NSW National Parks and Wildlife Service

Kosciuszko offset action plan – broad-toothed rat

Kosciuszko Offset Project

environment.nsw.gov.au

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.

This resource may contain images or names of deceased persons in photographs or historical content.

Cover photo: broad-toothed rat. David Watts/DCCEEW

Published by:

Environment and Heritage
Department of Climate Change,
Energy, the Environment and Water
Locked Bag 5022, Parramatta NSW 2124
Phone: +61 2 9995 5000 (switchboard)
Phone: 1300 361 967 (Environment and Heritage enquiries)
TTY users: phone 133 677, then ask for 1300 361 967
Speak and listen users: phone 1300 555 727, then ask for 1300 361 967
Email: info@environment.nsw.gov.au
Website: www.environment.nsw.gov.au

ISBN 978-1-923285-08-8
EH 2024/0214
August 2024

Find out more about your environment at:

www.environment.nsw.gov.au

Contents

List of tables

List of figures

Objective

This plan sets out management actions that, when implemented and measured, will deliver biodiversity gains for broad-toothed rats *(Mastacomys fuscus)* within Kosciuszko National Park.

The Kosciuszko Offset Strategy 2023 sets out a framework for the development of these 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 Main Works, up to 162 hectares of broad-toothed rat habitat was identified as being impacted. (Assessments for the Snowy 2.0 Exploratory Works and Transmission Connection projects did not identify any impacts to broad-toothed rats.) At an estimated 2 individuals per hectare (see Section 3 – Step 1), the impact of the Snowy 2.0 project on the broad-toothed rat is estimated to be a reduction of the population by 324 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 broad-toothed rats in Kosciuszko National Park by 389 individuals**.

As this is a Commonwealth-listed species and the potential impacts on it are significant, this action plan has been approved by both the Deputy Secretary, NSW National Parks and Wildlife Service and the Deputy Secretary, Commonwealth Department of Climate Change, Energy, the Environment and Water.

Species overview and key threatening processes

The broad-toothed rat 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 the broad-toothed rat including a description of the species, its habitat, its preferred food sources and its distribution within Kosciuszko National Park.

Table 1 Species summary: broad-toothed rat

Category	Summary
Description	A compact rodent with a short, wide face and ears, and long, dense, fine fur. It is brown above with rufous highlights. The tail is shorter than the head and body length (compared to *Rattus* species, which have tails as long or longer than the head and body). The tail is ringed, with very little fur. The species' large, fibrous, green droppings are distinctive. The broad-toothed rat is more similar, genetically and ecologically, to native mice (*Pseudomys* species) than to *Rattus* species. The females have a maximum of 4 nipples, distinguishing them from the *Rattus* species, which have at least twice as many.
Habitat	The broad-toothed rat lives in a complex of runways through the dense vegetation of a wet grass, sedge or heath environment, and under the snow in winter. This relatively warm under-snow space enables them to be active throughout winter. A male's home range overlaps the ranges of several females. Sheltering nests of grass are built in the understorey or under logs, where 2 or 3 young are born in summer. In winter the rats huddle together in nests, for warmth.
Diet	Food is mostly gathered at night in summer and autumn, and during the afternoon and early evening in winter. The diet consists almost solely of greenery – grass and sedge stems, supplemented by seeds and moss spore cases.
Distribution and population	In New South Wales the broad-toothed rat occurs in 2 widely separated areas: in the south in the wet alpine and subalpine heaths and woodlands in Kosciuszko National Park, adjacent nature reserves (Bimberi Nature Reserve and Scabby Range Nature Reserve) and Buccleuch State Forest; in the north on the Barrington Tops, north-west of Newcastle. They have also been found in wet sedge and grasslands at lower elevations in Victoria (South Gippsland and the Otways) and western Tasmania.

Source: Saving our Species and personal communication Department of Climate Change, Biodiversity Conservation Division.

Table 2 provides a list of key threatening processes to broad-toothed rats within Kosciuszko National Park that will be addressed via cost-effective management actions (see Section 3). Actions will also consider relevant Australian Government threat abatement plans to reduce the impacts from key threatening processes on native species.

Table 2 Key threatening processes to broad-toothed rats in Kosciuszko National Park

Threat	Description
Feral herbivores	Grazing by rabbits and hares may eliminate grass cover. Rabbits attract predators to areas of habitat. Wild horses and deer degrade habitat/cover and disturb species.
Feral pigs	Feral pigs degrade habitat/cover and disturb species.
Feral predators	Predation by feral cats, especially around ski resorts where cat densities are high. Predation by foxes causes high mortality and restricts population growth.
Inappropriate fire regimes	Catastrophic fire events and hazard reduction burning can cause localised extinction.
Anthropogenic climate change	Global warming causing loss of snow cover will result in increased exposure to foxes and cats in alpine areas. Competition with other rodent species may also increase. Populations at lower altitudes have already suffered local extinction.
Disturbance	Habitat loss, fragmentation and degradation from roads, ski runs and buildings.
Weeds	Invasion of habitat by exotic weeds.

