



NSW National Parks and Wildlife Service

# Kosciuszko offset action plan – yellow-bellied glider

Kosciuszko Offset Project



## Acknowledgement of Country

Department of Climate Change, Energy, the Environment and Water acknowledges the Traditional Custodians of the lands where we work and live.

We pay our respects to Elders past, present and emerging.

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Artist and designer Nikita Ridgeway from Aboriginal design agency – Boss Lady Creative Designs, created the People and Community symbol.

Cover photo: Yellow-bellied glider. Kerri-Lee Harris/DCCEEW

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ISBN 978-1-923516-52-6  
EH 2025/0264  
August 2025



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## Objective

This plan sets out management actions that, when implemented and measured, will deliver biodiversity gains for the yellow-bellied glider (*Petaurus australis*) within Kosciuszko National Park.

The Kosciuszko Offset Strategy 2023 sets out a framework for the development of offset action plans. It is based on a clear objective – to deliver a biodiversity gain in the park equivalent to 120% of the biodiversity loss identified in the Snowy 2.0 environmental assessments.

In the Snowy 2.0 environmental assessments for Transmission Connection, up to 21 hectares of yellow-bellied glider habitat was identified as being impacted. (Assessments for the Snowy 2.0 Exploratory Works and Main Works projects did not identify any impacts to yellow-bellied gliders.) At an estimated 0.085 individuals per hectare (see Step 1), the impact of the project on the yellow-bellied glider is estimated to be a reduction in the population by 2 individuals.

To deliver the 120% biodiversity gain identified under the Kosciuszko Offset Strategy, the objective of this action plan is to **increase the population of yellow-bellied gliders in Kosciuszko National Park by 3 individuals.**

The impacts to this species were not identified as being Commonwealth matters of national environmental significance under the Snowy 2.0 environmental assessments. Therefore, this action plan has been approved only by the acting Deputy Secretary, NSW National Parks and Wildlife Service.



# Species overview and key threatening processes

The yellow-bellied glider is listed as **vulnerable** under the NSW *Biodiversity Conservation Act 2016* and **vulnerable** under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Table 1 provides a species summary for yellow-bellied glider, including a description of the species, its habitat, its preferred food sources and its distribution within Kosciuszko National Park.

**Table 1 Species summary – yellow-bellied glider**

Category	Summary
Description	The yellow-bellied glider is a large, active, sociable and vocal glider. Adults weigh between 450 g and 700 g. They have a combined head and body length of about 30 cm and a large bushy tail that is about 45 cm long. The fur is grey to brown on top with a cream to yellow belly, which is paler in young animals. A dark stripe down the back is characteristic of the species. It has a large gliding membrane that extends from the wrist to the ankle. It has a loud, distinctive call, beginning with a high-pitched shriek and subsiding into a throaty rattle.
Habitat	The species is found in tall mature eucalypt forests, generally in areas with high rainfall and nutrient-rich soils. Forest type preferences vary with latitude and elevation, from mixed coastal forests to dry escarpment forests in the north, to moist coastal gullies and creek flats to tall montane forests in the south.
Diet	Yellow-bellied gliders feed primarily on fluids from plants and insects, including nectar, sap, honeydew and manna, with pollen and insects providing protein. Extract sap is obtained by biting into the trunks and branches of favoured food trees, often leaving a distinctive V-shaped scar on the tree.
Distribution and population	The yellow-bellied glider lives in small family groups of 2 to 6 individuals and is a nocturnal species. Dens occur in the hollows of large trees. The species is very mobile and occupies large home ranges of 20 ha to 85 ha in order to access dispersed and seasonally variable food resources.

Source: Saving Our Species and personal communication NSW Department of Climate Change, Energy, the Environment and Water, Biodiversity Conservation Division

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Table 2 provides a list of key threatening processes to yellow-bellied gliders within Kosciuszko National Park that will be addressed via cost-effective management actions (see Table 3).

