Ecological Health Performance Scorecard

Kosciuszko National Park 2022–23

The NSW National Parks and Wildlife Service's (NPWS) Ecological Health Performance Scorecards program (Scorecards) aims to improve conservation outcomes by systematically collecting quantitative data to track long-term trends and report on the health of our national parks over time. These metrics will provide guidance on cost-effective management actions and interventions as part of a statewide approach to optimising the health of our national parks. The Scorecards program is initially operating across 8 sites. Tranche 1 of the program includes Kosciuszko National Park and the aggregate of Royal National Park, Heathcote National Park and Garawarra State Conservation Area.

This Scorecard covers 689,728 ha extending over 4 NSW bioregions – Australian Alps, NSW South Western Slopes, South East Corner, and South Eastern Highlands. It reports on:

- the health of conservation assets (including threatened and/or declining species)

- the status of ecological threats (including feral animals, weeds, and inappropriate fire regimes)

- the health of ecological processes (including water quality and soil health).
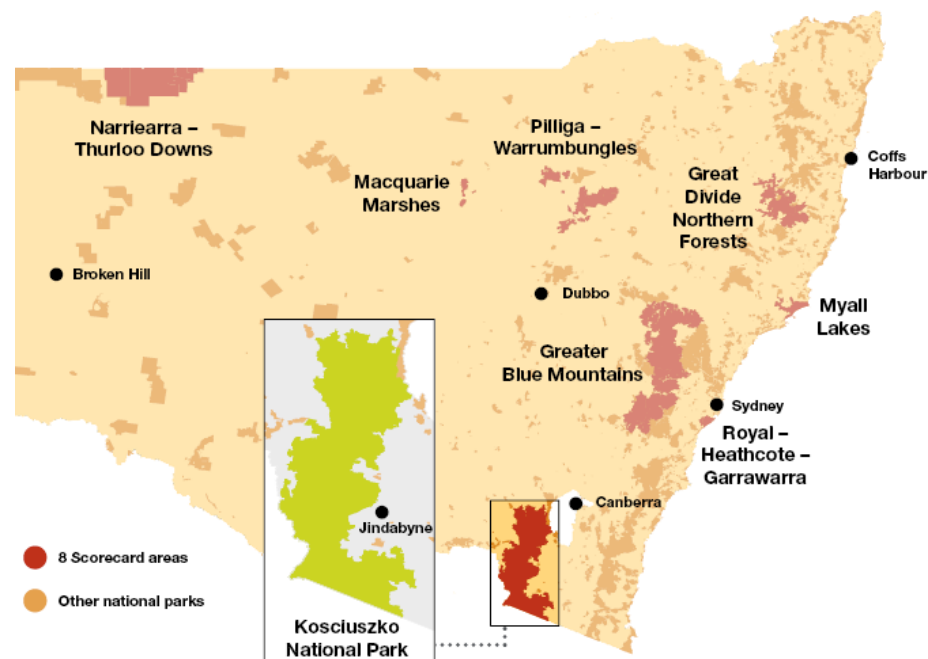

Figure 1   Kosciuszko National Park is one of 8 NPWS Scorecards sites

Native species indicators

The Scorecards surveillance monitoring program found that Kosciuszko National Park is home to a diverse and widespread population of small and medium ground-dwelling mammals in the alpine area of Australia. A total of 34 species of mammals (12 microbats, 7 small ground-dwelling mammals, 6 large mammals, 5 arboreal mammals, 3 medium-sized mammals and 1 semi-aquatic mammal) and 110 species of bird were detected across 100 monitoring sites. Scorecard results for mammals, bats, birds, reptiles and amphibians, and threatened flora are provided in tables 1 to 5.

Mammals

Table 1   Mammal indicators, metrics and results for 2022–23

Indicator	Metric	2023	2022	Trend	Commentary
All native mammals					
	Number of species (surveillance monitoring)	34	–	–	Camera-based surveys were conducted at 100 of a proposed 125 park-wide surveillance monitoring sites targeting ground-dwelling mammals. Ultrasonic recorders targeting microbats were deployed at 74 sites. Data includes species detected on cameras and ultrasonic devices.
					More species were detected in wet sclerophyll (grassy) and dry sclerophyll (shrub/grass) forests, with a mean of 7 species per site.
	Number of species last 5 years	45	–	–	Data compiled from surveys, incidental records from surveys, incidental records, and records from BioNet and Atlas of Living Australia (ALA) over the last 5 years (30 June 2018–30 June 2023).
					The difference between species recorded from the park-wide surveillance monitoring sites and BioNet/ALA records is mostly attributed to arboreal species (i.e. 5 glider species) which were not surveyed in 2022–23. Other species not detected from the Scorecard surveys were platypus, grey-headed flying fox, eastern horseshoe bat, Gould's long-eared bat and mountain pygmy-possum (habitat specialist). One species of bat, yellow-bellied sheathtail, had not been detected in the last 5 years until the Scorecard survey.
	Pre-European c.1750 mammal assemblage	57	–	–	An initial assessment of the mammal species assemblage present c.1750 has identified 55 species. Small and medium ground-dwelling mammals were the largest group not detected in the last 5 years. This includes 7 species that are suspected to be locally extinct, one extinct species (white-footed rabbit rat), and 4 species not detected in the last 5 years.

Indicator	Metric	2023	2022	Trend	Commentary
	% of 1750 mammal assemblage	79–86%	–	–	Current number of species recorded in the park (45) in the last 5 years as a percentage of total number of original species at the time of European settlement (79%), plus 4 species that may still be extant.
					The loss of 14–21% of the original species assemblage represents, by global standards, a high rate of local extinction. However, the site retains a relatively high proportion of its original mammal assemblage.
Small ground-dwelling mammals					
	Number of species	7	–	–	Species detected include broad-toothed rat, agile antechinus, bush rat, swamp rat, common dunnart, dusky antechinus and smoky mouse.
	Activity	18.0 (±2.3)*	–	–	
Broad-toothed rat	Occupancy	6%	–	–	Camera-based surveys detected this species at 6% of the park-wide surveillance monitoring sites. A targeted monitoring program for this species is being developed and expanded to determine its distribution and monitor abundance across the park. Habitat of exceptional value has been declared as an Asset of Intergenerational Significance (AIS) for this species under s.153G of the *National Parks and Wildlife Act 1974*. Listed as vulnerable under the *Biodiversity Conservation Act 2016*.
	Abundance	–	–	–	
Smoky mouse	Occupancy	2%	–	–	Detected in dry sclerophyll (shrubby) and wet sclerophyll (grassy) in surveillance monitoring. Targeted surveys are currently underway to define the species distribution. Habitat of exceptional value has been declared an AIS for this species under s 153G of the National Parks and Wildlife Act. Listed as critically endangered under the Biodiversity Conservation (BC) Act.
Mountain pygmy-possum	Occupancy	–	–	–	Species restricted to mostly boulder fields. Targeted monitoring is being developed to clarify the current distribution of the species. The number of trap nights in 2022 was 3,636, and in 2023, 2,728. The number of animals trapped, standardised by the number of trap nights is 331 (2022) and 309 (2023). Relative abundance at monitoring sites has remained constant since 2019. Data is being analysed to estimate total population with a preliminary estimate for KNP of 800–1100 individuals. Habitat of exceptional value has been declared an AIS for this species under s 153G of the National Parks and Wildlife Act. Listed as endangered under the BC Act.
	Mean number of individuals trapped	10.4 per 100 trap nights	11.1 per 100 trap nights	⟷	
	Population estimate	–	–	-	
Medium ground-dwelling mammals					
	Number of species	3	–	–	Species detected include spotted-tailed quoll, long-nosed bandicoot, echidna.
	Occupancy	5%	–	–	

