan (Western LLS 2017). An infestation of *Opuntia* cactus species also requires ongoing monitoring and treatment at Shepherds Hill.

2.5 Fire

The primary objectives of NPWS fire management are to protect life, property and community assets from the adverse impacts of fire, while also managing fire regimes in parks to maintain and enhance biodiversity. NPWS adopts a risk management approach across planning, prevention, response and recovery phases of its fire management. The protection of human life is the highest priority when managing the risk to assets. NPWS maintains cooperative arrangements with surrounding landowners and the Rural Fire Service and is a member of the Murrumbidgee Irrigation Area (MIA) and Far West bush fire management committees.

2.5.1 Fire management strategy

A fire management strategy which defines the fire management approach is prepared for all NPWS reserves and is updated as required. These strategies outline the recent fire history of the reserves, key assets in and adjoining the reserves, including sites of natural and cultural heritage value, fire management zones and fire control advantages such as management trails and water supply points. The strategies also contain fire regime guidelines for conservation of the vegetation communities found in the reserves based on biodiversity thresholds.

The reserve fire management strategies for the Central Mallee reserves designate the majority of the reserves' area as a land management zone (OEH 2014b, OEH 2014d). The objective of this zone is to conserve biodiversity and protect cultural and historic heritage. Asset protection zones are identified exist around homesteads and management infrastructure. Linear strategic fire advantage zones occur adjacent to the fire trail network.

The reserve fire management strategies will be reviewed to take account of the Cat Project and new infrastructure such as the feral predator-free area. The review will also consider how best to provide a source of water for firefighting which does not allow access for feral pest animals.

Fire is an integral part of the Australian environment. It is a major factor in determining the structure and species composition of vegetation and has long-term effects on animal populations. Inappropriate fire regimes can lead to loss of particular plant and animal species and communities, and high-frequency fires are listed as a key threatening process under the Biodiversity Conservation Act (NSW SC 2000b).

Fire regimes being the cumulative pattern of fires and their individual characteristics (fire type, frequency, severity, season of occurrence) are major factors influencing the distribution and composition of plant and animal communities, including in the Central Mallee reserves. Through the use of prescribed fire and other fire management techniques, NPWS has considerable potential to influence these factors. A great deal of research has been directed at understanding the effects of fire on plants and animals in mallee ecosystems in order to develop an appropriate fire regime which will not compromise conservation of this significant vegetation type (Benshemesh 1990; Bradstock 1989, 1990; Caughley 1985; Haslem et al. 2011; Noble et al. 1990; Priddel & Wheeler 1995; Sass & Wilson 2006; Schlesinger et al. 1997). This has included research in the Central Mallee reserves, Tarawi Nature Reserve and Mallee Cliffs National Park, as well as in other states (Bennett et al. 2010).

2.5.2 Fire history

The fire history of the reserves before 1957 is poorly documented. Records exist of fires in the area during the following seasons: 1917–18, 1921–22, 1931–32 and 1939–40 (Cullenward 1989a); but the effect of these fires in the area that is now the Central Mallee reserves and their surrounds is unknown.

Between 1957 and 2013 wildfire affected the reserves in 12 fire seasons. In 1957, large fires burnt extensive areas from Cobar to Mount Hope, Hillston and Roto, including all of the Nombinnie reserves, most of Round Hill and a small portion of Yathong. In 1974–75, almost all of Yathong was burnt by wildfire. Then again in the 1984–85 fire season, about 80% of the reserves were burnt, destroying Lysmoyle and Nombinnie homesteads and causing extensive damage to boundary fencing.

These large fires consistently followed 'speargrass years' occurring after La Ninã weather conditions, which promote the growth of ephemeral grasses and increased fuel loads (NPWS 2003b).

The impacts of the 1974–75 fires led to development of the Mallee Bushfire Prevention Scheme (Cullenward 1989b) and the clearing of wide fire breaks. After large bushfire events in 1974–75, 1984–85 and 2000, NPWS staff observed that fire ‘shadows’ were created along linear fire breaks. These fire refugia areas provided a safe haven for animal species during the passage of the fire front and vital food sources following the fires as unburnt patches in the landscape (John Brickhill, pers. comm., 2021).

Based on these observations, in mallee habitats NPWS now implements linear prescribed burns adjacent to fire trails, and north–south strip prescribed burns in larger blocks of land management zones, in order to ‘break up’ the continuous fuel loadings and provide for a reduced-fuel zone. Implementing linear, fuel-reduced breaks across the landscape may provide fire control advantages and assist in creating fire refugia areas during a large wildfire event. No very large landscape fires have occurred across this landscape since 1984, so the effect of these prescribed burns remains untested, although positive results have been observed from other reserves (John Brickhill, pers. comm., 2021).

2.5.3 Fire ecology

The fire fuel of leaf litter, twigs and loose bark that accumulates under individual mallee clumps is typically discontinuous with large patches of open ground. Therefore, it is the growth and accumulation of ephemeral grasses and forbs in the years after effective rainfall and significant flooding events that can create a continuous fuel layer that will carry fire.

In the Central Mallee reserves, fire can have both beneficial and undesirable outcomes. For example, fire can provide a nutrient-rich ash bed, increased light penetration and decreased competition for recruitment. Fire also benefits plant species which need fire to release or germinate seed. The flush in vegetation germination immediately after fire has the potential to produce resources for animals (including seeding grasses for malleefowl and seed-eating mammals). Conversely, grazing by introduced pests and native herbivores after fire affects the recruitment of palatable plants. Some species can disappear from the landscape if fire kills plants and eliminates seed banks or if suitable habitat for animals has been lost.

Mallee ecosystems are fire prone (Noble 1989) and fire in this landscape is a key driver of ecological change. In mallee vegetation communities, habitat and fuel characteristics such as leaf litter, hollows, canopy cover and height, bark and porcupine grass cover all increase in the first 35 years after fire. From about 35 years to 100 years post-fire these characteristics provide optimum habitat for a large number of species including several threatened species. Maximum fuel loads are also attained by 35 years and they remain high for at least another 65 years (Haslem et al. 2011).

Plant species and communities vary in their adaptation to and reliance on fire. Dune mallee (also referred to as spinifex mallee) contains plant species which are generally fire dependent, while others such as sandplain mallee (also referred to as chenopod mallee) are less tolerant and less flammable. Malleefowl prefer older age-class mallee, however, they are also known to occupy burnt areas 5 years after fire.

