



NSW National Parks and Wildlife Service

Kosciuszko offset action plan – alpine sphagnum bogs and associated fens

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.

This resource may contain images or names of deceased persons in photographs or historical content.

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

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Objective

This plan sets out management actions that, when implemented and measured, will deliver biodiversity gains for alpine sphagnum bogs and associated fens (alpine bogs and fens) 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 Main Works, up to 1.03 hectares of bogs and fens were identified as being impacted (assessments for the Snowy 2.0 Exploratory Works and Transmission Connection projects did not identify any impacts to bogs and fens). It is assumed that this area is impacted to the point where the vegetation integrity score is zero. A vegetation integrity score represents the degree to which the composition, structure and function of the vegetation at a site differs from the best-on-offer condition for the same vegetation type in the contemporary landscape.

To deliver the 120% ecological gain identified under the Kosciuszko Offset Strategy, the objective of this action plan is to deliver the **equivalent restoration of 1.24 hectares of bogs and fens in Kosciuszko National Park**.

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

Threatened ecological community overview and key threatening processes

Bogs and fens are listed as **endangered** under the NSW *Biodiversity Conservation Act 2016* and **endangered** under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Table 1 provides a summary for bogs and fens, including a description of the community, its structure, habitat and distribution within Kosciuszko National Park.

Table 1 Threatened ecological community summary – bogs and fens

Category	Summary
Structure	Wetlands comprising either dense to open patches of sclerophyllous shrubs up to 1 m tall (bogs), or more open and shorter communities of herbs and sedges (fens). The bogs often have conspicuous hummocks of sphagnum moss, but this is less often so in the fens.
Habitat	Boggy soils (peat) in hollows and drainage lines. The boggy soils are generally more acidic and have less phosphorus, nitrogen and potassium than those of the fens, although the 2 types of wetlands are often juxtaposed.
Distribution	Restricted to the Kosciuszko National Park plateau and north to the Brindabella range. Bogs and fens are also found in the Victorian alps.

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 bogs and fens within Kosciuszko National Park that will be addressed via cost-effective management actions (see Table 3). Actions will also consider relevant Australian Government threat abatement plans to reduce the impacts from key threatening processes on native species and communities.

Table 2 Key threatening processes to bogs and fens in Kosciuszko National Park

Threat	Description
Weeds	Weed invasion, including scotch broom, grey willow, blackberry, orange hawkweed, exotic perennial grasses and emerging weeds
Pathogens, diseases and microorganisms	Plant and animal pathogens leading to local extinction of susceptible species
Inappropriate fire regimes	Too frequent fire
Anthropogenic climate change	Periodic or long-term drying of peatlands leading to habitat degradation and vulnerability to fire
Feral herbivores	Grazing and trampling by feral animals (deer, pigs, horses)
Disturbance	Construction of infrastructure in alpine areas such as roads, tracks, buildings and ski trails resulting in loss and fragmentation of subalpine and alpine habitat. Hydrological change (including erosion and sedimentation) from roadworks, drainage works and aqueducts Recreational activities (including vehicle use, commercial horse riding, mountain biking, and bushwalking). Habitat degradation from past grazing and mining operations (including historic peat mining and ruby mining). Pollution (including herbicides) and sedimentation from runoff
Interactions with native species	Uncertainty about the ecology of bogs and fens, particularly in relation to groundwater-dependent species

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 or ecological 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 an ecological gain.

In setting an objective to exceed the statutory requirements, the strategy recognised the difficulties in measuring ecological gains and the inherent fluctuations in ecological condition 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 ecological 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 bogs and fens and benefits that must be delivered

Up to 1.03 hectares of bogs and fens were identified as being impacted by Snowy 2.0 Main Works. The benefit that must be delivered will be equivalent to the restoration of 1.24 hectares of bogs and fens in Kosciuszko National Park (being 120% of the impact).

Step 1 limitations, assumptions and notes

- Bog and fen condition will be assessed using 2 methodologies – the extent of sphagnum moss cover (area in hectares) and a scoring system developed by Robertson et al. (2019).
- Robertson et al. (2019) includes assessing stream bank stability, pugging damage, drainage lines, sediment levels on the stream bed, define animal paths in close proximity, grazing disturbance, projected foliage cover and proportion of native vegetation.
- This action plan also recognises that the condition of an ecological community generally refers to more than just the presence of one native species, but rather the presence of a group of plants and animals and other organisms that work together to form a unique habitat. However, sphagnum moss is used as the sole species indicator in this plan as it is the most important component found within this ecological community.
- This approach of using sphagnum moss as an indicator of bog and fen condition is consistent with the Victorian and Commonwealth government approaches to assessing the condition and monitoring of bogs and fens.