Indicator	Metric	2023	2022	Trend	Commentary
Spotted-tailed quoll	Activity	1.2 (±0.4)*	–	–	Detected commonly in dry sclerophyll forest (shrub/grassy) and wet sclerophyll forest (grassy). Detected in the south-east of the park at 5 sites as part of surveillance monitoring. Targeted surveys to monitor density of the species are being reviewed. Listed as a vulnerable species under the BC Act.
	Density	–	–	–	
Long-nosed bandicoot	Occupancy	22%	–	–	Detected commonly in wet and dry sclerophyll forests, and grassy woodlands. Not recorded in the alpine complex vegetation formation.
	Activity	1.7 (±0.4)*	–	–	
Large ground-dwelling mammals					
	Number of species	6			Species detected include bare-nosed wombat, common wallaroo, dingo (wild dog), eastern grey kangaroo, red-necked wallaby, swamp wallaby.
Dingo	Occupancy	22%	–		There has been no attempt to distinguish between dingo and other wild dogs in KNP. NPWS notes there is an obligation under the NSW Biosecurity Act in relation to wild dogs.
Bare-nosed wombat	Occupancy	69%	–		Widespread and common across KNP.
Arboreal mammals					
	Number of species	5	–	–	Detections from camera data: eastern pygmy-possum, common ringtail possum, common brushtail possum, and mountain brushtail possum. Detection from acoustic data: koala.
Koala	Occupancy	10%	–	–	Recorded in wet sclerophyll forest. Only detected in Byadbo Wilderness area and either do not occur or are very uncommon in other parts of the park.
	Abundance	–	–	–	Interim reporting pending development of park-wide targeted monitoring program to estimate distribution and abundance.
					Listed as an endangered species under the BC Act.
Eastern pygmy-possum	Occupancy	–	–	–	Detected across all vegetation formations surveyed except the alpine complex. More often detected in wet and dry sclerophyll forest and detected at very low levels in grassy woodland. Listed as a vulnerable species under the BC Act.
	Activity	2.4 (±0.7)*	–	–	
Yellow-bellied glider	Occupancy	–	–	–	Processing of audio data is still under development. Listed as a vulnerable species under the BC Act.
	Density	–	–	–	

– refers to insufficient data to determine a trend. ⟷ refers to stable trend.

* Mammal activity: the number of unique detections (separated per 30 minutes) of a species in 100 camera-based survey days.

Bats

Table 2   **Bat indicators, metrics and results for 2022–23**

Indicator	Metric	2023	2022	Trend	Commentary
All microbats					
	Number of microbat species (surveillance monitoring)	12	–	–	Ultrasonic recording devices were deployed at 74 sites. Species richness was evenly spread across all main vegetation formations (wet and dry sclerophyll forests, grassy woodlands and the alpine complex).
					One genus (*Nyctophilus*) could not be identified to a species level as calls cannot currently be distinguished. Therefore, only one species has been counted but it is likely that both *Nyctophilus geoffroyi* and *N. gouldi* are in the park.
					Five species listed as vulnerable under the BC Act.
	Number of microbat species last 5 years	15	–	–	Data compiled from incidental records from this program plus records from BioNet and ALA over the last 5 years (30 June 2018 to 30 June 2023). Two species were not detected from surveillance monitoring: eastern horseshoe bat (*Rhinolophus megaphyllus*) and one of the 2 *Nyctophilus* species as mentioned above.
	Pre-European c.1750 microbat assemblage	17	–	–	Microbat assemblage is based on BioNet and ALA database records (30 June 2018 to 30 June 2023). Two species not detected in the last 5 years are the south-eastern freetail bat (*Ozimops planiceps*) and the eastern broad-nosed bat (*Scotorepens orion*).
	% of 1750 microbat assemblage	88–100%	–	–	There have been limited surveys on microbats prior to 1980, and they can be uncommon in the fossil record. Data from surveys conducted in the last 30 years indicate that the microbat assemblage remains intact in the park, based on available historic data.
Southern Myotis	Occupancy	–	–		Targeted surveys planned for 2024–25.
	Activity				
Eastern false pipistrelle	Occupancy	81%	–	–	Highest activity in wet sclerophyll forests (grassy) at approximately 3 times the level of all other vegetation formations in Kosciuszko National Park (KNP). Listed as a vulnerable species under the BC Act.
	Activity	0.8 (±0.1)[#]	–	–	

– refers to insufficient data to determine a trend; # bat activity: mean number of unique detections (separated per 30 minutes) per site per night.

Birds

Table 3   Bird indicators, metrics and results for 2022–23

Indicator	Metric	2023	2022	Trend	Commentary
All native birds					
	Number of bird species	109	–	–	Number of species detected across diurnal bird surveys at 44 of the park-wide surveillance monitoring sites and from camera-based surveys. Each diurnal bird survey site was surveyed twice. More bird species were detected in wet sclerophyll forest and the least number were detected in the alpine complex. Includes 13 species listed as threatened, 9 under the BC Act, 2 under the Environment Protection and Biodiversity Conservation (EPBC) Act and 2 under State and Commonwealth Acts.
	Number of bird species last 5 years	187	–	–	Data based on records from BioNet, ALA and eBird databases. This includes 32 species listed as threatened under BC, EPBC, State and Commonwealth Acts.
	Pre-European (c.1750) bird species assemblage	243	–	–	A total of 243 bird species have been recorded in databases for KNP, however, many species are migratory and some of these records may represent species that rarely occur in the park.
	% of 1750 bird assemblage	77–84%	–	–	The number recorded in the last 5 years is not yet a reliable measure of the extant bird assemblage. There are 17 species which have not been recorded in the past 5 years but are expected to still occur (204 total species likely still occur). However, there are 2 species of particular concern that have not been recorded in the last 5 years: southern whiteface and blue-winged parrot.
Diurnal birds					
	Number of species	77	–	–	Highest species richness observed in dry sclerophyll forests (shrubby) and wet sclerophyll forests (grassy). Range of 1 to 37 species observed per site. The most frequently observed species were brown thornbill, white-throated treecreeper and grey fantail.
Raptors	Number of species	8	–	–	Eight species of raptor were recorded: collared sparrowhawk, brown goshawk, swamp harrier, wedge-tailed eagle, brown falcon, nankeen kestrel, Australian hobby and peregrine falcon.
Robins	Number of species	7	–	–	Seven species of robin were recorded: eastern yellow robin, jacky winter, scarlet robin, red-capped robin, pink robin, rose robin and

Indicator	Metric	2023	2022	Trend	Commentary
					flame robin. The scarlet and the flame robins are listed as vulnerable species under the BC Act.
Gang-gang cockatoo	Occupancy	77%	–	–	Recorded throughout the park from acoustic recorders but infrequently from diurnal surveys. Listed as an endangered species under the BC Act.
Superb lyrebird	Occupancy	50%	–	–	Detected commonly in wet and dry sclerophyll vegetation formations. Not recorded in the alpine complex vegetation and occurrence was low in the grassy woodland formation.
	Activity	6.4 (±1.1)*			
Nocturnal birds					
	Number of species	3	–	–	Species detected: tawny frogmouth and southern boobook through incidental observations during diurnal bird surveys and camera-based surveys, and Australian owlet-nightjar detected by camera-based surveys. Processing of audio data is still under development.
Powerful owl	Occupancy	15%	–	–	Powerful and boobook owl detected from acoustic recorders.
Boobook owl	Occupancy	64%	–	–	

– refers to insufficient data to determine a trend.