A better understanding is needed of the significance of a diversity of fire age classes at different spatial scales. The current fire management objective in mallee-dominated vegetation communities is to provide patchiness and multiple age classes whilst maximising the amount of older mallee which has optimum habitat features.

Fire management for the reserves will be guided by the following general principles (NPWS 2003b):

- the fire regime needs to be diverse in terms of intensity, frequency and size
- maintaining areas of unburnt vegetation is desirable because unburnt areas provide refuges and source populations for recolonisation of burnt areas; and maintaining large

areas of unburnt vegetation is undesirable because a single fire event could impact on the whole area

- where possible, thresholds will be developed for threatened plant species as the limited abundance/distribution of these species may be indicators of the general health of existing vegetation communities
- wildfire will be suppressed where it could potentially impact on life, property and sensitive areas or vegetation communities where fire should be avoided.

It is also important to note that not all vegetation communities require fire to maintain ecosystem process and health. In these reserves, fire should be avoided in belah – rosewood woodlands because fire is not the primary germination mechanism for these species. Old-growth belah trees provide habitat for threatened species. These areas generally have low fuel levels and are natural fire control advantages during average or below average rainfall years.

Longer periods between fires will result in greater vegetation variety and it appears desirable that communities in the park should generally not be burnt more often than at least every 20–40 years. Some areas should remain unburnt for as long as possible to provide old-age stands of vegetation. Mallee pine is thought to take 15 years to form cones, but mallee pine clumps will survive for up to 500 years if they escape being burnt for the first 50 years of their life. On the other hand, a number of reptiles are most favoured by the 6–25 years post-fire stages because fire promotes the growth of porcupine grass (Caughley 1985) which is important shelter and habitat for reptiles. The most desirable result would be for a diversity of post-fire stages and age classes to be present in some part of the reserves to provide habitat diversity for different groups of animals.

Key habitat elements develop slowly after fire in mallee (Haslem 2011) and there is a preference by some species, for long unburnt mallee (Taylor et al. 2012; Watson et al. 2012). However, mallee-dependent species show varying responses to time since fire so monitoring of recovery is needed after wildfire occurs, together with management of soil erosion, invasive pests and weed species.

2.6 Climate change

Human-induced climate change is listed as a key threatening process under the Biodiversity Conservation Act (NSW SC 2000a), and habitat loss caused by human-induced greenhouse gas emissions is listed under the Environment Protection and Biodiversity Conservation Act (TSSC 2001).

The latest information on projected changes to climate are from the NSW and ACT Regional Climate Modelling (NARClIM) project (OEH 2014a). The climate projections for 2020–2039 are described as ‘near future’ (or 2030); and projections for 2060–2079 are described as ‘far future’. The snapshot shown in Table 3 is for the Far West Region which includes Yathong Nature Reserve and the northern half of the Nombinnie reserves. The southern half of the Nombinnie reserves are in the Murray Murrumbidgee Region.

Table 3 Far West Region climate change snapshot

Maximum temperatures are projected to increase in the near future by 0.3–1.0°C	Maximum temperatures are projected to increase in the far future by 1.8–2.7°C
Minimum temperatures are projected to increase in the near future by 0.4–0.8°C	Minimum temperatures are projected to increase in the far future by 1.4–2.7°C
The number of hot days (i.e. > 35°C) will increase	The number of cold nights (i.e. < 2°C) will decrease
Rainfall is projected to decrease in winter and spring	Rainfall is projected to increase in summer and autumn
Average fire weather is projected to increase in summer and spring	Number of days with severe fire weather is projected to increase in summer and spring

Source: OEH 2014a.

The region currently experiences more hot days over 35°C each year than the other regions in New South Wales (30–40 on average). Under the projections for climate change, this is expected to increase by 20–30 additional days.

The projected increases in temperature and increased number of hot days will lead to an increase in evaporation in western NSW. This is projected to create drier soil conditions throughout the year. Increases in severe fire weather days and length of fire season are expected. Although weather conditions conducive to large intense fires are likely to increase, the amount of fuel available, such as grasses and herbaceous plants, may decrease. However, in areas with available fuel and fire-prone vegetation, such as mallee woodlands and porcupine grass grasslands, fires are likely to increase.

While a slight increase in rainfall is projected to occur, the modelling of run-off shows significant variation, and there are no clear patterns about whether or not droughts are going to be more or less severe (DECCW 2010).

Larger areas will be vulnerable to increased erosion by wind and by heavy downpours during more frequent intense storms. This increases the risk of disturbance and damage to Aboriginal cultural heritage in the landscape.

Increased temperatures and the increase in hot days are also likely to exceed the physiological limits of many soil-crust lichens and cryptogams which are present in arid environments (DECCW 2010). Soil crusts form a major component of ground cover in these environments and play an important role in soil stability, nitrogen fixing and soil fertility.

Ephemeral wetlands will be under increased pressure to support waterbirds and other native animals through the dry times.

Throughout the region, animal species which are unable to cope with the intensification of extreme temperatures will decline. Species most at risk are those already under pressure because they are unable to migrate or adapt, for example, because they have specialised habitat or thermal requirements, small population sizes or slow growth rates. This could include the mallee specialists such as malleefowl, which require sufficient rainfall at the right time of year to build their nests in long-unburnt mallee communities.

The Central Mallee reserves have been managed as conservation reserves for between 50 and 60 years to mitigate the effect of threatening processes and restore habitat needed by native plants and animals. Reserve management activities aimed at avoiding fire in old-age mallee and decommissioning artificial water sources have helped build resilience in a region where mallee ecosystems have been greatly reduced. Continuing these measures and maintaining a species-sensitive fire regime in the broader landscape will help reduce the severity of the effects of climate change on the reserves.

However, long-term conservation of biodiversity under changed climatic conditions depends in part on the protection, enhancement and connection of remaining habitat across the landscape, incorporating vegetation remnants on both public and private lands. Cooperative arrangements with neighbours will continue to be essential for controlling vertebrate pest species in the broader landscape to protect the natural and cultural values of the reserves.

3. Looking after our culture and heritage

3.1 Aboriginal culture and heritage

Aboriginal people have an association with and connection to Country which includes and transcends the Central Mallee reserves. Aboriginal communities associate natural resources with the use and enjoyment of foods and medicines, caring for Country, passing on cultural knowledge, kinship systems and strengthening social bonds. Aboriginal heritage and connection to nature are inseparable from each other and need to be managed in an integrated manner across the landscape.