Source: Saving our Species, *Conservation Action Plan: Broad-toothed Rat (Mastacomys fuscus)*, and personal communication Department of Climate Change, Energy, the Environment and Water, Biodiversity Conservation Division

The draft *Conservation Action Plan: Broad-toothed Rat (Mastacomys fuscus)* (under the Assets of Intergenerational Significance program) includes a key risk of 'unintended harm' from vermin control around ski resorts with the resulting action being development of educational material for resort operators. This risk is not included in this action plan as the action is only relevant to ski resort areas.

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. 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 required offset

Step 3: measuring and reporting on the biodiversity benefit.

Step 1: quantifying the impacts on broad-toothed rats and benefits that must be delivered

It is estimated that 324 broad-toothed rats will be impacted by Snowy 2.0 Main Works. The benefit that must be delivered is the successful and sustainable establishment of an additional 389 broad-toothed rats in Kosciuszko National Park (being 120% of the impact). This calculation is based on impacts to 162 hectares of broad-toothed rat habitat from Snowy 2.0 with an estimated population density of zero to 4 individuals per hectare (an average of 2 broad-toothed rats per hectare).

Step 1 limitations, assumptions and notes

- Elliot trapping of broad-toothed rats has occurred in southern Kosciuszko National Park, but National Parks and Wildlife Service has not done Eliot trapping in the north. (Some Elliot trapping was undertaken in the north as part of the Snowy 2.0 Main Works environmental impact statement biodiversity assessments.)
- The estimate of 2 broad-toothed rats per hectare is based on a previous 5-year study (2017 to 2021 inclusive, unpublished) by National Parks and Wildlife Service. This was done in optimum habitat in the subalpine Smiggins area of the park where from one to 4 individuals per hectare were detected by Elliot trapping (refer to details in Step 2 below).
- Upon actions 1, 2 and 3 (see Table 3 below), and as further studies and information on broad-toothed rat populations and densities in the park become available over the life of this action plan, the benefit that must be delivered will be refined and adjusted accordingly.

Step 2: implementing the management actions for broad-toothed rats to deliver the required offset

Delivering an offset of at least 389 additional broad-toothed rats in Kosciuszko National Park will involve the following management interventions:

- identifying an area (or areas) of suitable habitat for delivery of the offset (see actions 1 and 2 in Table 3)
- measuring the current density (or other suitable metric) of broad-toothed rats at that location 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)
- undertaking genetic research on broad-toothed rat scats to determine the number of individuals within a population (density) and establish a greater understanding of gene flow across the park (see action 3 in Table 3). If unsuccessful, a biometrician will be engaged to develop and apply a density model based on scat collections – see information below explaining why scat collection is the preferred method for measuring population under this action plan rather than continuing with Elliot trapping surveys
- increasing the density (or other suitable metric) of broad-toothed rats at that location through a targeted series of offset actions such as intensive feral predator and feral herbivore control above and beyond core management (see actions 4, 5, 6, 7 and 8 in Table 3) and, if required, the reintroduction of broad-toothed rat if the current density is zero or very low (see Step 2 limitations, assumptions and notes below).

Surveys (remote camera and Elliot trapping), as part of the Snowy 2.0 Main Works environmental impact statement, identified the broad-toothed rat in the Main Works disturbance footprint, for example in the Long Plain and Tantangara areas.

Over the past 5 years (2017 to 2021 inclusive), broad-toothed rat surveys have been conducted in areas of optimal habitat in the subalpine area of Smiggins (Figure 1) in southern Kosciuszko National Park. These surveys used Elliot trapping (no tagging) as the survey methodology. The population density of an average of 2 broad-toothed rats per hectare used in this action plan is based on these Elliot trap surveys. Elliot trapping, while often the preferred methodology for tracking small mammal populations, has been found to cause stress to the animal and is a significantly resource-intensive exercise for a species which is considered trap shy.

Scat surveys (presence/absence) have been completed as part of the Saving our Species program (2021 to 2022 inclusive) in the Long Plain and Happy Jacks areas (Figure 1), positively identifying the presence of the species in these locations. Scat surveys are significantly less resource intensive than Elliot trapping, however they have limited accuracy in determining population density.

