Office of Environment & Heritage
NSW National Parks & Wildlife Service

# Draft Wild Horse Management Plan

## Kosciuszko National Park

## Acknowledgements

This Draft Wild Horse Management Plan was prepared by staff of the Southern Ranges Region of the NSW National Parks and Wildlife Service (NPWS) incorporating the advice of the Kosciuszko National Park Horse Management Plan Review – Independent Technical Reference Group. Specialists were engaged by NPWS to identify community understanding of park values and views on wild horse management in the park, and to assess the cultural heritage values of wild horses in the park.

Valuable information and comments were provided by NPWS staff, including botanists, ecologists, threatened species officers, and staff specialists in pest management, science and research, community and stakeholder engagement, and heritage management. Local NPWS staff including managers, rangers and field staff with a depth of knowledge, skills and experience in wild horse management and other operational issues in the park were also integral to the preparation of the draft plan. This, along with information, views and opinions provided by stakeholders and members of the public, has assisted NPWS in formulating this draft plan.

Kosciuszko National Park is managed by the Southern Ranges Region of the NPWS which is part of the NSW Office of Environment and Heritage (OEH). For additional information or enquiries about the plan, contact the NPWS Regional Office at: PO Box 2228, Jindabyne NSW 2627; visit the office at: Kosciuszko Road, Jindabyne; or call us on (02) 6450 5555.

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# Contents

# List of figures



# List of tables

# Invitation to Comment

This *Kosciuszko National Park Draft Wild Horse Management Plan* has been developed with input from an Independent Technical Reference Group, an extensive community and stakeholder engagement process, a review of the heritage significance of wild horses in Kosciuszko National Park and a thorough review of the 2008 *Kosciuszko National Park Horse Management Plan*. The draft plan is now being placed on public exhibition for comment. Members of the public, whether as individuals or as members of community interest groups, are invited to comment in writing on this plan.

The draft plan is on exhibition until 8 July 2016.

You can provide your written submission in one of the following ways:

- use the online submission form at engage.environment.nsw.gov.au/consult
- email your comments to kosciuszko.wildhorseplan@environment.nsw.gov.au
- post your submission to The Project Officer, Kosciuszko National Park Wild Horse Management Plan Review, National Parks and Wildlife Service, PO Box 2228, Jindabyne NSW 2627.

To make consideration of your submission as effective as possible, please:

- outline areas where you agree or disagree and/or the positive and negative aspects of the plan in your opinion
- identify the section heading and number to which your comment relates
- briefly explain the reason for your comment and, if appropriate, suggest other ways to address the issue.

All submissions received by NPWS are a matter of public record and are available for inspection upon request. Your comments on this draft plan may contain information that is defined as 'personal information' under the NSW *Privacy and Personal Information Protection Act 1998*. The submission of personal information with your comments is voluntary.

Following public exhibition of this draft plan, all submissions received will be considered and reviewed, and changes may be made to the plan where deemed appropriate. NPWS will provide the NPWS Southern Ranges Regional Advisory Committee with an overview of feedback from the community.

Subject to approval of a final plan by the Chief Executive, Office of Environment and Heritage, actions in the plan will be implemented as part of an integrated regional pest management strategy across Kosciuszko National Park. Progress on the implementation of the plan will be reported in NPWS annual reports and through NPWS reporting on implementation of the Southern Ranges Regional Pest Management Strategy. Implementation of the plan will also be audited and reported on by the Southern Ranges Regional Advisory Committee and by the proposed Kosciuszko National Park Wild Horse Management Reference Group.

# Our vision:

To conserve the outstanding values of Kosciuszko National Park with the support of the community through active, adaptive and humane management of wild horses to minimise their adverse impacts on natural, cultural and visitor values, while acknowledging the cultural and social values of the Kosciuszko National Park wild horse population.

# Summary

Kosciuszko National Park is the largest national park in New South Wales and one of the largest conservation reserves in Australia. The park is a UNESCO Biosphere Reserve and is an integral component of the Australian Alps National Parks and Reserves, which were included on the National Heritage List in 2008.

The park preserves a range of special places and values: the highest mountain on the Australian mainland (Mount Kosciuszko); outstanding scenery, landscapes and Aboriginal and historic cultural heritage values; and plants, animals and ecological communities that are only found in the park or Australian Alps.

The preparation of this *Kosciuszko National Park Draft Wild Horse Management Plan* was guided by an extensive review of the 2008 *Kosciuszko National Park Horse Management Plan*. The review process involved five significant components:

- identification of community understanding of park values and views on wild horse (*Equus caballus*) management in the park
- assessment of the national cultural heritage values of wild horses in the park
- provision of rigorous scientific and technical advice through an Independent Technical Reference Group
- a literature review
- consultation with NPWS experts.

NPWS has a legal duty to protect the range of natural and cultural values within the park, and a responsibility to minimise the impact of introduced species, including those of wild horses. However, the issue of wild horse management within Kosciuszko National Park is often highly contentious and emotive. There is a diverse range of views in the general community and deeply polarised views between major stakeholder groups about if and how wild horses in the park should be managed.