Step 2: implementing the management actions for bogs and fens to deliver the required offset

Delivering the required offset by restoring at least 1.24 hectares of bogs and fens in Kosciuszko National Park (or equivalent amount depending on the assessed condition of the offset action area), will involve the following management interventions:

- identifying suitable offset sites and measuring the current condition (baseline) and presence of sphagnum moss at prioritised locations (see Figure 1 and actions 1 and 2 in Table 3)
- identifying the required area(s) across which the offset actions are to be delivered (see actions 2 and 3 in Table 3)
- increasing the condition at that location through a targeted series of offset actions such as fencing, intensive feral herbivore control above and beyond core management (see actions 4, 5, 6 and 7 in Table 3), and, if required, the rehabilitation and transplanting of sphagnum moss into areas deemed suitable (assessment of suitability for transplant will be made based off feral herbivore (horse) retention areas and during action 2 and in reviewing the results of annual monitoring).

For the purposes of this action plan, this threatened ecological community will be defined by the presence of sphagnum moss. In addition, the condition of the threatened ecological community will be assessed on the extent of sphagnum moss cover and the Robertson et al. scoring system.

Mapping of bogs and fens in Kosciuszko National Park commenced in 2005 and was completed in 2010. The results of the mapping were completed as part of a National Parks and Wildlife Service project and documented in a National Parks and Wildlife Service technical report titled *Peat-forming bogs and fens of the Snowy Mountains of NSW*. The report provided a list of priority bog and fen sites for protection and restoration.

These priority sites were used as a starting point from which 5 offset sites have been preliminarily identified (Figure 1) via desktop mapping (action 1, Figure 1). The 5 sites were chosen based on their proximity to the impact area, accessibility, assumed recovery potential, feral herbivore retention and control areas, and previous bog and fen restoration works. Actions 2 and 3 (Table 3) will:

- confirm the number and location of the 5 proposed offset polygons
- assess the condition of the bogs and fens via the extent of sphagnum moss present and the Robertson et al. scoring system
- determine the required management actions to take place within each polygon to reach the required offset.

Currently, 3 of the identified sites (Port Phillip Trail, Boggy Plain and Bullocks Hill Trail) are located within the feral herbivore retention zone, which, if confirmed as priority offset sites, will likely require fencing for immediate protection (identified in action 4, Table 3). The total area of fencing is estimated to be 997 hectares (in 3 separate enclosures) to enclose the surrounding areas of sphagnum, which must be free from surface impact for restoration to occur.

As the rate of recovery is unknown and it is unknown if changes to the underground hydrology will impact the recovery of sphagnum, 2 additional sites (Murray Gap Trail and Happy Jacks) outside of the feral herbivore retention zone have been identified for restoration works, including potential sphagnum transplantations (identified in action 5, Table 3).

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The proposed priority sites 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 plan may, where appropriate, occur within AIS sites where offset funds are used to benefit the ecological community and where actions go above and beyond those identified under the AIS program.

Table 3 lists the actions needed to deliver the required ecological gains.

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Table 3 Management actions for bogs and fens to deliver the required offset in Kosciuszko National Park

Action number	Action	Threat addressed	Location	When	Who	Total cost (preliminary estimates)	Comment
1	Undertake a desktop assessment to determine bog and fen prioritisation in order to identify potentially suitable offset areas/restoration sites	–	Areas shaded yellow (Figure 1 – identified priority sites)	Completed in 2023	NPWS	\$1,000	Sites included in the prioritisation process considered current monitoring sites and previous prioritisation lists.
2	Conduct site visits to the 5 prioritised locations identified in action 1 and Figure 1. Site visits will assess sphagnum moss extent and bog and fen condition using Robertson et al., determine site accessibility and suitability for offset actions	–	Areas shaded yellow (Figure 1 – identified priority sites)	Completed in 2024	NPWS	\$15,000	Required to confirm offset areas and suitable management actions to improve the vegetative condition and extent of the threatened ecological community. Site visits occurred in February 2024 with accountable officer and external expert ecologist. The 5 prioritised locations were not deemed suitable as offset sites and an additional 7 locations were surveyed. Two of these additional locations (Blanket Plain and Wild Horse Plain) were determined to be high priority for restoration and selected to move forward to step 3.
3	Undertake a site and/or desktop assessment to calculate the offset to be delivered for each identified area in action 1 and any additional sites	–	Designated bog and fen offset areas identified under action 2	Completed in 2024	NPWS	\$500	To establish the baseline condition of each site to determine the required increase in condition and extent to offset the impact.