* lyrebird activity: the number of unique detections (separated per 30 minutes) of a species in 100 camera-based survey days.

Reptiles and amphibians

Table 4   Reptile and amphibian indicators, metrics and results for 2022–23

Indicator	Metric	2023	2022	Trend	Commentary
Alpine and sub-alpine reptiles					
	Number of species	–	12	–	A range of species were detected incidentally as part of other targeted monitoring programs. These include southern tussock skink, highland copperhead, eastern three-lined skink, white-lipped snake, alpine water skink, and mountain skink.
Guthega skink	Abundance	206 active burrows	236 active burrows	↓	This colonial species has a restricted distribution in New South Wales, occurring between 1600 m and 2170 m in montane, sub-alpine and alpine habitats. Targeted monitoring of the population occurs at key sites across its range. Ground disturbance (grazing and trampling) can impact the species' burrow network and basking and foraging areas. An increase in the presence of deer was recorded at targeted monitoring sites in 2022; ongoing feral animal control is required. Listed as an endangered species under the BC Act. Habitat of exceptional value has been declared an AIS for this species under s 153G of the National Parks and Wildlife Act. This is an interim metric pending review of the survey design.
Alpine she-oak skink	Occupancy	–	–	–	This species is a grassland specialist and has a restricted distribution in New South Wales, only being detected above 1200 m above sea level. A targeted monitoring program for the species is being reviewed. Listed as an endangered species under the BC Act. Habitat of exceptional value has been declared an AIS for this species under s 153G of the National Parks and Wildlife Act.
	Abundance	–	–	–	
Amphibians					
Alpine tree frog	Occupancy	–	100%	↔	Occupancy and average relative abundance have remained constant since the last survey in 2019. Additional monitoring sites will be added in the future. Listed as an endangered species under the BC Act.
	Abundance	–	20/site		
Booroolong frog	Occupancy	–	100% [2019 surveys]	↔	While occupancy across sites has remained constant since surveys began in 2015, the average relative abundance across sites has declined. However, this is consistent with natural fluctuations in abundance for this species. Listed as an endangered species under the BC Act.
	Abundance	–	19		
Southern corroboree frog	Abundance	29	35	↔	Only occurs at introduction sites where captive-bred individuals are being released. Listed as a critically endangered species under the BC Act. Habitat of exceptional value has been declared an AIS for this species under s 153G of the National Parks and Wildlife Act.
Northern corroboree frog	Abundance	149	187	↓	This species is in ongoing decline due to the amphibian chytrid fungus, which was exacerbated by the 2019–20 wildfires. A robust captive assurance colony is currently being established at Taronga Zoo. Listed as a critically endangered species under the BC Act.

Indicator	Metric	2023	2022	Trend	Commentary
					Habitat of exceptional value has been declared an AIS for this species under s 153G of the National Parks and Wildlife Act.
Spotted tree frog	Abundance	49	6	↑	Recovery is being observed following impacts from the 2019–20 wildfires. Work is currently being undertaken to identify a suitable host site to establish a second NSW population for this species. Listed as a critically endangered species under the BC Act. Habitat of exceptional value has been declared an AIS for this species under s 153G of the National Parks and Wildlife Act.
Invertebrates					
Bogong moth	Abundance	–	–	–	Targeted survey to be developed to monitor seasonal trends in abundance. Listed as an endangered species on the International Union for Conservation of Nature (IUCN) Red List in 2021.

– refers to insufficient data to determine a trend.

⟷ refers to stable trend.

↓ refers to downward trend.

↑ refers to upward trend.

Threatened flora

Table 5   Threatened flora, metrics and results for 2022–23

Indicator	Metric	2023	2022	Trend	Commentary
Threatened flora					
Anemone buttercup (*Ranunculus anemoneus*)	Stem abundance	–	5,308 stems	–	This is an interim metric pending review of survey design. This species is endemic to KNP and occurs only above 1600 m; biennial targeted monitoring of the population occurs above this elevation. An increase in the number of above-ground stems has been observed since 2020 (a 45% increase), when monitoring commenced. Browsing damage has been observed at 50% of the monitored sites. In the habitat of this species, strategic control programs are targeting feral herbivores and pigs. Weed impacts have been observed at sites where previously no weeds occurred. Listed as a vulnerable species under the BC Act.
Leafy anchor plant (*Discaria nitida*)	Abundance	97 tagged plants	100 tagged plants [2021 surveys]	–	This is an interim metric pending review of survey design. This species occurs above 900 m elevation along riparian corridors. In the past, 30 plants have been tagged and monitored over time at each of 4 sites in KNP. Tagged plants have been monitored for their survival, flowering success and impacts of damage from herbivores. One targeted monitoring site was impacted by fire in 2019–20 resulting in a 70% decrease in the number of plants. Other sites have recorded 3–13% declines in the number of plants. Overall, 97 of the original 120 tagged plants are alive. Listed as a vulnerable species under the BC Act.
Max Mueller's burr-daisy (*Calotis pubescens*)	Population density	40 occupied patches/100m²	45 occupied patches/100m²	–	This is an interim metric pending review of survey design. This species occurs only in subalpine and montane grasslands. Threats are weed invasion, impacts from feral herbivores and pigs. One site has been impacted by competition from the weed species oxeye daisy. Control programs are being undertaken to manage this species. Listed as an endangered species under the BC Act. Habitat of exceptional value has been declared an AIS for this species under s 153G of the National Parks and Wildlife Act.
Suggan Buggan mallee (*Eucalyptus saxatilis*)	Abundance	174 tagged plants	191 tagged plants [2021 surveys]	–	This is an interim metric pending review of survey design. Known from only 4 locations in KNP, this species is restricted to the lower snowy area; targeted monitoring occurs across its known occurrence. Tagged plants are monitored for their survival, flowering success and impacts of damage from herbivores. Listed as an endangered species under the BC Act. Habitat of exceptional value has been declared an AIS for this species under s 153G of the National Parks and Wildlife Act. A trend is currently unable to be determined for this species due to the inconsistency in monitoring frequency across sites over the years data has been collected for this species.

Ecological community indicators

A total of 501 native plant species and 55 exotic plant species were recorded across the 95 park-wide vegetation surveillance monitoring sites. All of these sites are away from disturbance boundaries (roads, trails, river, visitor areas) but the vegetation surveys indicate that weed incursion is high ranging from 44–100% of sites in each vegetation formation. Three significant environmental weed species were detected during the park-wide surveillance monitoring. Nine sites recorded blackberry, one site recorded oxeye daisy, and sweet vernal grass was detected at 23 sites. Scorecard results for 2023 are provided in tables 6 and 7 for vegetation formations and targeted communities, respectively.