This Draft Wild Horse Management Plan has three objectives:

1. To reduce the impacts of wild horses on the natural and cultural heritage values of Kosciuszko National Park by reducing the overall population of wild horses using a range of cost-effective and humane control measures.
2. To reduce and mitigate the risk of adverse wild horse interactions or incidents with park visitors and the public more generally.
3. To involve the community in the ongoing management of wild horses in Kosciuszko National Park through active participation in research, monitoring and control programs where possible.

Key strategies to achieve these objectives are to reduce the wild horse population from 6000 to less than 3000 horses in five to 10 years; and to reduce the population to 600 (400–800) horses within 20 years.

# Introduction

This 2016 *Kosciuszko National Park Draft Wild Horse Management Plan* (the 'Draft Wild Horse Management Plan' or 'draft plan') is the third iteration of a wild horse management plan for the park. It applies to the entirety of the park and builds on the 2003 *Horse Management Plan for the Alpine Area of Kosciuszko National Park* (NPWS 2003) and the 2008 *Kosciuszko National Park Horse Management Plan* (DECC 2008) (2008 Horse Plan).

The 2008 Horse Plan included an action to review the plan after five years and in 2013 the then Minister for the Environment, Robyn Parker, formally asked the NSW National Parks and Wildlife Service (NPWS) to review the plan. This Draft Wild Horse Management Plan is the result of an extensive and detailed review of the 2008 Horse Plan.

The review concluded that key objectives of the 2008 Horse Plan have not been achieved. In particular, objectives to exclude horses from a number of key areas and reduce their numbers in other areas have not been realised. Trapping using lures and removal – the only method employed during the life of the 2008 Horse Plan – was costly, time consuming and did not effectively reduce the wild horse population. In addition, lack of demand for suitable domesticating ('rehoming') opportunities or other disposal opportunities was an impediment in implementing the plan. A trial of low stress aerial mustering has not been undertaken due to limited opportunities to rehome or otherwise dispose of the larger numbers of horses that may result from an aerial mustering operation, and due to concerns expressed by some stakeholder groups over aerial mustering.

Since the wild horse management program began in 2002, NPWS has removed 3183 horses from the park. However, there are still horses present in the key areas where exclusion was the aim. Moreover, numbers have not been reduced to a level where there are no longer impacts on the park's natural and cultural values or visitor safety.

One of the constraints in implementing the 2008 Horse Plan has been a lack of demand for domesticating captured wild horses. Of the horses removed, 18% (583) were domesticated and the rest were sent to a knackery or abattoir. In light of these limitations, NPWS has continued to consult stakeholder groups about wild horse management in the park.

A new plan is needed to guide the management of wild horses in the park into the future. This *Kosciuszko National Park Draft Wild Horse Management Plan* is being put on exhibition to allow interested parties to comment.

## How the 2016 Draft Wild Horse Management Plan was prepared

The preparation of the Draft Wild Horse Management Plan was guided by an extensive review of the 2008 Horse Plan. Five significant projects were undertaken to inform the review:

1. Extensive community and stakeholder engagement, using contemporary techniques, to identify the community's understanding of park values and views on wild horse management in Kosciuszko National Park (see supporting document by Straight Talk 2015).
2. An assessment to better understand the national cultural heritage values associated with the Kosciuszko National Park wild horse population (see supporting document by Context 2015).
3. Formation of an Independent Technical Reference Group (ITRG) to provide independent and rigorous scientific and technical advice on the management of wild horses in the park (see supporting document by ITRG 2016).
4. A literature review focussing on a number of key documents and reports that have been produced since the 2008 Horse Plan or are directly related to the review of the plan.

5. Consultation with NPWS staff with experience and knowledge of the wild horse management program in the park, including horse removal, monitoring and research.

The *Review of the 2008 Horse Management Plan and Wild Horse Management Program, Kosciuszko National Park* (OEH 2016) is a companion document to this draft plan. It provides the detailed background information, evidence and analysis to support the 2016 Draft Wild Horse Management Plan.

The issue of wild horse management in Kosciuszko National Park is often highly contentious and emotive. There is a diverse range of views in the general community and deeply polarised views between stakeholder groups about if and how wild horses in the park should be managed.

For some visitors, seeing introduced animals such as horses detracts from their visit to the park. For other visitors, such encounters may add to the richness of their experiences in the park.

NPWS has a legal duty to protect native habitats, fauna and flora, geological features and historic and cultural features and values within the park. While NPWS recognises and acknowledges the community and heritage values associated with the wild horse population in the park, it has a responsibility to minimise the impacts of introduced species, including those of wild horses.

The acknowledgement of the Kosciuszko National Park wild horse population as an 'attribute' associated with nationally significant cultural and social values is unique to the Kosciuszko National Park and cannot be applied to other wild horse populations in the NSW park system.

## Our vision

Our vision for wild horse management in Kosciuszko National Park is:

**To conserve the outstanding values of Kosciuszko National Park with the support of the community through active, adaptive and humane management of wild horses to minimise their adverse impacts on natural, cultural and visitor values, while acknowledging the cultural and social values of the Kosciuszko National Park wild horse population.**

# Background

## Why Kosciuszko National Park is important

Kosciuszko National Park, at 689,600 hectares, is the largest national park in New South Wales and one of the largest conservation reserves in Australia. The park is a UNESCO Biosphere Reserve. Located in the south-east corner of the Australian mainland, the park straddles the Great Dividing Range where it is known as the Snowy Mountains. See 0.