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Action number	Action	Threat addressed	Location	When	Who	Total cost (preliminary estimates)	Comment
	identified by NPWS during action 2						
4	Fencing suitable areas identified in action 2 and action 3	Feral herbivores	Designated bog and fen offset areas	2025 to 2035	NPWS	Up to \$450,000 over a minimum of 20 years	Fencing will depend on site accessibility and terrain, which will be determined during action 2.
5	Scotch broom, grey willow, blackberry, orange hawkweed, exotic perennial grasses (and other weeds as appropriate) control in areas identified in action 2 and 3 (designated bog and fen offset areas)	Weeds	Designated bog and fen offset areas	2025 to 2045	NPWS	Up to \$100,000 over a minimum of 20 years	Additional to core weed management. The area (ha) of land controlled will be measured.
6	Rehabilitate and transplant sphagnum moss in areas identified in bog and fen offset areas	Fire, climate change; feral herbivores	Designated bog and fen offset areas	2025 to 2045	NPWS	Up to \$100,000 over a minimum of 20 years	This action will be implemented if required. Additional to core rehabilitation works and consistent with the Australian Alps Rehabilitation Guidelines.
7	Deer, horse and feral pig control in bog and fen offset areas	Feral herbivores	Designated bog and fen offset areas	2025 to 2045	Integrated into existing feral herbivore control programs for northern areas	Up to \$63,000 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.
8	Fire protection of designated bog and fen offset areas sites	Fire – too frequent burning	Designated bog and fen offset areas	2025 to 2045	NPWS operational area staff including fire planning officers	Up to \$30,000 over a minimum of 20 years	Work with fire planning officers to limit or prevent hazard reduction burning in these areas.

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Action number	Action	Threat addressed	Location	When	Who	Total cost (preliminary estimates)	Comment
9	Additional monitoring of feral animal numbers	Feral herbivores	Designated bog and fen offset areas	2025 to 2045	Integrate into existing feral animal monitoring	Up to \$60,000 over a minimum of 20 years	As required, implement monitoring to measure and track feral animal densities in the designated bog and fen offset areas consistent with NPWS protocols.
					Total cost	\$0.82 million	

Step 2 limitations, assumptions and notes

- The data used to determine suitable sites in the prioritisation process is based on the most recent and comprehensive data available, however, it is recognised that some data will have inherent limitations due to the lack of ground truthing and recency of research.
- 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.
- 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. Rehabilitating bogs and fens on Snowy 2.0 project sites is outside the scope and timeframe of this project and action plan.

Step 3: measuring and reporting on the ecological benefit to bogs and fens

The Kosciuszko Offset Strategy states that each action plan must describe how the required biodiversity or ecological benefit (offset) will be measured. This involves setting out the attributes to be measured and the methodology, timing and other details relevant to monitoring. The ecological benefit to be delivered for bogs and fens will be measured by the extent of sphagnum moss cover, and the scoring result from Robertson et al.

If this monitoring design is not working, then using sphagnum moss as a sole species indicator/attribute will be reconsidered.

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.

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Table 4 Measuring ecological benefits to bogs and fens

Attribute to be measured	Metric	Location	Methodology	Monitoring design	Timing	Cost	Frequency of measurement
Bog and fen condition	Robertson et al. scoring system. and the extent of sphagnum moss cover (area in hectares)	Hectares of suitable habitat identified in action 3 (Figure 1)	Quadrant assessment	Detailed monitoring design to be determined during implementation of actions 1 to 3	December to January	\$300,000	Annually

Step 3 limitations, assumptions and notes

- An increase in sphagnum moss extent and an improvement in the bog and fen Robertson et al. condition score will be defined as an improvement in ecological community condition.
- Sphagnum moss is used as a sole species indicator in this action plan as it is only found within this ecological community.
- This approach of using sphagnum moss as a sole species indicator is consistent with the Victorian and Commonwealth government approaches to monitoring bog and fen condition.