The Central Mallee reserves are part of Ngiyampaa Country which is roughly bounded by the Darling, Barwon, Bogan and Lachlan rivers. The western boundary lies around Ivanhoe and near the Neckarboo Range. Along these river corridors there is shared Country, for example with Wailwan to the east, Paakantji (Baakantji) to the north-west, and with Wiradjuri to the south and south-east. Shared Country would be used by other Aboriginal people in times of drought, for ceremony, for marriage or for trade. Roughly 75 kilometres north-west of the Central Mallee reserves, there is a dreaming line of mythological places and rock art sites running from the Darling River below Bourke through Gundabooka, Wuttagoona, Mount Grenfell Historic Site, Bulla Bulla, Mount Doris, Neckarboo, Corinya, Mount Manara and down to Pooncarie back on the Darling River. This dreaming line is believed to have delineated the boundaries of Ngiyampaa Country (OEH 2015).

Ngiyampaa People group themselves according to the type of Country they occupied: *Pilaarrkiyalu* (Belah Tree People), *Nhiilyikiyalu* (Nelia Tree People), and *Karulkiyalu* (Stone Country People). The Pilaarrkiyalu People occupied the dry, riverless country between Sandy and Willandra creeks, including the area now in the Central Mallee reserves. In this area, they were also sometimes known as *Kaliny-tyalapaang-kiyalu* (Dryland People). Their language is Ngiyampaa Wangaaypuwan, meaning they speak the Ngiyampaa language the Wangaaypuwan (Wongaibon) way (Beckett & Donaldson 2003).

Box 6: What is 'Country'?

To Aboriginal people, the landscape is made up of many features that are interrelated. These include land, water, plants and animals, places and stories, historical and current uses, and people and their interactions with each other and place. These features are central to Aboriginal spirituality and contribute to Aboriginal identity. They are inseparable and make up what is known as 'Country'.

Aboriginal sites are places with evidence of Aboriginal occupation or places that are related to other aspects of Aboriginal culture. They are important as evidence of Aboriginal history and as part of the culture of local Aboriginal people.

The earliest written accounts of the Ngiyampaa People, culture and place names were compiled by a local settler, ALP Cameron, in 1885. He also described art sites on 'Coombie Station' which adjoined 'Yathong Station' to the north, noting that the white 'pipe clay' used in the paintings was abundant in the locality (Cameron 1900). Several rock art sites using white clay have also been recorded near permanent rock pools in the Merrimurriwa Range on Yathong Nature Reserve. However, prior to sinking of bores by European settlers, water was a scarce commodity, and it is possible that Aboriginal people visited the area rather than occupying it continuously (Beckett & Meredith 2006).

In their traditional Country the Pilaarrkiyalu hunted and gathered a greater diversity of wildlife and plants than are now present. Some of the animals remembered by Pilaarrkiyalu

Ngiyampaa today as being more prevalent prior to European settlement include the bustard, bilby, carpet snake and malleefowl. Plants had many uses and enabled Aboriginal people to survive in a challenging landscape (see Table 4).

Table 4 Traditional Ngiyampaa uses for native plants

Ngiyampaa name	Common English name	Traditional uses
<i>Pilaarr</i>	Belah	The significant and special symbol of the Pilaarrkiyalu as the Belah Tree People Extremely good cooking wood, especially for <i>ngurruy</i> (emu)
(Not remembered)	Beefwood	Prolific, sweet nectar Wood used for boomerangs
<i>Tharii</i>	Butterbush, dogwood, native apricot	When the seed is red and ripe it can be ground for use as an aphrodisiac
<i>Thirriil</i>	Bullrush, cumbungi	Rhizomes are source of gluten; baked and eaten as bread Fibre also used to make thread for fishing nets and other utensils
<i>Karapaarr</i> (Keewong mob) <i>Puratharr</i> (Trida mob)	White cypress pine	Used to set broken limbs
<i>Thiku</i>	Emu bush	Bathing in water boiled with leaves aids in the treatment of measles and other skin problems Regular doses of leaves and water has cured stomach ulcers
<i>Tharramulan</i>	Mallee fringe-lily	An important yam The roots, leaves and flowers can all be eaten
<i>Yaama</i>	Kurrajong	Roots used for fishing line, rope and strengthening other rope fibres Young fruit can be picked and cooked for eating Older seeds can be ground for making flour. Tips of the roots can also be eaten and are a valuable source of water
<i>Ngarrakaray</i>	Leopardwood	Used for making boomerangs and ornaments
<i>Mithirr</i>	Miljee	Seeds can be eaten as is, or ground for making flour
(Not remembered)	Common nardoo	Provides the best seeds for making flour
<i>Kuwanhthaa</i>	Sweet quandong	Fruit can be eaten cooked or dried Seeds can be ground for making flour Stones were also used to play a game similar to marbles
<i>Puutu</i>	Quena	Fruit are cooked on the coals for eating, typically as accompaniment to meat
<i>Wilkarr</i>	Wilga	Seeds can be ground to make flour

Ngiyampaa name	Common English name	Traditional uses
		Bark of the roots can be used to make splints for broken bones Timber can be used for boomerangs Leaves can be collected to form a mattress
<i>Yaaru</i>	Yarran	Gum can be collected and eaten or soaked in water for a sweet drink. Wood suitable for boomerangs
<i>Yarrayipiyay</i>	Rosewood	Fruit can be eaten fresh or dried Seeds can be ground for flour
<i>Puthaputhay</i>	Old man's weed, common sneezeweed	Rubbing liquid on joints made from boiling the whole plant in water can bring relief from arthritis

Source: Harris et al. (2000).

Yathong Run and Station were established on traditional Ngiyampaa Country in the mid-1860s and many Ngiyampaa worked on 'Yathong' over the years. Aboriginal girls were typically employed in domestic roles while Aboriginal men worked as stockmen, fencers, boundary riders and shearers.

Today, most Ngiyampaa Wangaaypuwan descendants can trace connections to stations further west than the Central Mallee reserves, such as Keewong, Trida, Conoble and Marfield; and to government settlements at Carowra Tank, Menindee, Brewarrina; and since 1949, Murrin Bridge (Beckett & Meredith 2006). Ngiyampaa are also settled in places like Euabalong, Lake Cargellico, Hillston and Roto.