The park is very important, preserving a range of special places and values, including:

- the only true alpine zone in mainland Australia and extensive subalpine areas
- the highest mountains on the Australian mainland, including Mount Kosciuszko
- the most extensive peatlands in the Australian Alps
- glacial landforms and karst (i.e. limestone) systems
- unusual plants and animals, including 21 species found nowhere else
- the headwaters of major rivers, namely the Murray, Murrumbidgee and Snowy
- a significant range of historic and cultural values.

## Natural values: landscapes, plants, animals

True alpine areas in Australia cover less than 0.01% of the continent. The alpine area within the park – running along the Main Range – is Australia's largest alpine ecosystem, at about 120 square kilometres.

Karst (limestone) areas in the park – the Yarrangobilly and Cooleman Plain karst catchments – are nationally significant because of the landforms and the unique plants and animals that they support. These karst catchments also include spectacular limestone gorges and show caves.

The diverse range of climates, soils, landforms and altitudes in the park in turn support some of the most diverse vegetation on the Australian mainland. In total, 853 species of native plants have been recorded in the park (Montague-Drake 2005). The alpine flora is extremely diverse and many species are only found in the park, including anemone buttercup (*Ranunculus anemoneus*).

There are a range of vegetation types in the park, including snow gum woodlands and subalpine grasslands in the High Country, extensive eucalypt forests, pockets of cool temperate rainforest, box woodlands and stands of native cypress pine.

The NSW Montane Peatlands and Swamps Endangered Ecological Community includes the wetlands and bogs of the Snowy Mountains. These habitats are included in the nationally listed Alpine Sphagnum Bogs and Associated Fens Endangered Ecological Community. Heaths in the park support the endangered mountain pygmy-possum (*Burramys parvus*) and sphagnum bogs provide habitat for the endangered corroboree frog (*Pseudophryne corroboree*). In summer, millions of Bogong moths (*Agrotis infusa*) arrive in the alpine areas after one of the longest insect migrations in the world (DEC 2006).