**Table 2 Key threatening processes to yellow-bellied gliders in Kosciuszko National Park**

Threat	Description
Disturbance	Loss and fragmentation of habitat. Loss of hollow-bearing trees. Loss of feed trees.
Feral herbivores	Feral deer are a threat to the saplings of habitat trees. Where deer density is high, saplings are often destroyed by rubbing, trampling and grazing.
Feral predators	Yellow-bellied gliders have been found in the scats of European red foxes. Previously, it was thought that these predators cannot climb into the canopy where gliders are found, so it was assumed they were eating already dead animals. However, video evidence from a Sydney University study published in 2017 shows that foxes can and do climb trees, meaning that some predation on living gliders may occur, although not at a scale likely to have a population-level impact. Analysis of scats found feral cats have consumed a similar species, the greater glider, although it is likely that this was through scavenging rather than predation. There is photographic evidence of feral cats climbing into yellow-bellied glider sap feeding stations. It is unknown if feral cats and foxes are having an impact on the population in Kosciuszko National Park.
Inappropriate fire regimes	Too frequent or too infrequent burning may impact on suitable habitat and food resources.

Source: Saving Our Species and personal communication NSW Department of Climate Change, Energy, the Environment and Water, Biodiversity Conservation Division

# Kosciuszko Offset Strategy: metrics-based approach

The Kosciuszko Offset Strategy requires expenditure of Snowy 2.0 offset funds to deliver biodiversity gains for Kosciuszko National Park equivalent to 120% of the loss for threatened species, threatened ecological communities, and ecosystems impacted by the Snowy 2.0 project. The benchmark of 120% has been set because this is considered to be achievable over the life of this action plan and it can be demonstrated as a biodiversity gain.

In setting an objective to exceed the statutory requirements, the strategy recognised the difficulties in measuring biodiversity gains and the inherent fluctuations in biodiversity over time. This benchmark provides a margin that will increase confidence that the minimum statutory requirements are being met. The strategy takes a metrics-based approach that will be applied to the delivery of biodiversity offsets by the NSW National Parks and Wildlife Service (NPWS). This will be achieved by following a 3-step process:

- Step 1: quantifying the impacts and benefits that must be delivered
- Step 2: implementing actions to deliver the offset required
- Step 3: measuring and reporting on the biodiversity benefit.

## Step 1: quantifying the impacts on yellow-bellied gliders and benefits that must be delivered

It is estimated that 2 yellow-bellied gliders will be impacted by the Snowy 2.0 Transmission Connection project. The benefit that must be delivered is therefore the successful and sustainable establishment of an additional 3 yellow-bellied gliders in Kosciuszko National Park (being 120% of the impact). This calculation is based on impacts to 21 hectares of yellow-bellied glider habitat from Snowy 2.0 with an estimated population density of 0.085 individuals per hectare.

### Step 1 limitations, assumptions and notes

- The estimate of 0.085 individuals per hectare is based on the average detection rate of between 0.03 and 0.14 individuals per hectare, as published by the Commonwealth (*Conservation advice for Petaurus australis australis (yellow-bellied glider (south eastern))* March 2022).
- Upon completion of actions 1 and 2 (see Table 3 below), and as further studies and information on yellow-bellied glider populations and densities in Kosciuszko National Park become available over the life of this action plan, the benefit that must be delivered will be refined and adjusted in this plan.



## Step 2: implementing the management actions for yellow-bellied gliders to deliver the required offset

Delivering an offset of at least 3 additional yellow-bellied gliders in Kosciuszko National Park will involve the following management interventions:

- identifying an area (or areas) of suitable habitat for delivery of the offset (see action 1 in Table 3)
- measuring the current density (or other suitable metric such as occupancy) of yellow-bellied gliders at the proposed offset areas and identifying the target density and thus the required area across which the offset actions are to be delivered (see actions 2 and 3 in Table 3)
- increasing the density (or other suitable metric) of yellow-bellied gliders at that location through a targeted series of offset actions such as habitat creation and intensive feral predator control above and beyond core management (see actions 4, 5, 6, 7 and 8 in Table 3).

There is a lack of information about yellow-bellied glider abundance and distribution in Kosciuszko National Park. In general, they have small social groups and occupy large and exclusive home ranges, so this action plan will use a variety of methods to identify suitable areas of habitat that may support population increases. Initial habitat assessments will focus on areas with recent NSW BioNet records of yellow-bellied gliders in Kosciuszko National Park, including records of recent feed markings on eucalyptus trees (see action 1 in Table 3).

Given that it is a relatively vocal marsupial, with its loud shrieking calls being audible 500 m away, counting of auditory recordings using song meters and night-time spotlighting surveys will be highly suitable for planned species population studies and ongoing monitoring.