To overcome this limitation, a genetic program using single nucleotide polymorphisms (SNP) genotyping of broad-toothed rat scats is under way. SNP genotyping of scats previously collected from Elliot traps in the Smiggins area is occurring as part of the Saving our Species program. This genetic work is hypothesised to be able to determine the number of individuals within a population. Results from the program are expected by early to mid-2024.

Scat collection within designated offset areas (not through Elliot trapping) and SNP genotyping will be the methodologies used to determine and monitor population density and gene flow under this action plan. This is non-invasive and a more cost-effective methodology than Elliot trapping, with a likely greater population density accuracy and the ability to cover a significantly wider range.

Until SNP genotyping of scats has been successfully established for broad-toothed rats, scat surveys (presence/absence) and collection without SNP genotyping will continue to be used

to determine presence/absence and estimate population density – recognising the accuracy limitations but still having the benefit of being less resource intensive than Elliot trapping.

In summary:

- The Smiggins area has been identified as optimal broad-toothed rat habitat and is likely to be a key offset area under this action plan. SNP genotyping of scats previously collected during Elliot trap surveys is currently being undertaken. To cover a wider range and gain a better understanding of the population density and gene flow in the Smiggins area, further scat collection with SNP genotyping will also be undertaken.
- Scat collection and SNP genotyping will also occur at Cascades and Tin Mines areas in southern Kosciuszko National Park, which have also been identified as suitable habitat for broad-toothed rats but have not been surveyed. These 2 sites are also likely to be broad-toothed rat offset areas under this action plan.
- Long Plain and Happy Jacks will be considered as offset areas under this action plan, recognising that the broad-toothed rat habitat in these locations is currently considered sub-optimal. Scat collection and SNP genotyping will be undertaken at these sites to help determine the extent of their contribution towards the overall benefit to be delivered under this action plan.

Some of the survey areas in Figure 1 include burnt and unburnt sites as well as sites 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 where actions go above and beyond those identified under the AIS program.

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

Table 3 Management actions for broad-toothed rats to deliver the required offset in Kosciuszko National Park

Action number	Action	Threat addressed	Location	When (calendar years)	Who	Total cost (preliminary estimates)	Comment
1	Complete broad-toothed rat scat surveys and collection for Smiggins, Cascades, Tin Mines, Happy Jacks and Long Plain	–	All sites marked in Figure 1	2023 to 2025 (next surveys will be spring 2023)	NSW National Parks and Wildlife Service (NPWS)	$10,000	Smiggins has previously been surveyed using Elliot traps, and scats from the trapping are currently being SNP genotyped. Cascades and Tin Mines have been identified as suitable habitat for broad-toothed rat but have not yet been surveyed. Happy Jacks and Long Plain have been surveyed for species presence. Scat collections will be undertaken at all sites. Collaborate delivery with Saving our Species program. Part of generating baseline data. Works to be largely undertaken by trained internal staff.
2	Scats collected during surveys (action 1) will be SNP genotyped to determine number of individuals within a population (density)	–	–	2023 to 2025	NPWS	Up to $300,000 over a minimum of 20 years	Saving our Species SNP genotyping is currently being undertaken (Smiggins). The aim is to commence action 2 across the additional sites. Successfully achieving this action will determine the number of individuals within a population (density) and give a more accurate density estimate of broad-toothed rats – Part of generating baseline data.
3	Undertake a desktop assessment/calculation to determine the required area across which the offset actions are to be delivered	–	Select sites from those areas identified in Figure 1 plus any other	2023 to 2026	NPWS	$500	Using the results from current Saving our Species SNP genotyping (Smiggins), then progressively include results from action 2.