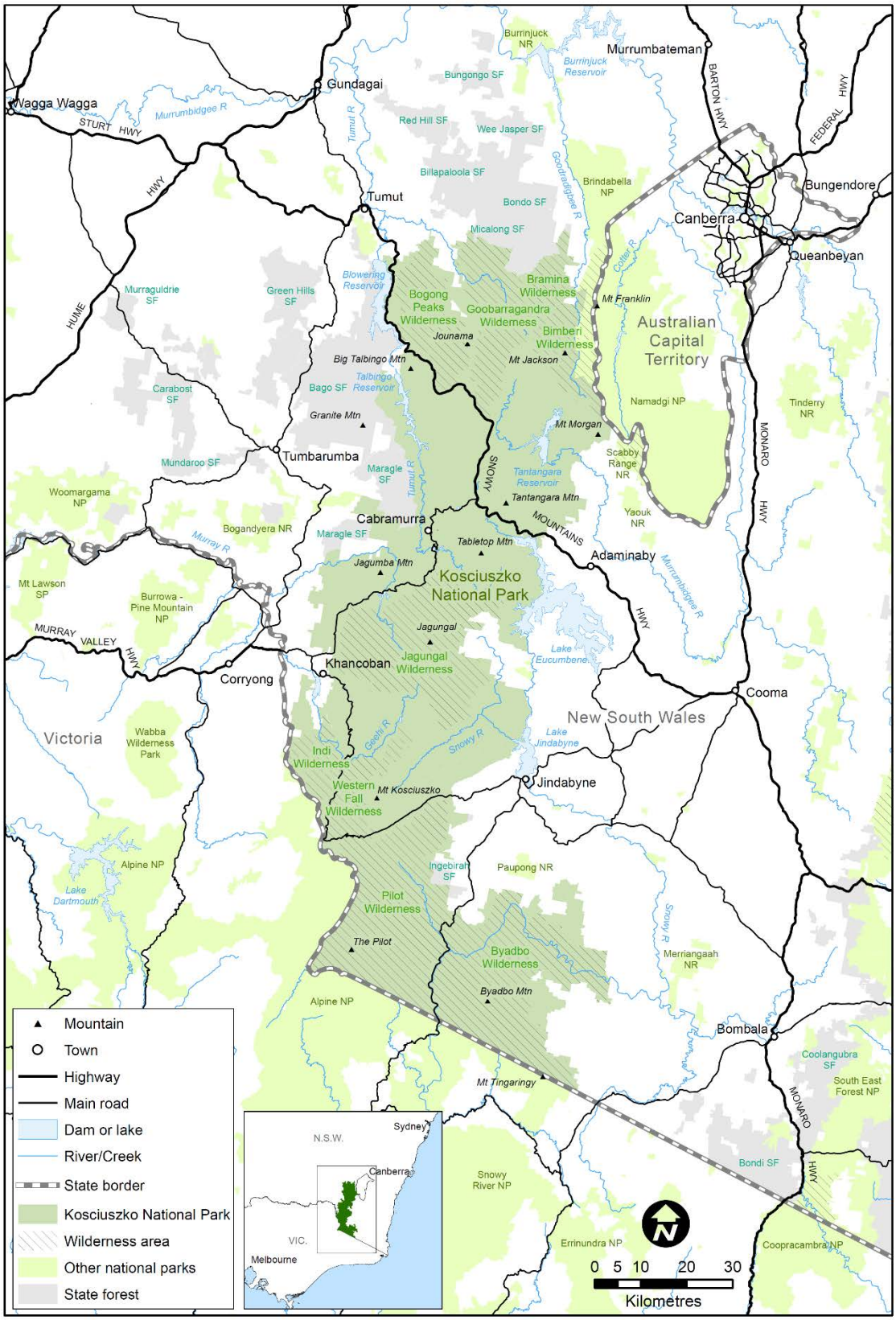



**Figure 1. Kosciuszko National Park and surrounds**

### Cultural heritage values

The cultural landscapes of the park are wide-ranging in type and significance and protect a large number of cultural remains and histories. The park has a strong and diverse cultural heritage including Aboriginal significance, exploration, pastoral use, the Kosciuszko huts, mining, timber and water harvesting, conservation and recreation.

Aboriginal people used a wide range of natural resources in the mountains as food, medicine, tools, clothing, in decoration, or for ceremonial purposes. The annual Bogong moth gathering was one of the most important Aboriginal cultural and social events in south-east Australia. Descendants of Aboriginal tribal groups that once occupied and visited the Snowy Mountains hold spiritual attachments to the place, with traditional knowledge, family stories and memories illustrating their ongoing cultural connection with the mountains (DEC 2006).

Places associated with the European contact period and post-contact Aboriginal life and history, including those from the pastoral era, are of historic and social significance to local Aboriginal people. Aboriginal men worked for pastoralists as stockmen, drovers and station hands, and were involved in mustering and breaking wild horses (Context 2015).

### Catchment values

The snow-fed rivers of the mountains provide some of Australia's most important water catchments, and the need to protect these catchments was a significant factor in the establishment of Kosciuszko State Park in 1944. The park contains the headwaters of the Snowy, Murray and Murrumbidgee rivers. Within the park, the sphagnum bogs (commonly called peat moss) and snow patch communities play an important role because of their water-holding capacity. High quality water supplies for towns/cities, for power generation and irrigation depend on the protection of these catchments.

### Visitor and tourism values

The park's natural and cultural values attract about three million visitor days each year. The park provides one of the few places in Australia where you can experience the unique climate, scenery, history and challenges of alpine and subalpine environments.

Visitors to the park go bushwalking, camping, mountain biking, skiing, horse riding and four-wheel driving. The park is also economically significant for south-east Australia as a tourist attraction, particularly during the winter months. Kosciuszko National Park and the Victorian Alps are the only two snowfield tourism destinations in mainland Australia.

## Horses in the park

### Brief history

Horses have been present in the Snowy Mountains since the 1830s when Europeans first explored the region (NPWS 2003). Substantial transhumance grazing (i.e. the annual movement of stock and stockmen to summer pastures in the High Country) of cattle and sheep soon followed and continued for more than 150 years (Context 2015). Horses were essential for anyone living in the mountains, both for travel and for moving stock. At times, domesticated horses would escape or were purposely released during drought or to improve the quality of mobs, and wild horses quickly became established in the mountains, including areas that are now within the park.

Over time numbers have fluctuated, but for much of the last century horse numbers in the park were kept much lower than current levels through active management. Wild horses were captured for their meat or hide and stockmen would undertake sporadic control of wild horses by shooting, trapping and 'brumby running' and roping when they became a nuisance. Captured horses were used as riding, hack or pack horses. Horse roping or

brumby running was also undertaken as a recreational activity and to source horses for local events such as the Cooma and Jindabyne rodeos.

## Wild horse populations

There are currently around 6000 wild horses in the park. They occupy about 331,000 hectares, or 48% of the park.

There are four disjunct populations in the Kosciuszko National Park area (see 0). These populations are discussed in more detail in Section 3.5.

The **North-east population** is mostly within the park, located north-east of the Snowy Mountains Highway. It also ranges outside of the park, north onto adjoining Bondo and Micalong state forests and north-east onto Namadgi National Park in the Australian Capital Territory (ACT). Horses move back and forth between the park and these adjacent areas.

The highest densities of horses occur in this population, predominantly on the grassy plains around Long Plain, Tantangara, Currango and Cooleman Plain.

While not known to inhabit the area previously, a small number of horses has recently established east of Tantangara Road – Pockets Saddle Road in the Nungar Plain area.

The **Bago–Maragle population** is mostly off-park on the adjoining Bago and Maragle state forests and private property. It extends east onto the park near Elliot Way, and south-east onto the park to Khancoban–Cabramurra Road. Horses move back and forth between the park and Bago and Maragle state forests.