Vegetation formation

Table 6   **Vegetation formations, metrics and results for 2023**

Metric	2023		Trend	Commentary
Alpine complex – 83,839 ha (12.4 % of KNP)				
Native species richness		Total number of species: 182 Mean per site: 40 (range: 30–55)	–	The alpine complex formation is unique within Australia, containing a high diversity of species (> 700) with many endemic alpine species and communities. This vegetation formation includes alpine vegetation, subalpine grasslands, bogs and fens, and heathland. Three threatened plant communities are restricted to the alpine zone and a fourth community, montane bogs and fen, occurs from the montane to the alpine zone. The formation is mostly treeless, with a few scattered examples of *Eucalyptus pauciflora*. The ground layer is dominated by sedges and shrubs with *Carex breviculmis*, *Grevillea australis*, and *Hovea montana* the most commonly recorded species in the alpine complex site (80% of sites).
Stem density (by tree-size classes)	<20 cm	Alive: 84 (range: 0–620)		
		Dead: 4 (range: 0–40)		
	20–49 cm	Alive: 16 (range: 0–230)		
		Dead: 0		
	>50 cm	Alive: 0		
		Dead: 0		
Native vegetation (% cover)	<1 m	91 (range: 64–99)		All alpine complex sites (100%) recorded weed species, with *Acetosella vulgaris* the most common species recorded and cats-ear (*Hypochaeris radicata*) the second most common species (recorded in 67% of sites). No other weed species were recorded in more than 20% of sites. The environmental weed sweet vernal grass was recorded in one site.
	1–3 m	3 (range: 0–29)		
	3–5 m	1 (range: 0–15)		
Litter (% cover)		26 (range: 4–52)		
Foliage projective cover (% ± standard error)		32 (± 9)		

Metric		2023	Trend	Commentary
Weed species richness		Total number of species: 11 Mean per site: 3 (range:1–7) % of site with weeds: 100		
Wet sclerophyll forests (grassy) – 319,904 ha (47.3 % of KNP)				
Native species richness		Total number of species: 303 Mean per site: 39 (range: 17–68)	–	Wet sclerophyll forests occur in the mid slopes grading into montane areas of the park. The tree canopy includes tall forests dominated by mountain gum (*Eucalyptus dalrympleana*) and brown barrel (*E. fastigata*). These species are known to recover after fire from epicormic growth. Other canopy species include the alpine ash (*E. delegatensis*), an obligate seeder which requires long intervals between fire events (> 20 years) for seed to reach maturity. Three species of eucalypt (*E. delegatensis, E. dives* and *E. robertsonii*) were each recorded in 20% of sites. *Eucalyptus dalrympleana* was recorded in 17% of sites. Species richness was highest in wet sclerophyll forests compared with other vegetation formation. Wet sclerophyll forest (grassy) sites had the highest density of large trees (>50 cm diameter at breast height [DBH]). The most common weed species recorded in this formation was sorrel (*Acetosella vulgaris*), recorded at 49% of sites. No weed species were recorded at more than 30% of all sites. Oxeye daisy was recorded in one site, sweet vernal grass was recorded in 12 sites and blackberry recorded in 7 sites.
Stem density	<20 cm	Alive: 1083 (range: 80–4570)		
		Dead: 67 (range: 0–1120)		
	20–49 cm	Alive: 152 (range: 0–600)		
		Dead: 14 (range: 0–100)		
	>50 cm	Alive: 52 (range: 0–140)		
		Dead: 8 (range: 0–50)		
Native vegetation (% cover)	<1 m	64 (range: 18–100)		
	1–3 m	24 (range: 1–73)		
	3–5 m	13 (range: 0–53)		
	>5 m	–		
Litter (% cover)		52 (range: 2–99)		
Foliage projective cover (% ± standard error)		47 (± 2)		
Weed species richness		Total number of species: 34 Mean per site: 3 (range: 0–12) % of sites with weeds: 78		

Metric		2023	Trend	Commentary
Dry sclerophyll forest (shrub/grass) – 14,600 ha (2.2 % of KNP)				
Native species richness		Total number of species: 126 Mean per site: 33 (range: 23–46)	–	The dry sclerophyll forest (shrub/grass) is comprised of open eucalypt woodland up to 20 m in height with an open sclerophyllous understorey. It is typically located in low rainfall (< 500 mm per annum) areas between 300–700 m above sea level. It is most representative in the lower Snowy River region of KNP. Common tree canopy species include *Eucalyptus albens*, *Acacia deanei* subsp. *pacijuga* and *Callitris glaucophylla*. A diverse understorey layer includes shrub species (*Senecio quadridentatus, Lissanthe strigosa* subsp. *subulata, Astroloma humifusum*), grasses (*Poa sieberiana* var. *sieberiana, Rytidosperma monticola, Themeda triandra*) and herbaceous species (*Vittadinia cuneata* var. *cuneata, Glycine clandestina*, and *Cheilanthes sieberi* subsp. *sieberi*). Species richness was lowest in dry sclerophyll forests (shrub/grass) compared with other vegetation formations in KNP. The most common weed species sampled in this formation was a species of clover (*Trifolium arvense*) recorded at 44% of all sites.
Stem density	<20 cm	Alive: 677 (range: 20–1340)		
		Dead: 180 (range: 0–620)		
	20–49 cm	Alive: 133 (range: 30–220)		
		Dead: 7 (range: 0–50)		
	>50 cm	Alive: 3 (range: 0–10)		
		Dead: 0 (range: 0)		
Native vegetation (% cover)	<1 m	No data (range: no data)		
	1–3 m	12 (range: 2–27)		
	3–5 m	23 (range: 2–45)		
	>5 m	-		
Litter (% cover)		41 (range: 12–99)		
Foliage projective cover (% ± standard error)		35 (± 2)		
Weed species richness		Total number of species: 18 Mean per site: 5 (range: 0–9) % of sites with weeds: 89		
Dry sclerophyll forest (shrubby) – 99,509 ha (14.8 % of KNP)				
Native species richness		Total number of species: 157 Mean per site: 36 (range: 14–66)	–	The dry sclerophyll forest (shrubby) covers 15% of the park and recorded more native species than the shrub/grassy sub-formation. The dominant canopy species vary across KNP depending on elevation, aspect, rainfall, and soil depth but may include broad-leaved peppermint (*Eucalyptus dives*) and stringybark (*E. macrorohyncha*). The most commonly recorded tree species were *Eucalyptus dives* (56% of sites) and *E. macrorhyncha* (44% of sites). The diverse shrubby
Stem density	<20 cm	Alive: 659 (range: 130–1180)		
		Dead: 51 (range: 0–100)		
	20–49 cm	Alive: 262 (range: 100–530)		
		Dead: 9 (range: 0–30)		

Metric		2023	Trend	Commentary
	>50 cm	Alive: 42 (range: 0–100)		understorey was dominated by *Gonocarpus tetragynus*, *Hibbertia obtusifolia* and *Cassinia aculeata*. The herbaceous understorey was dominated by *Lomandra longifolia* which was recorded at 89% of all sites, along with *Hardenbergia violacea*, *Dianella revoluta* var. *revoluta* and *Poa sieberiana* var. s*ieberiana*. This vegetation formation had the highest density of medium-sized trees (20–49 cm DBH). Cats-ear (*Hypochaeris radicata*) was the most commonly recorded weed species (44% of sites) and sweet vernal and blackberry were both recorded at one site each.
		Dead: 2 (range: 0–20)		
Native vegetation (% cover)	<1 m	48 (range: 33–69)		
	1–3 m	18 (range: 0–56)		
	3–5 m	11 (range: 0–49)		
	>5 m	–		
Litter (% cover)		64 (range: 24–91)		
Foliage projective cover (% ± standard error)		45 (± 2)		
Weed species richness		Total number of species: 12 Mean per site: 3 (range: 0–9) % of sites with weeds: 67		

Grassy woodlands – 156,023 ha (23.2 % of KNP)

Metric		2023	Trend	Commentary
Native species richness		Total number of species: 244 Mean per site: 40 (range: 14–66)	–	
Stem density	<20 cm	Alive: 916 (range: 50–4,840)		
		Dead: 64 (range: 0–210)		
	20–49 cm	Alive: 79 (range: 0–330)		
		Dead: 29 (range: 0–100)		
	>50 cm	Alive: 24 (range: 0–100)		
		Dead: 8 (range: 0–40)		
Native vegetation (% cover)	<1 m	79 (range: 42–100)		
	1–3 m	18 (range: 0–93)		
	3–5 m	9 (range: 0–45)		
	>5 m	–		
Litter (% cover)		33 (range: 1–100)		