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 condition and extent of cover of sphagnum moss at selected bogs and fens areas in the park. 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 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 actions 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

It is recognised that measuring the ecological benefit for bogs and fens focuses on increasing the extent and cover of sphagnum moss as an indicator of the health and functionality of the ecological community as a whole. Together, with the influence of natural variability, it is anticipated there will be a level of uncertainty to both measuring and interpreting ecological benefits for bogs and fens. This uncertainty will be addressed by applying an adaptive approach, including reviewing and updating monitoring and condition improvement 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	May 2025
Date approved – NPWS	22 June 2025
Approved by	Naomi Stephens, Acting Deputy Secretary National Parks and Wildlife Service
Date approved – DCCEEW (Cth)	10 September 2025
Approved by	Kate Gowland, Branch Head, Commonwealth Department of Climate Change, Energy, the Environment and Water
Date for review	September 2030

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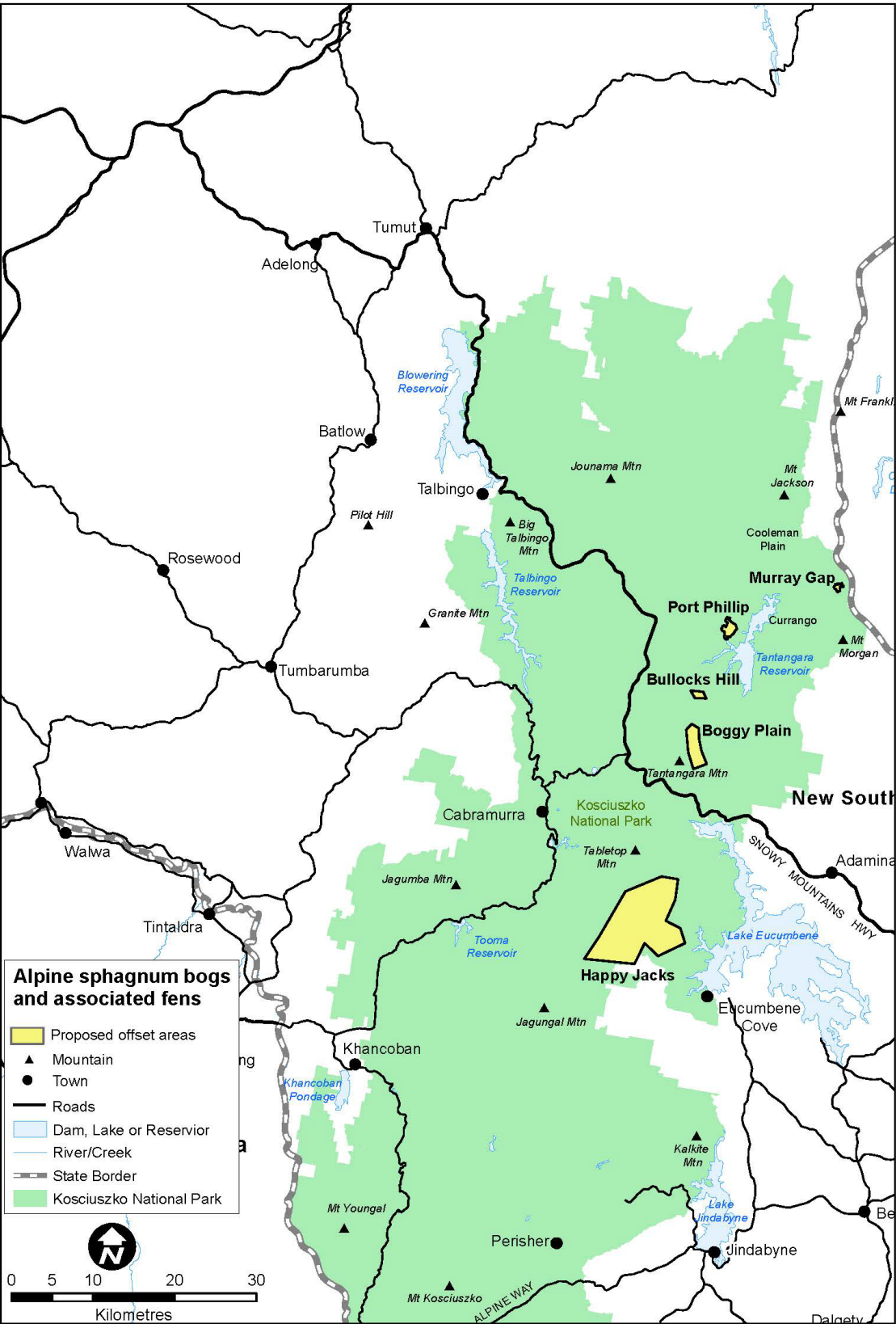


Figure 1 Proposed bogs and fens offset areas – Kosciuszko National Park

More information

- [Approved threat abatement plans](#)
- [Assets of Intergenerational Significance](#)