The records of 'Yathong Station' were unfortunately destroyed when the homestead burned down in 1965 but oral histories have provided valuable information about Ngiyampaa in the region. These include 'Working on Yathong' (Beckett & Meredith 2006), Ngiyampaa elder stories from the Mount Grenfell Board of Management (Waters Consultancy 2008), and reminiscences by Aunty Eliza Kennedy (Kennedy & Donaldson 1982). Aunty Eliza grew up around Keewong (north-west of the Central Mallee reserves) around the turn of the 19th century, by which time most of Ngiyampaa Country had already been occupied and subdivided by white pastoralists for several decades. For the early part of her life, Eliza regularly moved camp with her mob from tank to tank. This gradually changed with Aboriginal people getting work on stations and becoming part of station life.

Limited formal survey has been carried out for Aboriginal cultural heritage in the Central Mallee reserves. At times, Aboriginal people visiting the reserves have found sites, but they have not been recorded in NPWS Aboriginal Heritage Information Management System (AHIMS).

While 56 Aboriginal sites have been recorded in Yathong Nature Reserve, only a handful have been recorded in the other 3 reserves and it is likely that many more sites are present. The sites in Yathong are concentrated along the Merrimerrriwa Range and Keginni and Homestead creeks. Open camp sites, artefacts and modified trees are common along the creeks. The rock shelters with art found in the Merrimerrriwa Range are part of the dreaming line described in the beginning of this section. No Aboriginal sites have been recorded in mallee vegetation.



Photo 5 Art site on Keginni Creek. David Egan/DPIE

3.1.1 Management considerations and opportunities

Ngiyampaa have been actively involved with the Central Mallee reserves. A statement of joint management was agreed to with NPWS in 2007 and culture camps occurred on a regular basis with the help of a culture camp steering committee made up of Ngiyampaa traditional owners and NPWS staff. These camps were attended by up to 40 people from the Aboriginal community and provided opportunities for the passing on of cultural knowledge and strengthening connection with Country. In 2012, a keeping place was established in Yathong Nature Reserve for receiving Aboriginal remains repatriated from overseas.

Mawonga adjoins Yathong and Nombinnie nature reserves to the south and was dedicated as an Indigenous protected area in 2019. In the past Mawonga was an important place for ceremony, part of a young novice's journey through initiations, for hunting, family and clan interaction. Today it is administered by the Winangakirri Aboriginal Corporation and continues to be an important place for teaching, learning and connection (NIAA n.d.). There may be potential for some combined operations between NPWS and the Winangakirri Board, for example, further cultural surveys and pest control. NPWS will continue to support requests for Ngiyampaa to connect with Country on the Central Mallee reserves.

In 2012 Ngemba, Ngiyampaa, Wangaaypuwan and Wayilwan lodged a native title claim for traditional Country (NC2012/001) which is yet to be determined. The claim area includes the Central Mallee reserves and therefore the determination may have a bearing on how the reserves are managed in the future.

Recent inspection of a number of rock art sites shows that protective mesh installed on the floor of the shelters in about 2006 to reduce goat impacts are still effective.

Although the NSW Government has legal responsibility for the protection of Aboriginal sites and places, NPWS acknowledges the right of Aboriginal people to make decisions about their own heritage. Aboriginal communities will be consulted and involved in managing

Aboriginal sites, places and related issues; and in promoting and presenting Aboriginal culture and history.

3.2 Shared cultural heritage

Box 7: Shared history

History has taken place across the landscape. This includes the history of the first Australians, Aboriginal people, and our **shared history** since European settlement.

Cultural heritage comprises places and items that may have historic, scientific, cultural, social, archaeological, architectural, natural or aesthetic significance. NPWS conserves the significant heritage features of NSW parks.

From 1840 to the 1880s the western region of New South Wales was the frontier of Australian settlement as squatters took up land along the river systems (Condon 2002). Squatting on large areas of ‘unoccupied’ Crown land came to an end by about 1870, and various forms of tenure were consequently introduced in an effort to control the take up of land and to establish feasible land management mechanisms. The Western Division was formed under the *Crown Lands Act 1884*, although Western Lands leases did not come in until the *Western Lands Act 1901*.

Occupation of the ‘waterless’ backblocks between the Darling and Lachlan rivers by European settlers for sheep farming initially depended on the excavation of ground tanks or hand-powered windlasses and horse-powered whims to bring water from deep wells up to the surface. The tapping of the Great Artesian Basin in 1879 led to the development of networks of bore-fed tanks constructed using mechanical drilling rigs.

From the 1850s small towns were established in the region around the reserves to provide for the needs of the settlers, such as Hillston, Mossgiel, Ivanhoe, Brewarrina, Louth and Bourke. Copper was mined in Cobar in 1870 and Nymagee in 1878.

Box 8: Some impacts of early pastoral settlement

The promise of pastoral wealth, high wool prices and the introduction of wire fencing all contributed to rapid occupation and development of the backblocks in the 1870s, together with a rapid build-up of sheep. One estimate suggests that there were 6.5 million sheep in the Western Division by 1879 (Butlin 1962, cited in Condon 2002). Sheep numbers increased until the first of several droughts struck in 1884. Rabbit populations also grew exponentially and by 1890 had occupied the whole of the Western Division.

The severe drought from 1895 to 1902, combined with overstocking, rabbit plagues and erosion, led to land degradation on a massive scale. Mining developments of the late 19th century also contributed to land degradation through their voracious appetite for timber for pit-props and firewood to keep smelters stoked for pre-processing. For example, trees were removed from a wide area around the early town of Cobar (Condon 2002). The devastation and impact of natural disasters, together with widespread frustration with pastoral tenures, led to a Royal Commission into ‘the condition of Crown tenants in the Western Division’ in 1901. This was to be a major watershed in the administration and management of the lands of the Western Division (Condon 2002).

The area of the reserves was first surveyed in 1868 when the run was called 'Callytria' (after the callitris pine trees) (Beckett & Meredith 2006). The DeSailly brothers, wealthy pastoralists from Victoria, were the first to take up a lease over 'Yathong' with an area of 21,000 acres (8498 hectares). The DeSailly brothers acquired a whole suite of properties and set about supplying them with a source of water by digging channels (the 'Willanthy Cut' from the Lachlan River), damming creeks with earth (Willandra Creek) and later by sinking bores with steam-driven machinery (Condon 2002). At their peak, the DeSailly brothers controlled more than a million acres in New South Wales and were prominent in the Riverina secessionist movement of the 1860s.

Their landholdings declined in the late 1880s when 'Yathong' was mortgaged by the New Zealand Loan and Mercantile Agency and run as one property in a chain of holdings. At its largest 'Yathong' covered 250,000 acres (101,172 hectares), but its size fluctuated as sections of property were bought and sold. Little of this early history survives above ground in the reserves now, except the all-important tanks, a section of lashed-stake fencing and archaeological remains in the vicinity of Yathong Homestead.