Metric	2023	Trend	Commentary
Foliage projective cover (% ± standard error)	40 (± 2)		Grassy woodland plant community types range from 300 to 1,850 m above sea level. Sub-alpine woodlands, dominated by one species, the snow gum (*Eucalyptus pauciflora*), makes up 79% of the grassy woodland formation in KNP. Smaller patches of other woodland types occur on the western and eastern slopes. Recovery of species, such as snow gum, after fire is from lignotubers, and the development of a mature canopy may take decades. Common tree canopy species include *E. pauciflora* and *E. stellulata.* Heath (*Acrothamnus hookeri*) and pea species (*Hovea montana, Bossiaea sericea, Daviesia ulicifolia)* dominate the shrub layer. The ground layer is dominated by grasses (*Anthosachne scabra, Poa* sp.), sedges (*Carex breviculmis*) and herbaceous species (*Stellaria pungens, Acaena novae-zelandiae, Senecio gunnii, Viola betonicifolia, Arthropodium milleflorum*). Two species of weeds were each recorded at 76% of sites: sorrel (*Acetosella vulgaris*) and cats-ear (*Hypochaeris radicata*), and spear thistle (*Cirsium vulgare*) recorded at 47% of sites. Sweet vernal was recorded at 9 sites and blackberry was recorded at one site.
Weed species richness	Total number of species: 33 Mean per site: 5 (range: 0–12) % of sites with weeds: 90		

Targeted vegetation communities

Table 7   Targeted vegetation communities, metrics and results for 2022–23

Indicator	Metric	2023	2022	Trend	Commentary
Alpine ash community					
	Maturity index	–	–	–	Iconic species which occupies 77,050 ha of the park and 76% of the extent in New South Wales. The area burnt in 2003, and again in 2020 was 19,295 ha – a fire interval too short to maintain persistence in the landscape. A monitoring program is being developed.
	Recruitment rate	–	–		
Montane peatlands					
	Area (ha)	–	–	–	In 2012, 6,037 ha of peatlands was mapped in KNP. Updated mapping to be developed to refine the extent of this community. Some monitoring sites were impacted by fire in 2020. Most peatland vegetation is recovering well, however, some changes in vegetation composition were observed, with an increase in exotic perennial grasses at some sites compared to surveys in 2018. Montane peatlands in the Australian Alps bioregion is listed as an endangered ecological community under the BC Act and listed as Alpine sphagnum bogs and associated fens under the EPBC Act.
	Native vegetation (% cover)	–	[2021] Mean: 87 (range: 53–100)		
	Exotic vegetation (% cover)	–	[2021] Mean: 3 (range: 0–29)		
Threatened alpine communities					
Alpine snowpatch feldmark	Area (ha)	–	–	–	Monitoring to be developed. Endemic threatened ecological communities vulnerable to the indirect impacts of climate change and direct impacts of fire. Alpine snowpatch feldmark, windswept feldmark and snowpatch herbfield in the Australian Alps bioregion are critically endangered ecological communities under the BC Act.
Alpine windswept feldmark	Area (ha)	–	–	–	
Alpine snowpatch herbfield	Area (ha)	–	–	–	

– refers to insufficient data to determine a trend.

Aquatic and biological indicators

Soil health

Total nitrogen, phosphorus and organic carbon were highest in the alpine complex sites, which tend to have humus soils developed from the breakdown of organic material (i.e. decomposing plant material). These soils are an important store of carbon. Alpine soils are susceptible to soil erosion by deer and horses. Total nitrogen, phosphorus and organic carbon were also high in grassy woodland sites. Table 8 shows scorecard results for 2022 and 2023.

Table 8   Soil health metrics and results for vegetation formations for 2022–23

Metric	2023	2022	Trend
Alpine complex			
Total nitrogen (mg/kg)	Mean: 7,686 (range: 4,200–11,100)	–	–
Total phosphorus (mg/kg)	Mean:79 (range: 19–275)		
Total organic carbon (g/kg)	Mean: 116 (range: 56–178)		
Tonnes of carbon	Mean: 71 (range: 9–102)		
pH	Mean: 4.1 (range: 3.7–5)		
Wet sclerophyll forests (grassy)			
Total nitrogen (mg/kg)	Mean: 3,490 (range: 1,200–7,100)	–	–
Total phosphorus (mg/kg)	Mean: 41 (range: 6–323)		
Total organic carbon (g/kg)	Mean: 81 (range: 25–160)		
Tonnes of carbon	Mean: 60 (range: 14–226)		
pH	Mean: 4.5 (range: 3.3–5.9)		
Dry sclerophyll forest (shrub/grass)			
Total nitrogen (mg/kg)	Mean: 1,400 (range: 1,200–1,800)	–	–
Total phosphorus (mg/kg)	Mean: 15 (range: 6–40)		
Total organic carbon (g/kg)	Mean: 26 (range: 20–37)		
Tonnes of carbon	Mean: 45 (range: 13–76)		
pH	Mean: 5.4 (range: 4.1–6.5)		

Metric	2023	2022	Trend
Dry sclerophyll forest (shrubby)			
Total nitrogen (mg/kg)	Mean: 1,700 (range: 900–2,600)	–	–
Total phosphorus (mg/kg)	Mean: 9 (range: 3–19)		
Total organic carbon (g/kg)	Mean: 42 (range: 30–58)		
Tonnes of carbon	Mean: 54 (range: 31–116)		
pH	Mean: 4.3 (range: 4.6–5.0)		
Grassy woodlands			
Total nitrogen (mg/kg)	Mean: 6,209 (range: 2,000–11,800)	–	–
Total phosphorus (mg/kg)	Mean: 44 (range: 6–144)		
Total organic carbon (g/kg)	Mean: 109 (range: 30–305)		
Tonnes of carbon	Mean: 97 (range: 15–533)		
pH	Mean: 4.3 (range: 3.7–5.1)		

– refers to insufficient data to determine a trend.

Waterway health

Waterways have been impacted by historical land use, feral herbivore (including horse) impacts and wastewater inputs from tourist resort areas. Water monitoring across 54 sites, assesses the impact of environmental stressors, measured by chemical and physical water quality attributes, on the biological condition, as determined by benthic macroinvertebrate communities. Environmental stressors include nutrients, salinity and water clarity which, in high concentrations, can cause decline in macroinvertebrate diversity and pollution-sensitive taxa, resulting in decreased stream health. Many alpine stream sites are impacted by tourist activities, stormwater and snow melt runoff from hard surfaces. Upland river sites being monitored for horse impacts observed increased turbidity in areas under high horse activity resulting in increased stress on sensitive macroinvertebrate taxa.