During the day, yellow-bellied gliders shelter in hollows found in large, old trees. Trees do not usually start producing hollows until they reach at least 50 cm in diameter at chest height, which can take approximately 100 years to occur. As this is a critical habitat feature, this action plan will look for opportunities to create hollows or artificial nesting structures (see action 4 in Table 3) at sites determined to be suitable (see actions 1, 2, and 3 in Table 3). To support species prevalence during times of extreme heat and/or drought, high canopy wildlife watering stations may also be installed to ensure water availability without the risk of predation from cats and foxes (see actions 5 and 6 in Table 3).

Some of the survey blocks in Figure 1 include burnt and unburnt sites, and some sites are now also identified under the Assets of Intergenerational Significance (AIS) program. Actions under this action plan may, where appropriate, occur within AIS sites where offset funds are used to benefit the species, and actions go above and beyond those identified under the AIS program.

Table 3 lists the actions needed to deliver the required biodiversity gains. These include identifying suitable habitat areas, measuring the current species density in those areas, and addressing the identified key threatening processes (Table 2).

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**Table 3 Management actions for yellow-bellied gliders to deliver the required offset in Kosciuszko National Park**

Action number	Action	Threat addressed	Location	When	Who	Total cost (preliminary estimates)	Comment
1	Undertake habitat assessments noting recent records and feed tree markings to determine recent presence of species	–	Areas shaded in red (Figure 1)	2024 to 2025	NPWS	\$1,000	Underway. Identify suitable habitat and presence of yellow-bellied glider.
2	Undertake targeted auditory recording (song meter) surveys and, if required, spotlight surveys in the identified habitat, plus any additional sites determined by NPWS	–	Areas shaded in red (Figure 1)	2025 to 2030	NPWS	\$50,000	Underway.
3	Based on targeted survey results (action 2), calculate population density and undertake a desktop assessment to determine the required area across which the offset actions are to be delivered	–	Selected sites from the sites identified in Figure 1 plus any other sites identified by NPWS	2025 to 2030	NPWS	\$0	Based on the results of actions 1 and 2.
4	Install auger hollows or artificial nesting structures to create breeding habitat	Disturbance	Designated yellow-bellied glider offset areas	2026 onwards	NPWS	Up to \$500,000 over a minimum of 20 years	As required, to support breeding and nesting habitat.
5	If required, install high canopy wildlife watering stations	Disturbance	Designated yellow-bellied glider offset areas	2026 to 2046	NPWS	Up to \$200,000 over a minimum of 20 years	During times of extreme heat and/or drought conditions, installing high canopy wildlife watering stations allows yellow-

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Action number	Action	Threat addressed	Location	When	Who	Total cost (preliminary estimates)	Comment
							bellied gliders to access water without threat of being preyed upon.
6	Additional cat and fox control in areas identified in action 3 (designated yellow-bellied glider offset areas)	Feral predators	Designated yellow-bellied glider offset areas	2026 to 2046	NPWS	Up to \$200,000 over a minimum of 20 years	Additional to core cat, fox and dog management. Consider enhanced baiting such as aerial baiting.
7	Protection of unburnt sites and tree hollows identified in surveys as being suitable yellow-bellied glider habitat	Inappropriate fire regimes	Designated yellow-bellied glider offset areas	2026 to 2046	NPWS operational area staff including fire planning officers	Up to \$50,000 over a minimum of 20 years	Work with fire planning officers to implement additional measures to ensure adequate unburnt habitat in designated yellow-bellied glider areas, as appropriate.
8	Additional monitoring of feral animal numbers	Feral predators/feral herbivores	Designated yellow-bellied glider offset areas	2026 to 2046	Integrate into existing feral animal monitoring	Up to \$100,000 over a minimum of 20 years	As required, implement monitoring to measure and track feral animal densities in the designated yellow-bellied glider areas consistent with NPWS protocols.
Total cost						\$1.11 million	

### Step 2 limitations, assumptions and notes

- Threat control strategies and actions will continue to evolve throughout the life of this action plan. This plan will be updated accordingly as new information, knowledge and management techniques become available.
- Costs identified above will be revised as required, taking into account the relative cost-effectiveness of different measures.
- The success of using occupancy as a surrogate measure of density will continue to be evaluated through the project.
- It is expected that designated offset areas for different species will overlap, with resulting management actions being carried out across multiple areas at once. This will maximise biodiversity gains and create cost savings, potentially enabling additional management actions to be undertaken.
- Actions under this plan will not apply to sites directly impacted by Transmission Connection construction activities. Planning approvals require the project proponent to undertake habitat rehabilitation at these sites. Reintroducing yellow-bellied gliders into Transmission Connection project construction sites is outside the scope and timeframe of this project and action plan.