From about 1900 the size of properties began to be reduced and parts of 'Yathong' were incorporated into new, smaller holdings, namely 'Glenlea', 'Nombinnie' and 'Irymple'. 'Lysmoyle' was established towards the southern end of what is now Nombinnie Nature Reserve at about the same time. Many such properties were too small to be viable and ultimately failed. The pattern of breaking up of the larger runs to create small properties and the subsequent build-up of larger runs again is characteristic of the Riverina and is well represented in the Central Mallee reserves.

In the Western Division, the majority of land is Crown land held under Western Lands leases. When NPWS was first established, in 1967, the Minister required that as expiring lease lands became available, NPWS be given an opportunity to indicate its interest as well as landholders (Condon 2002). 'Yathong' was acquired and gazetted as a nature reserve in 1971 following expiration of the Yathong lease (WLL 105). Known leaseholders include the FW Hughes Estate (1957) and the last lessees, Ted and Leslie Fryer who stayed on after acquisition until 1980. Their son Simon Fryer continues to hold an interest in the Central Mallee reserves.

In the late 1970s parts of the Western Lands leases east of the Kidman Way in eastern Nombinnie and further east towards Round Hill were converted to cropping leases. The clearing of these areas in preparation for cropping became the catalyst for resumption of these lands for conservation. A wheat crop was also grown and this area is still known to birdwatchers as the Wheatfield. Nombinnie Nature Reserve was gazetted in 1988 and Nombinnie State Conservation Area was gazetted in 2005.

3.2.2 Standing heritage in the reserves

Each of the former pastoral properties that are now part of the Central Mallee reserves had their own self-sufficient homestead complex supporting an isolated sheep station, but not all of these have survived. The homesteads on 'Yathong' and 'Irymple' are new buildings on the site of older dwellings and provide accommodation for NPWS staff. Glenlea Homestead is in ruins and nothing remains of Lysmoyle Homestead.

'Yathong' illustrates the classic Riverina homestead pattern, with approximately three kilometres separation from the woolshed and shearers quarters. This pattern began to break down with the creation of smaller properties at the turn of the century. At 'Glenlea', 'Nombinnie' and 'Lysmoyle' the living and working precincts were close together, reflecting a breakdown in the rigid class distinctions of the larger, older runs. The shearers quarters at 'Yathong', and the workers' quarters at 'Lysmoyle' are standing, but the woolsheds have been demolished or destroyed by fire. A particularly fine timber slab-and-frame stable and adjoining tack room survive at 'Yathong', but most other outbuildings have been removed.

The rooms in the Lysmoyle workers' quarters are decorated with drawings by local Aboriginal people, such as Ken Johnson and Lindsay Kirby, dating from the 1950s and 1960s (Kereszy 2000). This is a unique record of artistic efforts, reflecting the concerns of the local workers (artists) of those times.

While many of the ancillary outbuildings have disappeared, there is still evidence of the pastoral way of life, including windmills, tanks, fences and yards, rubbish dumps, and hut sites. Some collapsed bores and old mine shafts have been fenced for safety reasons and to prevent access. Taken together these provide an important resource for understanding the history and development of the area and evolution of the present landscape. Activities such as ringbarking, carried out by Chinese labourers during the 1890s depression, created a distinctive cultural landscape.

3.2.3 Management considerations and opportunities

Preliminary recording and assessment of the shared heritage places on the reserves was undertaken as part of a historic heritage maintenance survey in the 1990s. Restoration works have been undertaken to the Yathong Shearers Quarters to allow adaptive re-use as accommodation for staff, researchers and other approved groups. From 2007 to 2010, the Yathong Cookhouse was restored as an office and meeting room for NPWS staff and approved visitors staying in the Shearers Quarters. Other buildings, including an ablutions block and a baiting facility have been constructed by NPWS in the precinct to support management operations in the reserves.

Although all visitors to the reserves are requested to contact NPWS to seek permission for entry, there is evidence that people trespass into the reserves and visit ruined homesteads and other sites. NPWS has endeavoured to remove hazards to staff and visitors from all sites.

A number of oral histories have been completed for the reserves. On the basis that the majority of shared heritage in the reserves has been assessed as having local heritage significance, no further restoration work is planned for the shared heritage buildings and structures remaining in the reserves, however, buildings may be adaptively re-used for operational purposes

4. Providing for visitor use and enjoyment

The primary purpose of nature reserves is to conserve ecosystems, species, communities or natural phenomena. Nature reserves differ from national parks and state conservation areas in that there is no requirement to provide for visitor use in nature reserves. Research, educational use, nature study and enjoyment are appropriate uses where they do not conflict with conservation.

Visitation to the reserves is generally low though several discrete locations are well-known destinations for special interest groups, primarily birdwatchers (see below). The reserves currently contain no visitor facilities other than an interpretation sign at the Bruce Cullenward Drive entrance to Yathong Nature Reserve. Visiting the Central Mallee reserves is constrained by their remoteness, harsh summer conditions, reliance on unsealed roads, absence of water and lack of mobile phone reception. There are also extremely limited visitor facilities nearby. For these reasons, the Central Mallee reserves are best suited to self-reliant, nature-based activities such as birdwatching.

The establishment of a feral predator-free area in Yathong Nature Reserve and reintroduction of locally extinct and declining species will create opportunities for visitors to learn about NPWS species reintroduction programs, the ecology of the region and the species that have been reintroduced. NPWS will investigate and implement options to enable public access to and interpretation of the feral predator-free area in Yathong Nature Reserve once the area is established.

Whoey Tank in Round Hill Nature Reserve provides ready access to mallee and other bird habitats and has historically been preferred as a site for camping by birdwatchers. The tank is not maintained, and no facilities are provided. Camping for birdwatching groups at Whoey Tank has been allowed following prior arrangement. Birdwatchers also frequent an area known as the Wheatfield on the north-eastern edge of Nombinnie Nature Reserve off Round Hill Road. This location is nationally recognised and described in detail in birdwatching publications as a site for many specialist mallee birds.

The Central Mallee reserves, and the proposed feral predator-free area in particular, offer opportunities for research that are unmatched elsewhere in New South Wales. Monitoring of mallee ecosystems, their biodiversity and responses to management interventions in the Central Mallee reserves continues to inform the management of mallee values broadly and supplement research conducted in other mallee remnants. NPWS encourages environmental research and student fieldwork, provided they benefit management and do not cause undue disturbance to reserve values or management operations. The Yathong Shearers Quarters are available for use by researchers and approved groups by consent.