Table 9   Waterways metrics and results for 2023–24

Metric	2023	2022	Trend	Commentary
Water quality – rivers and streams				
% of sites that meet water quality guideline values	20%	–	–	Across 54 water monitoring sites, environmental stressor attributes were outside guideline levels at: • 16 (84%) of 19 alpine streams exceeded trigger levels for one or more of the measures, and 9 (17%) exceeded 2 or more • 27 (77%) of 35 upland rivers exceeded trigger levels for one or more of the measures, and 11 (20%) exceeded 2 or more.
% of sites that meet biological condition guideline values	65%	–	–	Across 54 water monitoring sites, biological condition attributes were outside guideline levels at: • 5 (26%) of 19 alpine streams where outside one or more of the guideline levels, and one site was outside 2 or more • 14 (40%) of 35 upland rivers where outside one or more of the guideline levels, and 9 (26%) was outside 2 or more.
Chemical and physical water quality attributes				
% of sites that meet water quality guidelines for turbidity	Low flow: 52%	–	–	Turbidity levels were at or in excess of low flow trigger levels at 26 (48%) of the 54 sites: 16% of alpine stream and 66% of upland river sites. Values did not exceed high flow trigger levels during high flow events. High flow events resulting from heavy rains can mobilise and transport sediments resulting in higher measures of turbidity.
% of sites that meet water quality guidelines for turbidity	High flow: 100%	–	–	

Metric	2023	2022	Trend	Commentary
% of sites that meet water quality guidelines for dissolved oxygen	96%	–	–	Dissolved oxygen levels were outside trigger levels for 2 sites (4%) of the 54 sites: 5% of alpine stream and 3% of upland stream sites.
% of sites that meet water quality guidelines for total nitrogen	63%	–	–	Elevated nitrogen levels were detected in 11% of upland river sites (>250 µg/L) and 84% of alpine stream sites (>100 µg/L) with the majority of these in the ski resort monitoring areas across the park. Excess nutrient loads can increase eutrophication (excessive growth of algae in water), harm aquatic life and indicate pollution.
% of sites that meet water quality guidelines for total phosphorus	87%	–	–	Elevated phosphorus levels were detected in 716% of upland river sites (>20 µg/L) and 611% of alpine stream sites (>10 µg/L) across in the 3 water monitoring programs. Snowy and Murrumbidgee catchments. High levels can indicate contamination from sewage or animal waste, or excessive input of organic matter due to catchment disturbance such as fire, feral herbivores and human activity.
% of sites that meet water quality guidelines for nitrogen oxides	61%	–	–	Nitrogen oxides levels were at or in excess of trigger levels at 21 (39%) of the 54 sites: 42% alpine stream and 37% upland river sites. High levels of nitrogen oxides were predominately observed in alpine streams in the area being monitored for impacts from the ski resorts, with some upland rivers across the Murrumbidgee, Snowy and Murray catchments also recording high levels.
% of sites that meet water quality guidelines for ammonia	97%	–	–	Ammonia levels were at or in excess of trigger levels at 3 (9%) of the 54 sites: 11% of alpine streams and 3% of upland river sites. In generally most waterways in KNP have not exceeded the guidelines for ammonia.
% of sites that meet water quality guidelines for conductivity	96%	–	–	Conductivity increases with increased salinity, chemicals and minerals in the water. Elevated levels (>55 µS/cm) were found at 11% of upland river sites in the Murrumbidgee and Snowy catchments. In general, most waterways in KNP have not exceeded the guidelines for electrical conductivity.
Biological conditions				
Macroinvertebrate taxa richness	Mean: 24 (range 16–31)	–	–	A high diversity of macroinvertebrate taxa is associated with healthy waterways, which is found in most waterways of KNP.

Metric	2023	2022	Trend	Commentary
% of sites that meet water condition guidelines for macroinvertebrate taxa richness	83%	–	–	Taxa richness was outside guidelines for either edge or riffle samples at 9 sites (17%), including 2 alpine stream and 7 upland river sites.
EPT richness	Mean: 10 (range 6–15)	–	–	*Ephemeroptera*, *Plecoptera* and *Trichoptera* (EPT) are indicator family groups of macroinvertebrate taxa commonly sensitive to water quality issues or habitat degradation. All sample sites in KNP recorded EPT taxa.
% of sites that meet water condition guidelines for EPT richness	80%	–	–	EPT richness was outside guidelines for either edge or riffle samples at 11 sites (20%), including one alpine stream and 10 upland river sites.
SIGNAL2	Mean: 6 (range 4–7)	–	–	SIGNAL2 is a biotic index based on pollution sensitivity values assigned to aquatic macroinvertebrate families that have been derived from published information on their tolerance to pollutants. SIGNAL2 scores were outside guidelines for either edge or riffle samples at 12 sites (22%), including 3 alpine streams and 9 upland river sites.
% of sites that meet water condition guidelines for SIGNAL2	78%	–	–	

– refers to insufficient data to determine a trend.

Fire indicators

Area burnt

Table 10   Area burnt in Kosciuszko National Park

	2022–23 FY		20-year average	
	Area (ha)	**% of reserve**	**Area (ha)**	**% of reserve**
Total area burnt	3,065	0.4	18,933	2.74
Total area with canopy burnt	26	0.0	7,868	1.14
Total area unburnt	686,663	99.6	670,795	97.26
Prescribed burn area	3,065	0.4	5,255	0.76
Prescribed burn – canopy burnt	26	0.0	n/a	n/a
Prescribed burn by zone type				
Area of SFAZ	37,956	5.5	n/a	n/a
Prescribed burn – actual area burnt – SFAZ	949	0.1	n/a	n/a
Area of LMZ	637,824	92.5	n/a	n/a
Prescribed burn – actual area burnt – LMZ	2,116	0.3	n/a	n/a
Bushfire area burnt	0.13	0	13,678	2.0
No. of bushfires	2	n/a	5.4	n/a
% of bushfires <10 ha	–	100%	–	63%
% of bushfires contained on park	0.13	100%	n/a	n/a

Area burnt metrics are calculated from NPWS fire history data, and fire severity (canopy fires) is calculated from Fire Extent and Severity Map data.

FY = financial year

SFAZ = strategic fire advantage zone

LMZ= land management zone

Table 11   Fire patchiness in Kosciuszko National Park

Fire patchiness	10-year	20-year	30-year
Average distance (m) between burnt and long-unburnt patches	63,246 (range 0–168,548)	57,688 (Range 0–168,548)	33,143 (Range 2,274–128,186)
Heterogeneity index (burnt/unburnt)	Being developed		
Heterogeneity index (canopy burnt)	Being developed		

Dry sclerophyll forests (shrubby sub–formation): 99,509 ha

Table 12   Fire history for dry sclerophyll forests (shrubby) in Kosciuszko National Park

Fire history		Area (ha) burnt	% of formation	Area (ha) burnt by canopy fire	% of formation
Time since last fire					
1 to 5 years	(2018–19 to 2022–23)	16,760	16.8	7,232	7.27
6 to 10 years	(2013–14 to 2017–18)	9,375	9.4	256	0.26
11 to 15 years	(2008–09 to 2012–13)	14,233	14.3	77	0.08
16 to 20 years	(2003–04 to 2007–08)	2,250	2.3	282	0.28
21 to 25 years	(1998–99 to 2002–03)	44,592	44.8	32,165	32.32
26 to 30 years	(1993–94 to 1997–98)	169	0.2	114	0.11
31 to 40 years	(1983–84 to 1992–93)	2,866	2.9	n/a*	n/a*
41 to 50 years	(1972–73 to 1982–83)	1,126	1.1	n/a*	n/a*
50+ years	(pre-1972–73)	n/a*	n/a*	n/a*	n/a*
30-year fire history*					
Area unburnt		12,130	12.19	59,391	59.68
Area burnt once		51,669	51.92	37,371	37.56
Area burnt twice		30,286	30.44	2,712	2.73
Area burnt 3 times		4,573	4.60	30	0.03
Area burnt >3 times		851	0.86	5	0.01

Note: Desired fire interval 9 to 30 years based on plant species fire response.

Area burnt metrics are calculated from NPWS fire history data, and fire severity (canopy fires) is calculated from Fire Extent and Severity Map data.

* current fire severity data is only available from 1990–91; in subsequent years reporting of canopy fires will be extended to better represent the desired fire–interval range limits.