### Step 3: measuring and reporting on the biodiversity benefit to yellow-bellied gliders

The Kosciuszko Offset Strategy states that each action plan must describe how the required biodiversity benefit (offset) will be measured. This involves setting out the attributes to be measured and the methodology, timing and other relevant details relevant to monitoring. A hierarchical approach is being taken to measuring the biodiversity benefit.

1. The population density of a species is the desirable measurement attribute.
2. If this is not feasible due to challenges such as difficulty in detecting populations due to low numbers, then other metrics (such as occupancy) combined with modelling will be considered instead.
3. If the attribute and monitoring design in (1) or (2) above is not working, then the attribute being measured will be revisited with another metric being considered.

Any changes to metrics over time will be updated in the action plan and reported on as part of the adaptive management approach under the Kosciuszko Offset Strategy.

**Table 4 Measuring biodiversity benefits to yellow-bellied gliders**

Attribute to be measured	Metric	Location	Methodology	Monitoring design	Timing	Cost	Frequency of measurement
Population	Density (spatial estimates of density using occupancy as a surrogate measure)	Designated yellow-bellied glider offset areas	Auditory and spotlight surveys	Detailed monitoring design to be determined. Occupancy modelling will infer density gain/loss over the selected offset areas	During the active seasons (spring to autumn)	Up to \$500,000 over a minimum of 20 years for ongoing population monitoring to identify the extent of the offset delivered	Annually

**Step 3 limitations, assumptions and notes**

- Wire cages were once used to trap yellow-bellied gliders to provide population density estimates. However, this method can cause considerable stress for the animal and is considered unnecessary to determine robust population estimates. Instead, non-invasive techniques such as spotlighting and acoustic monitoring are now favoured and considered equally robust in establishing population information
- The challenges with monitoring low-density, relatively small species across large landscapes are well recognised. Advanced statistical approaches using presence/absence data, such as occupancy rates, have alleviated some of these challenges, and in some cases have allowed population density/abundance estimates of reasonable accuracy.



## Governance

### Reporting

As required under Snowy 2.0 approvals, NPWS must monitor, evaluate and publicly report on progress of the implementation program and the effectiveness of the specific projects and actions. They will prepare an annual report on the Snowy 2.0 biodiversity offset program for Kosciuszko National Park and its implementation, including progress with achieving the required increase in the population of the yellow-bellied glider. The report will be provided to the Commonwealth Department of Climate Change, Energy, the Environment and Water, and published on the [environment.nsw.gov.au](http://environment.nsw.gov.au) website within 3 months of the end of each financial year.

The annual report will:

- detail the expenditure from the biodiversity offset fund on agreed actions under the Kosciuszko offset action plans
- outline any interest earned and reinvested into the offset program
- provide details about the conservation actions carried out for each approved threatened species, threatened ecological community and threatened ecosystem action plan such as:
  - the type of conservation action implemented - for example, feral animal control, habitat restoration
  - the geographic extent and location of the conservation actions
  - the proportion of the proposed conservation actions achieved, and proportion yet to be achieved
  - an analysis and summary of monitoring data
  - future conservation actions, with key timeframes including intended completion
- include details on progress towards each action plan objective
- document where adaptive management principles have been applied to each action plan to improve their effectiveness.

### Adaptive management

Quantifying and measuring the biodiversity benefit for yellow-bellied gliders may present significant technical challenges. Together with the influence of natural variability, it is anticipated there will be a level of uncertainty to both measuring and interpreting biodiversity benefits relevant to the species. This uncertainty will be addressed by applying an adaptive approach, including reviewing and updating density numbers, monitoring, methodologies and strategies as new information, data or technology becomes available. At a minimum, action plans will be reviewed every 5 years.