A small, isolated but resident mob of horses has been observed in the Jagumba Mountain area in recent years.

The **Snowy Plain population** is predominantly within the park, north of Lake Jindabyne, but extends onto private and leasehold lands to the north and east of the park. It appears to be spreading west towards horse-free areas around Finns River and Jagungal Wilderness Area.

The **Pilot–Byadbo population** occurs primarily south of the Thredbo Valley through to the NSW–Victorian border. It is contiguous with the wild horse population that occurs in the Snowy River and Alpine national parks in Victoria. The population occupies upper catchments in the park as well as the Lower Snowy River corridor, and open woodlands and scrubs of the Byadbo Wilderness Area. This population is making seasonal incursions northwards onto the Main Range and is also spreading onto private and forestry lands to the east of the park.

It is believed that the relatively high numbers and densities of wild horses in adjoining areas has been a factor in the movement of horses into the alpine area and expansion into areas outlined above.

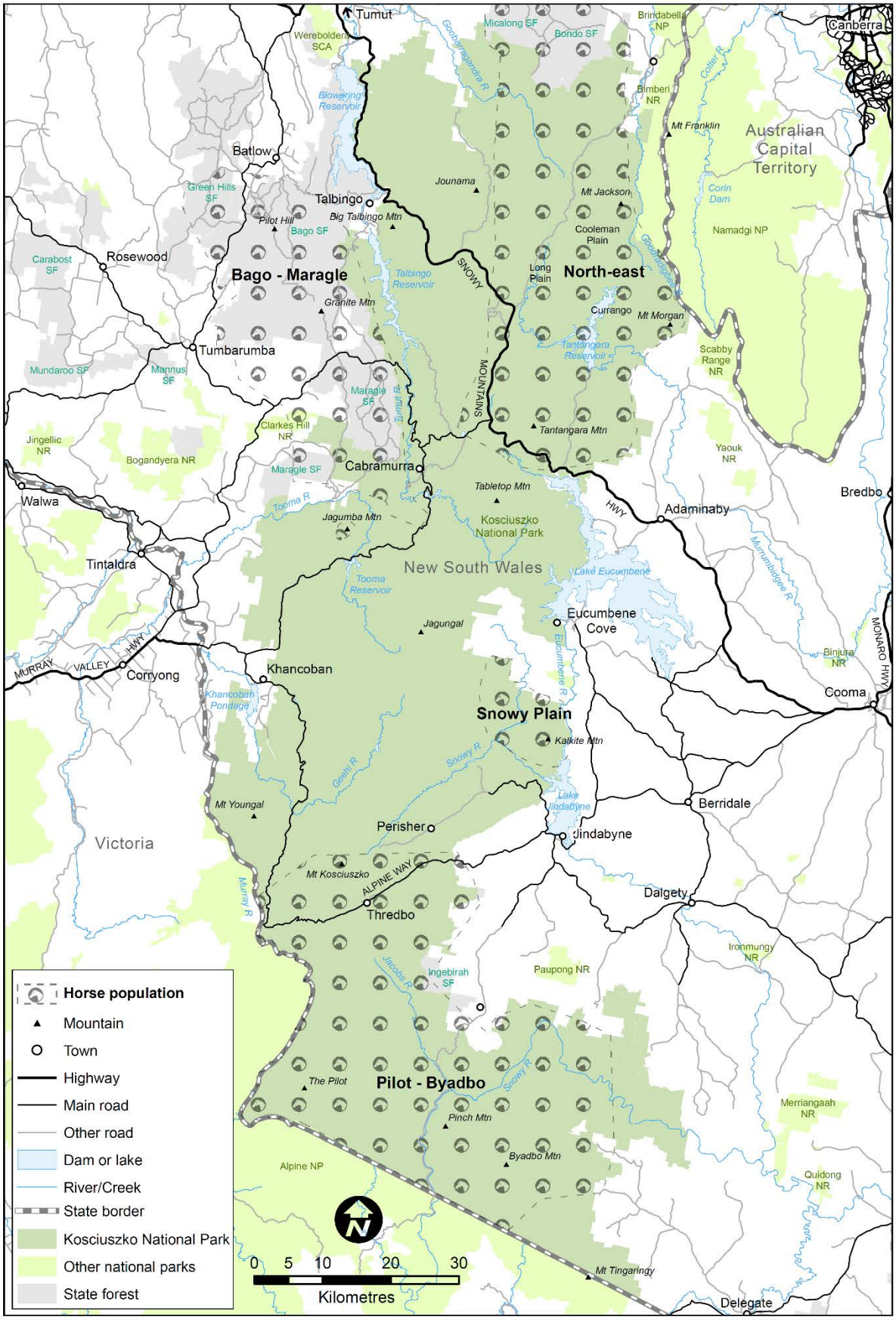



**Figure 2. Wild horse populations in the park**

## Wild horse biology

Horses are herd animals and usually form small social units:

- 'harem groups' – a dominant stallion plus mares and foals
- 'bachelor groups' – loose groups of young and old stallions that have been overthrown or lost their mob.

In the park these groups vary in size, but are usually five to 20 horses, with larger groups occurring in the north.