Action number	Action	Threat addressed	Location	When (calendar years)	Who	Total cost (preliminary estimates)	Comment
			sites identified by NPWS				
4	Additional feral cat control in areas identified in action 3 (designated broad-toothed rat offset areas)	Feral predators	Designated broad-toothed rat offset areas	2024 to 2044	Dedicated cat control officer/s. Cat removal is likely to give the greatest biodiversity gain for broad-toothed rats in the park.	Up to $200,000 over a minimum of 20 years	Additional to core cat management in the park. Consider enhanced baiting such as aerial baiting. A dedicated cat control officer would be undertaking actions across multiple species such as smoky mouse.
5	Additional fox control in areas identified in action 3 (designated broad-toothed rat offset areas)	Feral predators	Designated broad-toothed rat offset areas	2024 to 2044	Integrated into existing fox control programs	Up to $100,000 over a minimum of 20 years	Additional to core fox management in the park. Consider enhanced baiting such as aerial baiting.
6	Deer, horse, feral pig and rabbit control	Feral herbivores	Designated broad-toothed rat offset areas	2024 to 2044	Integrated into existing feral herbivore control programs	Up to $100,000 over a minimum of 20 years	Additional to core feral herbivore management. Horse removal will be consistent with the Kosciuszko National Park Wild Horse Heritage Management Plan.
7	Protection of unburnt sites identified as being suitable broad-toothed rat offset areas from scat surveys (actions 1 to 3)	Inappropriate fire regime	Designated broad-toothed rat offset areas	2024 to 2044	NPWS operational area staff including fire planning officers	Up to $20,000 over a minimum of 20 years	Work with fire planning officers to implement additional measures to ensure adequate unburnt habitat in designated broad-toothed rat offset areas, as appropriate.
8	Weed control	Weeds	Designated broad-toothed	2024 to 2044	Integrated into existing	Up to $50,000 over a	Additional to core weed management in KNP. Consider enhanced spraying and

Action number	Action	Threat addressed	Location	When (calendar years)	Who	Total cost (preliminary estimates)	Comment
			rat offset areas		weed control programs for KNP	minimum of 20 years	slashing for blackberry and scotch broom, which acts as a refuge for feral pigs, cats and foxes. Other weeds and blocks to be included as appropriate.
9	Additional monitoring of feral animal numbers	Feral predators Feral herbivores	Designated broad-toothed rat offset areas	2024 to 2044	Integrate into existing feral animal monitoring	Up to $50,000 over a minimum of 20 years	As required, implement monitoring to measure and track feral animal densities in the designated broad-toothed rat offset areas consistent with NPWS protocols.
					Total cost	**$0.83 million**	

Step 2 limitations, assumptions and notes

- Within the park, habitat at Long Plain in the north, Happy Jacks in the centre, and Smiggins, Cascades and Tin Mines sites in the south have been identified as suitable habitat for broad-toothed rats. Based on existing data, it is reasonable to assume that 2 broad-toothed rats per hectare (post 2019–20 fires) is achievable across the northern and southern areas.
- No one site is currently considered to have the carrying capacity to solely support the target population number due to a mix of optimal and suboptimal habitat, so multiple potential sites have been identified.
- Application of SNP genotyping of broad-toothed rat scats is new for this species. This genetic work is hypothesised to be able to determine the number of individuals within a population (density) in a non-invasive and more cost-effective manner than Elliot trapping. If SNP genotyping is not successful, an alternative methodology will be determined.
- Threat control strategies and actions will continue to evolve throughout the life of this action plan. It 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.
- 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 or timeframes increased.
- Captive breeding programs and translocation of broad-toothed rats into areas of Kosciuszko National Park will be considered if the measures identified in Table 3 do not deliver increases in broad-toothed rat density.
- Actions under this plan will not apply to sites directly impacted by Snowy 2.0 construction activities. Snowy Hydro Limited is required under planning approvals to undertake habitat rehabilitation at these sites. Reintroducing broad-toothed rats into Snowy 2.0 project sites is outside the scope and timeframe of this project and action plan.

Step 3: measuring and reporting on the biodiversity benefits to broad-toothed rats

The Kosciuszko Offset Strategy states that each Kosciuszko offset 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 details relevant to monitoring. A hierarchical approach is being taken to measure the biodiversity benefit.

i. The population density of a species is the desirable measurement attribute.

ii. If this is not feasible due to challenges such as difficulty in capturing and detecting populations due to low numbers or species known to be trap shy, then other metrics (such as occupancy) combined with modelling will be considered instead.

iii. If the attribute and monitoring design in (i) or (ii) above is not working, then the attribute being measured will be revisited and another metric 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 broad-toothed rat

Attribute to be measured	Metric	Location	Methodology	Monitoring design	Timing	Cost	Frequency of measurement
Population	Density	Designated broad-toothed rat offset areas	Scat collection and SNP genotyping	Annual (staged) scat surveying and SNP genotyping over broad-toothed rat offset areas identified under action 3. Ensure consistency/integration with ecological health surveys	During the rat's active months from spring to autumn	Up to $200,000 over a minimum of 20 years	Each offset area will be monitored once in every 3-year period. Over each 3-year period all areas will be monitored.

Step 3 limitations, assumptions and notes

- This action plan will be updated upon completion of the SNP genotyping to refine suitable population density for the designated offset areas (action 3).