## Approvals

Date/approval	
Date prepared	February 2025
Date approved	April 2025
Approved by	Naomi Stephens, Acting Deputy Secretary NSW National Parks and Wildlife Service
Date for review	February 2030

## Kosciuszko offset action plan – yellow-bellied glider

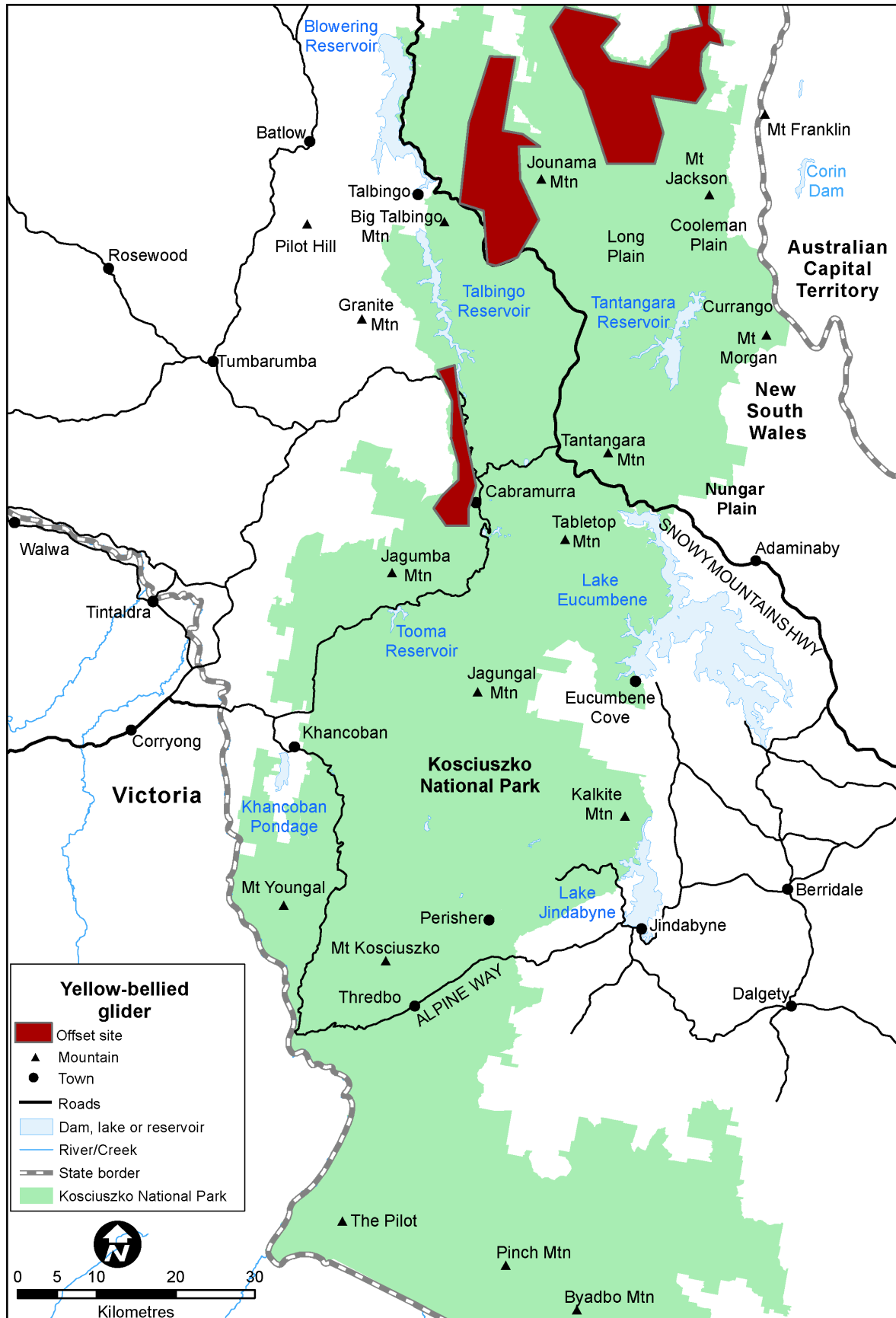


Figure 1 Yellow-bellied glider offset areas – Kosciuszko National Park

## More information

- Assets of Intergenerational Significance