In the park, horses normally foal during spring and summer. Mares are able to foal at one to two years of age and usually raise one foal every two years (Dobbie & Berman 1992; Wagoner 1977). In Kosciuszko National Park, populations are likely to increase by between 6% and 17% per year (Cairns in prep.).

Horses stay within a defined home range area and generally resist being forced out of their home range (Dobbie & Berman 1992). In country similar to the park, home ranges are more than 9.76 square kilometres. As wild horse populations grow in number they also increase the areas they graze (Walter 2002). Bachelor males tend to have the largest home ranges, whereas harem groups occupy smaller, more stable areas.

Horses are primarily a grazing animal; they feed for 51–75% of the time, and eat a wide variety of foods (Mayes & Duncan 1986; Pratt et al. 1986). They prefer to eat grasses but will also feed on perennial shrubs and groundcovers, roots, bark, buds and fruit when preferred foods are not available. Horses are highly mobile and they create tracks or pathways that vary in width from narrow footpads to wide corridors between suitable grazing sites.

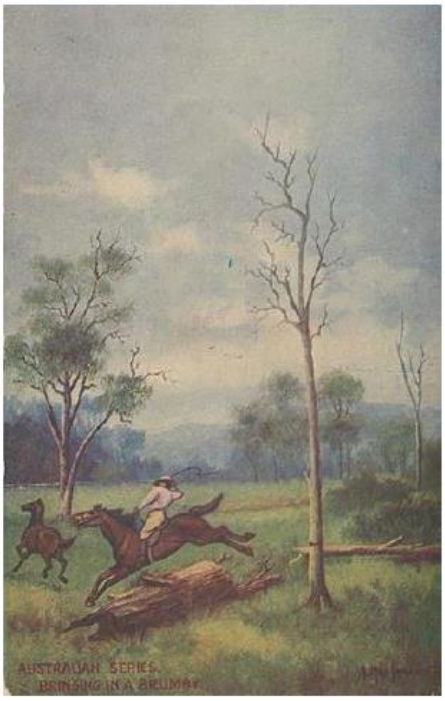
Although domestic horses can live for more than 30 years, the life expectancy of wild horses is less (NPWS 2006). The only real checks on wild horse populations are people and natural events like fire, drought and heavy snowfalls (Walter 2002). It is likely that horses in Kosciuszko National Park would have longer life spans than wild horses in other parts of Australia due to the more favourable conditions in the park. For example, currently there is abundant water and food sources even in times of drought. Snowfalls in most areas of the park are light and winters are short. There are no natural predators in the park, however, there are anecdotal reports of foals being taken by wild dogs.

## Cultural and social values of wild horses in Kosciuszko National Park

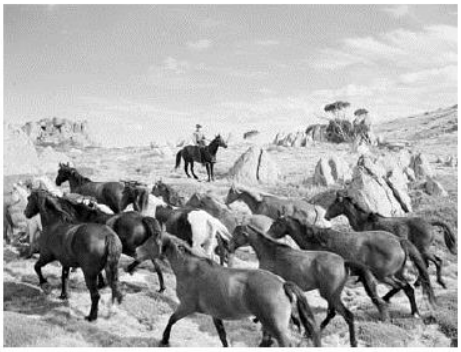
Wild horses, also known as 'brumbies', are a drawcard to some visitors and people living in the area. Many appreciate their beauty and the settler heritage they represent of a bygone lifestyle in the High Country. The poem and subsequent movie of AB 'Banjo' Paterson's *The Man from Snowy River* and the Elyne Mitchell's children's books, *The Silver Brumby* series, have provided many people with a connection to these wild horses.

Many local business use the 'brumby' and its iconography as part of marketing strategies for their business or product. Commercial horse riding tour operators, and more recently specific 'brumby' or wild horse viewing or photography tour businesses, strongly desire the continued presence of wild horses in the landscape.

Cultural heritage legislation in Australia, particularly at the national level, focuses on 'places' (i.e. sites, buildings or landscapes). Criteria are used to consider the nature and level of cultural significance of the place, and to define the 'attributes' (or features) that are essential to retaining those identified heritage values.




Postcard, 'Bringing in a Brumby', c.1910 (NMA)



The Brumby Master, Jim Fitzpatrick, 1949 (NAA)


Brumbies being driven into stock yard Jim Fitzpatrick, 1949 (NLA)

[Images from Context 2015]

In the study conducted as part of the review of the 2008 Horse Plan (Context 2015), the wild horse population in the park is considered as an 'attribute' of the place; the place being Kosciuszko National Park. The National Heritage List criteria and assessment guidelines were used to frame the assessment of the significance of wild horses in the park. The Context study drew on previous cultural heritage assessments relating to the listing of the Australian Alps National Parks and Reserves (which include the park) as a place on the National Heritage List.

The Context (2015) assessment of the cultural heritage values of the wild horse population in the park detailed the cultural and social values that many people associate with the wild horse population, including those values outlined above.