Governance

Reporting

As required under Snowy 2.0 approvals, NSW National Parks and Wildlife Service 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 broad-toothed rat. The report will be provided to the Commonwealth Department of Climate Change, Energy, the Environment and Water, and published on the National Parks and Wildlife Service 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 plans 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 that has been delivered
- 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 broad-toothed rats 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 them. 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 become available. At a minimum, action plans will be reviewed every 5 years.

Approvals

Date/approval	
Date prepared	December 2023
Date approved – NPWS	31 January 2024
Approved by	Atticus Fleming, Deputy Secretary NPWS
Date approved – DCCEEW	29 April 2024
Approved by	Kate Gowland, Branch Head, Department of Climate Change, Energy, the Environment and Water
Date for review	April 2029

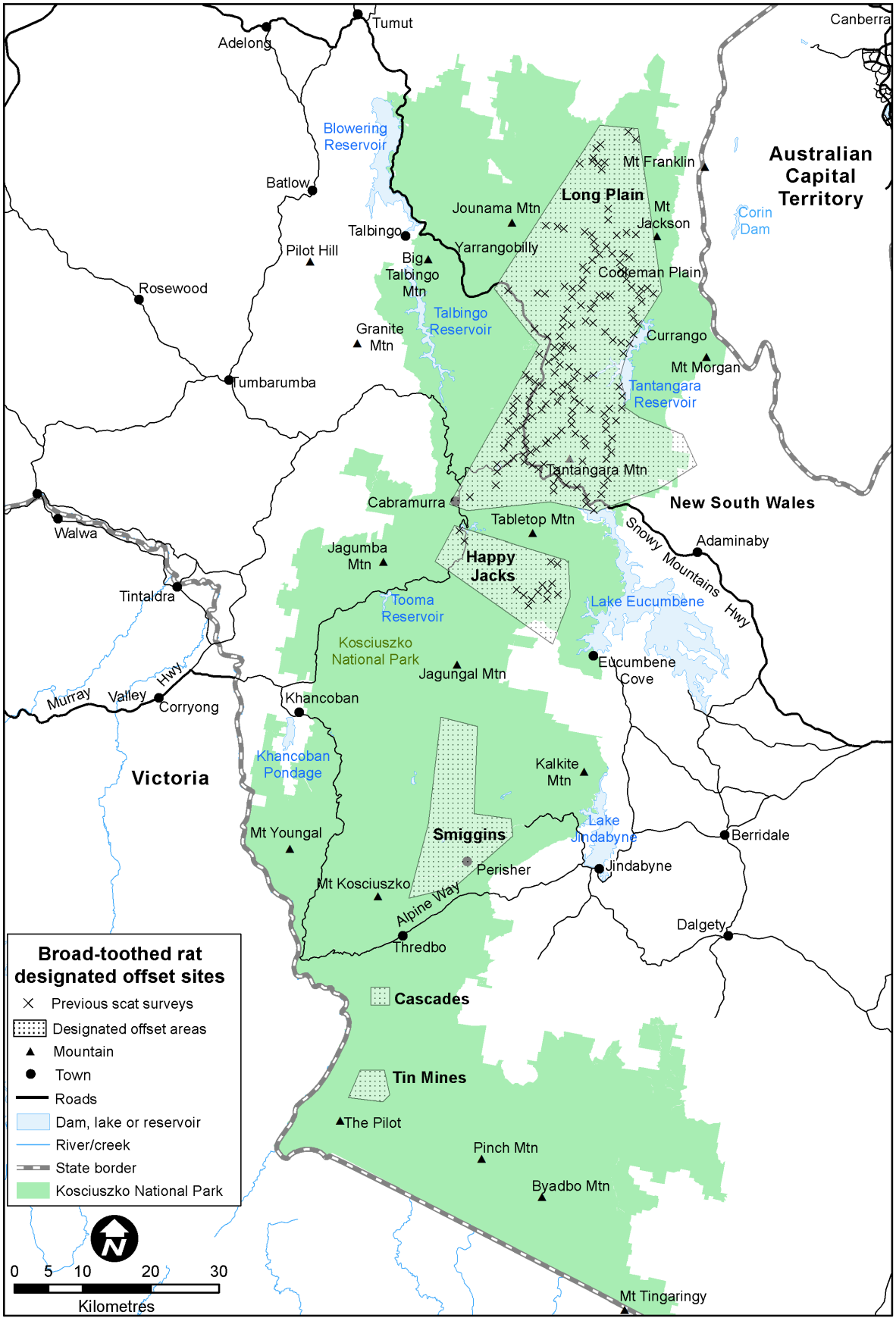

Figure 1 Broad-toothed rat survey sites – Kosciuszko National Park (November 2022)

More information

- Approved threat abatement plans
- Assets of Intergenerational Significance