Dry sclerophyll forest (shrub/grass sub-formation): 14,600 ha

Table 13   Fire history for dry sclerophyll forests (shrub/grass) in Kosciuszko National Park

Fire history		Area (ha) burnt	% of formation	Area (ha) burnt by canopy fire	% of formation
Time since last fire					
1 to 5 years	(2018–19 to 2022–23)	961	6.6	669	4.6
6 to 10 years	(2013–14 to 2017–18)	406	2.8	0	0
11 to 15 years	(2008–09 to 2012–13)	638	4.4	5	0
16 to 20 years	(2003–04 to 2007–08)	198	1.4	0	0
21 to 25 years	(1998–99 to 2002–03)	7,231	49.5	2,583	17.7
26 to 30 years	(1993–94 to 1997–98)	0	0	0	0
31 to 40 years	(1983–84 to 1992–93)	1,938	13.3	n/a*	n/a*
41 to 50 years	(1972–73 to 1982–83)	88	0.6	n/a*	n/a*
50+ years	(pre-1972–73)	n/a*	n/a*	n/a*	n/a*
30-year fire history*					
Area unburnt		5,165	35.38	11,342	77.68
Area burnt once		8,068	55.26	3,006	20.59
Area burnt twice		1,066	7.30	159	1.09
Area burnt 3 times		280	1.92	93	0.64
Area burnt >3 times		21	0.14	0	0

Note: Desired fire interval 9 to 50 years based on plant species fire response.

Area burnt metrics are calculated from NPWS fire history data, and fire severity (canopy fires) from Fire Extent and Severity Map data.

* current fire severity data is only available from 1990–91; in subsequent years reporting of canopy fires will be extended to better represent the desired fire–interval range limits.

Grassy woodland: 156,023 ha

Table 14   Fire history for grassy woodlands in Kosciuszko National Park

Fire history		Area (ha) burnt	% of formation	Area (ha) burnt by canopy fire	% of formation
Time since last fire					
1 to 5 years	(2018–19 to 2022–23)	66,533	42.6	48,759	31.25
6 to 10 years	(2013–14 to 2017–18)	3,028	1.9	261	0.17
11 to 15 years	(2008–09 to 2012–13)	3,695	2.4	82	0.05
16 to 20 years	(2003–04 to 2007–08)	4,940	3.2	3,034	1.94
21 to 25 years	(1998–99 to 2002–03)	63,195	40.5	50,624	32.45
26 to 30 years	(1993–94 to 1997–98)	264	0.2	158	0.10
31 to 40 years	(1983–84 to 1992–93)	2,137	1.4	n/a*	n/a*
41 to 50 years	(1972–73 to 1982–83)	4,394	2.8	n/a*	n/a*
50+ years	(pre-1972–73)	n/a*	n/a*	n/a*	n/a*
30-year fire history*					
Area unburnt		14,368	9.21	53,104	34.04
Area burnt once		76,231	48.86	67,770	43.44
Area burnt twice		57,406	36.79	34,135	21.88
Area burnt 3 times		7,043	4.51	948	0.61
Area burnt >3 times		975	0.62	66	0.04

Note: Desired fire interval 13 to 40 years based on plant species fire response.

Area burnt metrics are calculated from NPWS fire history data, and fire severity (canopy fires) is calculated from Fire Extent and Severity Map data.

* current data is only available from 1990–91; in subsequent years reporting of canopy fires will be extended to better represent the desired fire–interval range limits.

Wet sclerophyll forest (grassy sub-formation): 319,034 ha

Table 15   Fire history for wet sclerophyll forest (grassy) in Kosciuszko National Park

Fire history		Area (ha) burnt	% of formation	Area (ha) burnt by canopy fire	% of formation
Time since last fire					
1 to 5 years	(2018–19 to 2022–23)	142,441	44.6	71,746	22.49
6 to 10 years	(2013–14 to 2017–18)	10,482	3.3	554	0.17
11 to 15 years	(2008–09 to 2012–13)	8,892	2.8	75	0.02
16 to 20 years	(2003–04 to 2007–08)	8,001	2.5	5,201	1.63
21 to 25 years	(1998–99 to 2002–03)	111,123	34.8	70,257	22.02
26 to 30 years	(1993–94 to 1997–98)	370	0.1	182	0.06
31 to 40 years	(1983–84 to 1992–93)	5,550	1.7	n/a*	n/a*
41 to 50 years	(1972–73 to 1982–83)	16,806	5.3	n/a*	n/a*
50+ years	(pre-1972–73)	n/a*	n/a*	n/a*	n/a*
30-year fire history*		**Area (ha)**	**% of formation**	**Area (ha) – canopy fire**	**% of formation**
Area unburnt		37,725	11.82	171,021	53.61
Area burnt once		155,847	48.85	127,173	39.86
Area burnt twice		108,274	33.94	20,526	6.43
Area burnt 3 times		15,777	4.95	300	0.09
Area burnt >3 times		1,411	0.44	14	0.00

Note: Desired fire interval 15 to 50 years based on plant species fire response.

Area burnt metrics are calculated from NPWS fire history data, and fire severity (canopy fires) is calculated from Fire Extent and Severity Map data.

* current data is only available from 1990–91; in subsequent years reporting of canopy fires will be extended to better represent the desired fire–interval range limits.

Alpine complex: 83,839 ha

Table 16   Fire history for wet sclerophyll forest (grassy) in Kosciuszko National Park

Fire history		Area (ha) burnt	% of formation
Time since last fire			
1 to 5 years	(2018–19 to 2022–23)	21,750	25.9
6 to 10 years	(2013–14 to 2017–18)	153	0.2
11 to 15 years	(2008–09 to 2012–13)	307	0.4
16 to 20 years	(2003–04 to 2007–08)	5,735	6.8
21 to 25 years	(1998–99 to 2002–03)	34,981	41.7
26 to 30 years	(1993–94 to 1997–98)	4	0
31 to 40 years	(1983–84 to 1992–93)	265	0.3
41 to 50 years	(1972–73 to 1982–83)	379	0.5
50+ years	(pre-1972–73)	n/a*	n/a*
30-year fire history*		**Area (ha)**	**% of formation**
Area unburnt		20,908	24.94
Area burnt once		43,143	51.46
Area burnt twice		18,263	21.78
Area burnt 3 times		1,450	1.73
Area burnt >3 times		75	0.09

Note: Fire sensitive vegetation.

Canopy fire data does not apply to this vegetation type.

* current data is only available from 1990–91; in subsequent years reporting of canopy fires will be extended to better represent the desired fire–interval range limits.

Threat indicators

Feral animals

Table 17   **Feral animal and feral animal control metrics, 2022–23 financial year**

Indicator	2022–23 FY expenditure ($)	Management activity	2022–23 FY input	2022–23 FY output	Metric	2023	2022	Trend	Commentary
All feral species	$190,340	Aerial baiting, ground baiting, shooting, trapping	3,072 hrs						This metric is for management input across a number of feral animal control programs with overlapping management areas and duration. Separating metrics to a target species, or a particular management activity, is not currently feasible due to the aggregate nature of the data. Where possible, output for targeted species is presented in the results below.
Feral predators									
Feral cat[#]	#	Shooting	#	0 shot	Occupancy	–	40%	–	Occupancy of cats was greatest in the wet sclerophyll forest (grassy) but was also prevalent in dry sclerophyll forest (shrubby) and grassy woodlands formations. Targeted surveys to estimate density to be implemented in 2025.
	#	Trapping	#	206 trapped	Activity	–	1.3 (±0.2)	–	
					Density	–	–	–	
Red fox[#]	#	Shooting	#	8 shot	Occupancy		38%		Fox occupancy was not confined to any one area of the park but was highest in the grassy woodland formation.\nAerial baits were deployed over 576 km.
	$11,276*	Ground baiting	48 hrs*	95 baits taken					
	#	Aerial baiting^	#	17,176 deployed	Activity		3.6 (±0.8)		
	$10,905*	Trapping	#	31 trapped					