5. NPWS infrastructure and services

Infrastructure managed and maintained by NPWS in the reserves includes:

- A management trail network – the existing network of management trails is for use by NPWS staff and approved researchers and includes all boundaries and access between the four reserves. Public vehicle access is not permitted without consent.
- Homesteads – Yathong and Irymple homesteads are now used for NPWS staff accommodation and provide an important on-site presence for protecting reserve values and deterring unauthorised activities.
- Yathong Shearers Quarters precinct – the Shearers Quarters, ablution block and restored Cookhouse provide accommodation and facilities for visiting staff, researchers and approved groups. The precinct also includes storage sheds and a workshop.
- Airstrip – an unsealed airstrip is located 0.5 kilometre from Yathong Shearers Quarters to support aerial shooting and baiting activities.
- Lysmoyle Homestead and Shearers Quarters – these are managed as ruins.
- Boundary fencing – boundary fencing is maintained in cooperation with neighbours consistent with NPWS policy.
- Ground tanks – 3 solar-powered pumps provide a domestic water supply from ground tanks at Yathong and Irymple homesteads, and Yathong Shearers Quarters. Many other tanks have been decommissioned but may require further works to assist in the management of pest animals.
- Sealed water tanks – tanks have been installed throughout the reserves to provide a source of water for firefighting and domestic supply.



Photo 6 Airstrip for facilitating aerial pest operations and malleefowl monitoring on Yathong NR. M Billington/DPIE

5.1 Proposed new infrastructure

New infrastructure will be required for the proposed establishment of a feral predator-free area in Yathong Nature Reserve. The area under consideration for fencing is indicated in Figure 1 but the final fence alignment and location of individual infrastructure components will be confirmed following the consideration of logistical constraints and environmental and cultural impact assessments.

Infrastructure needed to support the proposal include:

- approximately 100 kilometres of feral predator-proof fencing to enclose 40,000 hectares with internal dividing fences for breeding areas or staged reintroductions
- management trails adjacent to and within the feral predator-proof fence
- potentially accommodation and supporting facilities (such as power supplies and storage facilities) for project staff and visiting researchers
- visitor access and interpretation.

6. Non-NPWS infrastructure and services

6.1 Mining and exploration

Exploration for and production of minerals and petroleum are permissible uses in state conservation areas.

It is suspected that Nombinnie State Conservation Area is underlain by felsic marine volcanic rocks and volcanic-derived sedimentary rocks of the Devonian Mount Hope Group, which belong to the Cobar Supergroup. Although mineral deposits have not been found in the area, the basement rocks are highly prospective, particularly for volcanic-hosted-style mineralisation. Rocks of the Cobar Supergroup host the nearby Mount Hope Copper Mine, the Coan Copper Mine at Mount Allen, and the Great Central base metal mines (OEH 2014c).

Three mining exploration licences are current for metallic minerals in Nombinnie State Conservation Area.

NPWS works closely with the state government authorities responsible for mining and petroleum activities, including mineral exploration and mine site rehabilitation, to ensure that exploration and production proposals in state conservation areas comply with all statutory requirements, including any necessary environmental impact assessments and approvals.

6.2 Transport corridors

Yathong Nature Reserve is dissected by Merri Road. The Kidman Way passes north–south through the Nombinnie reserves and the Bruce Cullenward Road – Tipping Way and Round Hill Road pass north-west to south-east through Nombinnie State Conservation Area and Round Hill Nature Reserve.

The Orange – Broken Hill Railway passes east-west through the Nombinnie reserves and Round Hill Nature Reserve and is part of the transcontinental railway line linking Sydney and Perth. Apart from freight, the line is also used by the Indian Pacific passenger train, and for a weekly passenger train.

The railway line and corridor are maintained by a private company under contract to Transport for NSW. The public roads and railway are not part of the reserves.

6.3 Transmission lines

Two 19.1 kV overhead transmission lines operated by Essential Energy are located in Yathong Nature Reserve and provide power for NPWS staff accommodation.

These lines are not covered by formal easements. In the absence of an access and/or maintenance agreement, Essential Energy must comply with the National Parks and Wildlife Act and Regulation when carrying out maintenance or replacement work and may require NPWS consent for certain works.

6.4 Crown land

Travelling stock reserves adjoin sections of the Merri Road through Yathong Nature Reserve and Kidman Way through Nombinnie State Conservation Area. Travelling stock reserves are a type of Crown land managed by LLS, available for moving stock or to be leased for grazing by neighbouring property owners. These reserves have not been used for these purposes for many years. Travelling stock reserves can contribute to the conservation of native

vegetation and habitat values in agricultural landscapes by protecting the seedbank of native species and retaining native vegetation. LLS has undertaken a statewide review of travelling stock reserves to determine their future ownership and management arrangements, which could include transfer to an adjoining landowner or land management agency, local council or Aboriginal land council.

A parcel of former Crown land (3201 hectares) held as a travelling stock reserve along the Merri Road was added to Yathong Nature Reserve in 2020. Two small parcels of Crown land on the Kidman Way (adjoining Nombinnie State Conservation Area) are held under licence by NPWS and have not been reserved. A small area of land at the intersection of Bruce Cullenward Drive and Merri Road on the eastern edge of Yathong Nature Reserve is Crown land. It is being managed by NPWS as if it were part of the gazetted Central Mallee reserves. There may be potential for this area to be added to the reserves in the future.

6.5 Inholdings

There are 2 inholdings within the reserves:

- an area of 13 hectares adjoining the Merri Road near the southern boundary of Yathong Nature Reserve
- an area of 29 hectares at the intersection of Yathong Road and Coombie Road near the southern boundary of Yathong Nature Reserve.

6.6 Bee keeping

A licensed bee site is located near the southern boundary of Yathong Nature Reserve. The site is on land which was formerly Yathong State Forest but was added to the Central Mallee reserves in 2011 and 2013. The bee site is an 'existing interest' and is allowed to continue in the reserve under the NPWS Beekeeping Policy.

The European honeybee (*Apis mellifera*) can have adverse impacts on some native plants and animals (Paton 1996), including poor flower pollination and competition with native nectar feeders. To minimise the impacts of non-native bees, new bee sites will only be considered where there is a clear and demonstrable benefit to park values consistent with the National Parks and Wildlife Act and NPWS policy.