The assessment found that the wild horse population in the park is an attribute associated with the cultural heritage significance of the park in relation to five of the nine criteria. The values associated with these criteria include (Context 2015):

- Historical values associated with the High Country pastoralism and the 'Alps experience' that contribute to the national identity. (Criterion a).
- Cultural values associated with alpine pastoral landscapes, particularly the north-east Kosciuszko landscape, that demonstrate the pastoral way of life. Wild horses are a key element of the pastoral landscape, as are the alpine and subalpine terrain, extensive grasslands, huts, pastoral properties, the bushmen/women, former stock routes and historical narrative. (Criterion d).
- Aesthetic values associated with the uniquely wild and remote alpine landscapes that represent a cultural icon with Mount Kosciuszko as a defining image in the minds of Australians. The wild horses are a tangible attribute associated with the positive experience that some people have when witnessing wild horses in the landscape. There is a strong aesthetic appreciation of the 'Australian brumby' across the Australian community and the High Country community. (Criterion e).
- Social values associated with the love of the High Country cultural landscape and *The Man from Snowy River* legend – a value derived from the long social and cultural history associated with pastoralism in the area. The landscape, the legend, and past pastoral activities have reached iconic status in the nation-building mythology of Australia. (Criterion g).
- The High Country environment and landscape – the Snowy River and Main Range/Cascade Hut in particular – have had an important role in the lives and works of significant people, in particular writer Elyne Mitchell (*Silver Brumby* series) and AB 'Banjo' Paterson (*The Man from Snowy River*). (Criterion h).

The presence of wild horses in the park has tourism, economic and marketing value to the Snowy Mountains region because some people visit the park with the expectation of seeing wild horses in the landscape. In contrast, many other people visit the region and the park expecting a pristine and native landscape without the intrusion of what they consider to be feral animals. This creates significant challenges for NPWS when trying to resolve or reach a solution around conflicts between the protection of natural and cultural values and acknowledging the cultural values of wild horses in the park.

The acknowledgement of the Kosciuszko National Park wild horse population as an 'attribute' associated with nationally significant cultural and social values will be achieved by permitting an overall population of between 400 to 800 wild horses in the longer term.

## Impacts of horses in the park

### Impacts on natural values

It is widely recognised that Australian alpine plants and animals did not evolve in association with hoofed animals or pastoral activity (Costin et al. 2000). Horses are large, heavy animals and only a small part of each horse comes into contact with the ground, resulting in compaction of the ground and trampling of vegetation. The soils of the Australian alpine area are very sensitive to compaction and are easily eroded. For this reason, alpine and subalpine environments are much more susceptible to trampling damage than most other Australian environments (Whinam & Comfort 1996).

Impacts on the water catchment values of the Australian Alps, of which Kosciuszko National Park is a significant and critical component, are highlighted by Worboys et al. (2015). Their report describes the impact of wild horses on Australia's Natural Heritage Listed alpine and subalpine environments. Horses selectively target rare wetland environments in the Alps and progressively degrade them. The report identifies that these wetlands are critical for delivering high quality water to the Murray–Darling Basin.

As part of the review of the 2008 Horse Plan, an Independent Technical Reference Group (ITRG) was established to provide rigorous, scientific and technical advice on the management of wild horses in the park. The group found that wild horses do have negative impacts on the environmental values of the park and therefore need to be managed to reduce those impacts. In particular, the ITRG found that wild horses have a significant negative environmental impact on Australian alpine and subalpine ecosystems in the park. This is particularly true for alpine bogs, waterways and drainage lines (ITRG 2016).

The ITRG provided a summary of the environmental impacts of horses in different habitat types across the globe. See 0. In relation to Kosciuszko National Park in particular, the ITRG report stated the following (see ITRG 2016):

- In the park, impacts on bogs and waterways are probably the greatest concern, particularly because they are important habitats for a range of Commonwealth and State threatened species (summarised in Robertson et al. in prep.). Broad-toothed rats (*Mastacomys fuscus*) also depend on this habitat that is linked to degradation due to horse impacts (O'Brien et al. 2008).
- Studies specifically in the Kosciuszko ecosystem show a variety of impacts in wetlands and demonstrate that the environmental impacts of horses have been of concern for decades (Robertson et al. in prep.).
- Some of the supposed benefits of horses, such as reduction in fire severity, do not seem to be supported by studies of cattle grazing in the Alps (Williams et al. 2006; Williamson et al. 2014). Furthermore, studies on cattle grazing in the greater ecosystem of the Australian Alps show significant impact on alpine and subalpine *Sphagnum* bogs (Wahren et al. 2001). In addition, Australian snow patch herbfields, which are already under threat from climate change, need to be protected from the impacts of introduced mammals such as horses (Williams et al. 2015).
- As a consequence, in part, of damage through trampling and grazing by horses, the NSW Scientific Committee (set up under the NSW *Threatened Species Conservation Act*) has made preliminary determinations to support proposals to list the terrestrial orchids *Caladenia montana* and *Pterostylis alpina* as vulnerable species (NSW Scientific Committee 2015a, b).

*Pterostylis foliata* is another terrestrial orchid that has a similar preliminary determination (NSW Scientific Committee 2015c). All three species have limited distributions in northern parts of the park and adjoining forestry areas which overlap the current wild horse population distribution.