Indicator	2022–23 FY expenditure ($)	Management activity	2022–23 FY input	2022–23 FY output	Metric	2023	2022	Trend	Commentary
Herbivores and omnivores									
All deer species[#]	[#]	Aerial shooting	200 hrs*		Occupancy		53%	−	Deer are distributed across all of the park.
					Population estimate				
Red deer[#]	[#]	Aerial shooting	[#]	15 shot	Occupancy		1%		
					Density				
Fallow deer[#]	[#]	Aerial shooting	[#]	1,202 shot	Occupancy		20%		Fallow deer show a clear pattern in distribution, being found only in the south-east of the park. They are strongly associated with dry sclerophyll forest (shrub/grassy) at 3 times the occurrence of the other 4 main vegetation formations. Control programs aimed at feral herbivores (deer and pigs) along the western edge of the park and adjoining parks have significantly reduced the number of fallow deer.
		Ground shooting		4 shot	Activity		7.1 (±1.7)		
Sambar deer[#]	$872,369	Aerial shooting	[#]	492 shot	Occupancy		42%		Sambar deer were detected throughout the park and appear to have no preference for any of the vegetation formations.
		Ground shooting		1 shot	Activity		2.2 (±0.4)		
Horse	[#]	Controlled	[#]	1,606 removed (between Feb 2022 and June 2023)	Population estimate	17,393 (95% CI: 12,797–21,760) [§]	18,814 (95% CI: 14,501–23,535) [§]	⟷	There had been no discernible changes in horse numbers between Nov 2020 and Nov 2023 across the park. The greatest abundance of horses occurs in the northern section of the park.
Pig[#]	$7,933	Trapping	77 hrs	86 trapped	Occupancy		19%		Occurrence may be underestimated as pigs tend to favour moist low-lying areas. Pig occupancy was lowest in the alpine complex vegetation formation but relatively even across the other 4 formations.
		Aerial shooting	200 hrs*	122 shot	Activity				
	$21,308	Ground shooting	434 hrs	30 shot					

Indicator	2022–23 FY expenditure ($)	Management activity	2022–23 FY input	2022–23 FY output	Metric	2023	2022	Trend	Commentary
Goats	#	Aerial shooting	#	4 shot	Occupancy		0%		Aerial shooting in reserves surrounding the park, and along park boundaries, has significantly reduced numbers to the point where detections of goats are rare and numbers shot each year are in single digits.
Rabbit	#	Ground shooting	#	149 shot	Occupancy		21%		Rabbits were mostly observed in the grassy woodlands vegetation formation.

Expenditure and input metrics cannot be determined for individual species control programs due to the data being aggregated across multiple species.

* This figure does not represent the total NPWS investment into these particular control programs. Some expenditure and staff hours for this action are included in the expenditure and staff hours values for the 'All feral species' line item.

^ baits also taken by dingoes.

§ CI = Confidence intervals.

– refers to insufficient data to determine a trend.

⟷ refers to stable trend.

Weeds

Table 18   Weed and weed control metrics 2022–23 financial year

Indicator	2022–23 FY expenditure ($)	Management activity	2022–23 FY input	2022–23 FY output	Metric	2023	2022	Trend	Commentary
All weed species	$1,375,641	All treatment	24,871 hrs	15,850 ha		–	–	–	Weed survey methodology to be developed.
Blackberry		Foliar spraying[#]		1,239 ha+		–	–	–	Containment priority species.
Mouse-ear hawkweed	$187	Foliar spraying	4.25 hrs	7.9 m^2	Density	4 plants/100 ha	133 plants/100 ha		Eradication priority species. Decreasing through management actions. Metric is the number of plants found per 100 hectares searched.
	$268,015^	Surveillance and detection	7,890 hrs^	308 ha	–	–	–	–	
Orange hawkweed	$43,175	Foliar spraying	448 hrs	8,915 m^2	–	–	–	–	Eradication priority species. Decreasing through management actions.
	$478,814^	Surveillance and detection	8,996 hrs^	29,000 ha	–	–	–	–	
Oxeye daisy	$107,029*	Foliar spraying	2,612 hrs*	3,871 ha	–	–	–	–	Containment priority species.
Perennial exotic grasses	$15,270*	Foliar spraying	273 hrs*	0.004 ha	–	–	–	–	Control species: African love grass, Chilean needle grass, serrated tussock, sweet vernal grass.
Scotch broom	$12,362*	Foliar spraying/ physical removal – cut & paint	126 hrs*	0.059 ha	–	–	–	–	Containment priority species.
Willow[#] (*Salix* spp.)				0.0094 ha	–	–	–	–	Containment priority species.

[#] Expenditure and input metrics cannot be determined for individual species control programs due to the data being aggregated across multiple species.

+ ha of control based on the primary weed reported in the NPWS Pest and Weed Information System (PWIS), as a consequence weed metrics may be overstated for some species and understated for others.

^ These figures represent the other total costs for the respective hawkweed program – detection and monitoring, as well as some additional components related to treatment effort.

* This figure does not represent the total NPWS investment into these particular control programs. Some expenditure and staff hours for this action are included in the expenditure and staff hours values for the 'All weed species' line item.

– refers to insufficient data to determine a trend.

↓ refers to downward trend.

Glossary

Term	Meaning
Abundance	Average number of individuals per survey or by survey effort (e.g. trap nights).
Activity	Activity from camera traps (mammals and lyrebirds) is the number of unique detections (separated by 30 minutes) per site in 100 camera days (± standard error). Microbat activity is the number of unique detections (separated by 30 minutes) per site in 100 camera days (± standard error).
ALA	Atlas of Living Australia – Australia's national biodiversity database.
BioNet	NSW BioNet – the repository for biodiversity data products open to any user and managed by the NSW Department of Climate Change, Energy, the Environment and Water.
BC Act	*Biodiversity Conservation Act 2016* (NSW)
Canopy fire	Area derived from the Fire Extent and Severity Mapping (FESM) classes: High – full canopy scorch/partial consumption; Extreme – full canopy consumption.
Density	Number of animals or plants per unit area in sampled habitat.
Foliage projection cover	A canopy index derived from satellite imagery.
IUCN Red List	International Union for Conservation of Nature inventory of the global conservation status and extinction risk of biological species.
Litter cover	Average percentage of litter cover per vegetation formation or community.
LMZ	Landscape management zone: an area of land zoned to meet relevant land management objectives.
Native cover	Average percentage cover of native vegetation per vegetation formation or community.
Native species richness	Average number of native species detected.
Occupancy	Naïve occupancy, proportion of sites where a species was detected.
Patchiness	Average distance between burnt patches.
Population estimate	Total number of individuals within a defined area, ecosystem or habitat. This is regarded as a more accurate and comprehensive estimate compared to abundance.
Recruitment rate	Proportion or percentage of the total population size (mature individuals) that are seedlings.
SFAZ	Strategic fire advantage zone: land zoned to provide strategic areas of fire protection advantage.
Stem density	Number of tree stems, categorised by diameter at breast height classes, per hectare.
Targeted monitoring	Monitoring programs developed by the Saving Our Species programs.

Term	Meaning
Tonnes of carbon	Total tonnes of carbon per hectare of soil (tC/ha).
Total nitrogen	Milligrams of nitrogen per kg soil (TN mg/kg soil).
Total organic carbon	Grams of total organic carbon per kg of soil.
Total phosphorus	Milligrams of phosphorus per kg of soil (P mg/kg soil).
Weed species richness	Total number of weed species detected in each vegetation formation.