6.7 Unauthorised uses

A wheat crop was cultivated in the far south-west corner of Nombinnie State Conservation Area adjoining Roto Boundary Trail in 2006. A tank and yards were also located on the parcel. While the potential for revoking this disturbed area was considered, it remains in the reserve.

Other unauthorised activities known to occur in the reserves from time to time include illegal access for hunting, broombush cutting and poaching of goats. Law enforcement is ongoing. NPWS also works with neighbours and the police where necessary to control unauthorised activities and their negative impacts on reserve values.

Appendices

Appendix A Legislation and policy

The following laws and policies apply to how we manage our parks (this is not a complete list):

NSW legislation

- *National Parks and Wildlife Act 1974* and NPW Regulation
- *Environmental Planning and Assessment Act 1979*
- *Biodiversity Conservation Act 2016*
- *Biosecurity Act 2015*
- *Crown Land Management Act 2016*.

Other NSW laws may also apply to park management:

- *Work Health and Safety Act 2011*.

Commonwealth legislation and policy

- *Environment Protection and Biodiversity Conservation Act 1999*

NPWS policies and strategies

A range of NPWS policies and strategies may also apply to park management:

- Park management policies – See www.environment.nsw.gov.au/topics/parks-reserves-and-protected-areas/park-policies for published policies – others, such as the Staff Housing Policy, are internal documents.
- Regional pest management strategies – See www.environment.nsw.gov.au/topics/animals-and-plants/pest-animals-and-weeds/regional-pest-management-strategies
- Fire management strategies – See www.environment.nsw.gov.au/topics/parks-reserves-and-protected-areas/fire/fire-management-strategies.

Other laws, policies and strategies may also apply. Please contact NPWS for advice.

More information

- [Central Mallee Reserves Plan of Management](#)
- [Department of Planning, Industry and Environment](#)
- [Key threatening processes](#)
- [Local Land Services Act](#)
- [NPWS Pest Management Strategy](#)

Appendix B Scientific plant and animal names

The following table shows the scientific name for common plant and animal names used in this plan.

Common name	Scientific name
Plants	
Belah	<i>Casuarina cristata</i>
Bimble box	<i>Eucalyptus populnea</i>
Bitter quandong	<i>Santalum murrayanum</i>
Black box	<i>Eucalyptus largiflorens</i>
Black roly-poly	<i>Sclerolaena muricata</i>
Brigalow	<i>Acacia harpophylla</i>
Broombush	<i>Melaleuca uncinata</i>
Cobar rustyhood orchid	<i>Pterostylis cobarensis</i>
Curly-bark wattle	<i>Acacia curranii</i>
Cypress pine	<i>Callitris</i> spp.
Dwyer's red gum	<i>Eucalyptus dwyeri</i>
Emu-bush	<i>Eremophila</i> spp.
Green mallee	<i>Eucalyptus viridis</i>
Grey mallee	<i>Eucalyptus morrisii</i>
Gum coolibah (inland red box, western red box)	<i>Eucalyptus intertexta</i>
Holly-leaf grevillea	<i>Grevillea ilicifolia</i>
Hopbush	<i>Dodonaea</i> spp.
Ironwood	<i>Acacia excelsa</i> subsp. <i>angusta</i>
Kurrajong	<i>Brachychiton populneus</i>
Mallee pine	<i>Callitris verrucosa</i>
Mulga	<i>Acacia aneura</i>
Porcupine grass (Hummock grass)	<i>Triodia scariosa</i>
Red mallee	<i>Eucalyptus socialis</i>
Speargrass	<i>Stipa</i> spp.
Sweet quandong	<i>Santalum acuminatum</i>
Western rosewood	<i>Alectryon oleifolius</i>
White cypress	<i>Callitris glaucophylla</i>
White mallee	<i>Eucalyptus dumosa</i>
Wilga	<i>Geijera parviflora</i>
Yorrell	<i>Eucalyptus gracilis</i>
Animals	
Australasian grebe	<i>Tachybaptus novaehollandiae</i>
Australian bustard	<i>Ardeotis australis</i>

Central Mallee Reserves Planning Considerations

Common name	Scientific name
Banded stilt	<i>Cladorhynchus leucocephalus</i>
Barking owl	<i>Ninox connivens</i>
Black falcon	<i>Falco subniger</i>
Black-breasted buzzard	<i>Hamirostra melanosternon</i>
Black-chinned honeyeater (eastern subspecies)	<i>Melithreptus gularis</i>
Bridled nailtail wallaby	<i>Onychogalea fraenata</i>
Brolga	<i>Grus rubicunda</i>
Brown treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>
Brush-tailed bettong	<i>Bettongia penicillata penicillata</i>
Brush-tailed bettong	<i>Bettongia penicillata penicillata</i>
Brush-tailed rock-wallaby	<i>Petrogale penicillata</i>
Burrowing bettong	<i>Bettongia lesueuri</i>
Chestnut quail-thrush	<i>Cinclosoma castanotum</i>
Common dunnart	<i>Sminthopsis murina</i>
Common planigale	<i>Planigale maculata</i>
Common wallaroo	<i>Osphranter robustus</i>
Corben's long-eared bat	<i>Nyctophilus corbeni</i>
Crested bellbird	<i>Oreoica gutturalis</i>
Desert mouse	<i>Pseudomys desertor</i>
Diamond firetail	<i>Stagonopleura guttata</i>
Dusky woodswallow	<i>Artamus cyanopterus cyanopterus</i>
Eastern grey kangaroo	<i>Macropus giganteus</i>
Eastern mallee dragon	<i>Ctenophorus spinodomus</i>
Eastern Ranges rock-skink	<i>Liopholis modesta</i>
Echidna	<i>Tachyglossus aculeatus</i>
Emu	<i>Dromaius novaehollandiae</i>
Flame robin	<i>Petroica phoenicea</i>
Freckled duck	<i>Stictonetta naevosa</i>
Gilbert's whistler	<i>Pachycephala inornata</i>
Glossy black-cockatoo	<i>Calyptorhynchus lathami</i>
Greater bilby	<i>Macrotis lagotis</i>
Greater stick-nest rat	<i>Leporillus conditor</i>
Grey butcherbird	<i>Cracticus torquatus</i>
Grey falcon	<i>Falco hypoleucos</i>
Grey-crowned babbler (eastern subspecies)	<i>Pomatostomus temporalis temporalis</i>
Grey-fronted honeyeater	<i>Ptilotula plumula</i>
Hoary-headed grebe	<i>Poliiocephalus poliocephalus</i>

Central Mallee Reserves Planning Considerations

Common name	Scientific name
Hooded robin	<i>Melanodryas cucullata cucullata</i>
Inland forest bat	<i>Vespadelus baverstocki</i>
Kultarr	<i>Antechinomys laniger</i>
Little eagle	<i>Hieraaetus morphnoides</i>
Little lorikeet	<i>Glossopsitta pusilla</i>
Little pied bat	<i>Chalinolobus picatus</i>
Major Mitchell's cockatoo	<i>Lophochroa leadbeateri</i>
Malleefowl	<i>Leipoa ocellata</i>
Marble-faced delma	<i>Delma australis</i>
Mitchell's hopping mouse	<i>Notomys mitchellii</i>
Painted honeyeater	<i>Grantiella picta</i>
Pied honeyeater	<i>Certhionyx variegatus</i>
Pink-eared duck	<i>Malacorhynchus membranaceus</i>
Plumed whistling-duck	<i>Dendrocygna eytoni</i>
Red kangaroo	<i>Osphranter rufus</i>
Red-kneed dotterel	<i>Erythrogonyx cinctus</i>
Red-lored whistler	<i>Pachycephala rufogularis</i>
Shy heathwren	<i>Hylacola cautus</i>
Sloane's froglet	<i>Crinia sloanei</i>
Southern ningau	<i>Ningau yvonneae</i>
Southern scrub-robin	<i>Drymodes brunneopygia</i>
Speckled warbler	<i>Chthonicola sagittata</i>
Spotted harrier	<i>Circus assimilis</i>
Square-tailed kite	<i>Lophoictinia isura</i>
Straw-necked ibis	<i>Threskiornis spinicollis</i>
Striated grasswren	<i>Amytornis striatus</i>
Striped-faced dunnart	<i>Sminthopsis macroura</i>
Superb parrot	<i>Polytelis swainsonii</i>
Swift parrot	<i>Lathamus discolor</i>
Turquoise parrot	<i>Neophema pulchella</i>
Varied sittella	<i>Daphoenositta chrysoptera</i>
Weebill	<i>Smicronis brevirostris</i>
Western barred bandicoot	<i>Perameles bougainville fasciata</i>
Western blue-tongued lizard	<i>Tiliqua occipitalis</i>
Western grey kangaroo	<i>Macropus fuliginosus</i>
Western quoll	<i>Dasyurus geoffroii</i>
White-eared honeyeater	<i>Nesoptilotis leucotis</i>

Central Mallee Reserves Planning Considerations

Common name	Scientific name
White-fronted chat	<i>Epthianura albifrons</i>
Yellow-bellied sheath-tail-bat	<i>Saccolaimus flaviventris</i>

Appendix C Vegetation communities in the reserves

Plant community type	PCT No.	Yathong NR	Round Hill NR	Nombinnie NR & SCA
Ridge and ranges				
Dwyer's Red Gum – White Cypress Pine – Currawang low shrub-grass woodland of the Cobar Penneplain Bioregion	184	Y	Y	
Green Mallee – White Cypress Pine very tall mallee woodland on gravel rises mainly in the Cobar Penneplain Bioregion	176	Y		Y
Broombush shrubland in the mallee landscapes of the temperate and semi-arid (warm) climate zones	142	Y		
Grey Mallee – White Cypress Pine woodland on rocky hills of the eastern Cobar Penneplain Bioregion	180	Y	Y	
Mulga – Ironwood shrubland on loams and clays mainly of the Cobar Penneplain Bioregion	125	Y		
Open plains				
Belah/Black Oak – Western Rosewood – Wilga woodland of central NSW including the Cobar Penneplain Bioregion	57	Y	Y	Y
Gum Coolibah woodland on sedimentary substrates mainly in the Cobar Penneplain Bioregion	104	Y	Y	Y
Derived mixed shrubland on loamy-clay soils in the Cobar Penneplain Bioregion dominated by <i>Eremophila</i> shrub species	229	Y		Y
Black Box woodland, <i>Eucalyptus largiflorens</i> on claypans	38?			Y
Nitre Goosefoot on clays on the Inland Floodplains*	160 (prev 216)			Y
Pine Woodland – Flat to gently undulating plains on medium textured soils where mallee has been	246? Derived		Y	Y

Central Mallee Reserves Planning Considerations

Plant community type	PCT No.	Yathong NR	Round Hill NR	Nombinnie NR & SCA
cleared or there have been fires. Dominated by <i>Callitris</i>				
Wattle Woodland – <i>Acacia decora</i> often adjacent to plains Mallee	104			Y
Ironwood woodland of the semi-arid plains	134	Y		
Poplar Box grassy woodland on flats mainly in the Cobar Penepplain and Murray Darling Depression Bioregion	105	Y		
Mallee				
Spinifex linear dune mallee mainly of the Murray Darling Depression Bioregion	171	Y	Y	Y
Red mallee – white mallee extremely tall ‘tree mallee’ on silty-loam-clay soils of central SW NSW	193			Y
Sandplain mallee of central NSW	173	Y	Y	Y

Source: Cohn (1995), Benson (2008) and DPIE (2019).

* This community was mapped by Cohn (1995) as Black Roly-poly shrubland, however, it has now recovered in response to cessation of grazing and inundation events.

Appendix D Pests and weeds in the reserves

The following table summarises key information on priority pests and weeds in the park at the time of publication of the plan. Current information on the status of pests and whether they have a threat abatement plan can be found on the department's website. Further pest information on the park is also available in the relevant NPWS Pest Management Strategy. The Local Land Services Act declares certain animals to be pests.

Pest animals

Common name	Scientific name	KTP	Declared pest	LLS priority
Feral Cat	<i>Felis catus</i>	Y	N	Y
European red fox	<i>Vulpes</i>	Y	Y	Y
Feral goat	<i>Capra hircus</i>	Y	Y	Y
Feral dog	<i>Canis lupus familiaris</i>	Y	N	Y
Rabbit	<i>Oryctolagus cuniculus</i>	Y	Y	Y
Fallow deer	<i>Dama dama</i>	Y	N	Y

Priority weeds

Common name	Scientific name
African boxthorn ^{RC}	<i>Lycium ferocissimum</i>
Thornapple	<i>Datura stramonium</i>
Cactus	<i>Opuntia</i> spp.

KTP = key threatening process listed under the Biodiversity Conservation Act and Environment Protection and Biodiversity Conservation Act.

^{RC} = weed of regional concern under Western Regional Strategic Weed Management Plan (Western LLS 2017)

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