## Impacts on threatened species and ecological communities

The bogs referred to by the ITRG are part of the NSW Montane Peatlands and Swamps Endangered Ecological Community. The Commonwealth recognises components of this community as the Alpine *Sphagnum* Bogs and Associated Fens Endangered Ecological Community. These bogs and wetlands are extremely important as filters and storages for water as well as habitats for threatened species, for example, corroborree frog and broad-toothed rat.

**Table 1. Environmental impacts of horses in different types of habitat**

Source: Independent Technical Reference Group Report (ITRG 2016).

| **Ecological feature/Types of impact - Negative** | **Environments** |
|---|---|
| **Soil** | |
| Increase compaction, resistance to penetration, erosion, soil loss | Subalpine, montane, arid/semi-arid, coastal dunes |
| Lower soil aggregate stability | Arid/semi-arid |
| Impacts on ecological functioning (particularly water availability) resulting from soil impacts | Arid/semi-arid |
| **Water** | |
| Damage to waterways, including bank collapse, pugging and channel widening | Subalpine |
| Lower water quality including pollution and turbidity | Subalpine, arid/semi-arid |
| Damage to peatlands including gullying, compaction, drainage, irreversible oxidation of peat profiles and increased vulnerability to fire | Subalpine, montane |
| **Manure** | |
| Large manure piles suppress vegetation | Subalpine |
| Manure piles as 'invasion windows' for exotic plant species | Grasslands |
| **Plants** | |
| Vegetation and networks of tracks | Subalpine, arid/semi-arid |
| Reducing plant species richness | Arid/semi-arid |
| Change species composition and slow hydric successions | Subalpine, grassland |
| Increasing weed species | Subalpine |
| Reducing plant and seed density | Arid/semi-arid, montane |
| Altered species composition | Grassland, peatland, steppe |
| **Wildlife** | |
| Impacts on other species | Grassland, arid/semi-arid, alpine |
| Repress peatland fauna including crayfish and rodents. May assist other taxa (e.g. deer, marsupials) through access through horse trails | Subalpine |
| **Ecological feature / Types of impact - Positive** | **Environments** |
| **Plants** | |
| Increased species diversity | Sub-alpine, montane, desert |
| Seed dispersal | Coastal dunes |
| **Fire** | |
| Reduction of fire severity | Forest, sub-alpine, montane, semi-arid |

In 2011, the Victorian Government Scientific Advisory Committee listed the 'Degradation and loss of habitats caused by feral Horses (*Equus caballus*)' as a Potentially Threatening Process under their *Flora and Fauna Guarantee Act 1988*. The committee concluded that

feral horse populations currently threaten the survival and further development of a number of species and natural communities both in parts of the Victorian High Country and in the Barmah forest.

The chief threatening process impacting peat communities in the Australian Alps is physical damage by trampling, which leads to loss of vegetation cover and altered hydrology and channelling of water (McDougall & Walsh, cited in Hope et al. 2012).

Mountain pygmy-possum and broad-toothed rat are threatened species that are under threat from horses (OEH 2013). A study on broad-toothed rats conducted in Long Plain over a 10-year period showed that in sites where there were no horses, the number of rats did not change. However, all sites where horses were present were compromised by two actions: grazing of the tussocks and trampling of the inter-tussock spaces (K Green 2015, NPWS, pers. comm.).

Wetlands contain drinking water and green pick that are very attractive to horses. Research shows that horses will trample sphagnum moss as they search for food, however, they do not appear to eat the moss. Grazing and trampling near wetlands and bogs tends to result in a decrease in sphagnum and sedges, lateral erosion and increased probability of wetland draining. If these wetland areas dry out they can be reduced to stony pavements with no wetland habitat values (TAMS 2007). Wild horses have almost completely removed a former Sphagnum shrub bog at Dunns Creek (Hope et al. 2012).

Other threatened communities aside from the alpine and subalpine communities in the park are being impacted by wild horses. White-cypress pine – white box woodlands are part of the Snowy River Catchment Endangered Ecological Community. A study of the woodlands in the park (Bishwokarma et al. 2014) concluded that wild horses are now the major contributor to suppressing the recovery of these woodlands from historical degradation.

**Figure 3. Wetlands and bogs are sensitive to trampling. Horses crossing have changed the hydrology, causing them to dry out and increase the amounts of silt deposited downstream (Photo: M Bowden, 2007)**

## Impacts on vegetation

Feral horses are not randomly distributed over the different habitats within the park. They spend most of the time feeding and therefore numbers are concentrated in their preferred grazing areas: grasslands and heath. This preference for grassland and heath habitats is likely to eventually alter the ecology of these areas by selective grazing (Dyring 1990). Many alpine plants along the Main Range are small shrubs and ground-hugging plants which are

very sensitive to damage by heavy animals such as horses. The short summer growing season also means that recovery from damage is very slow (Montague-Drake 2005).

**Figure 4. Examples of track formation and trampling of vegetation caused by horses in the Rams Head area of Kosciuszko National Park (Photos: K Green)**

## Impacts on soil – compaction and erosion

A study in Kosciuszko National Park found that dry soils needed only 20–50 passes by unshod horses before significant compacting occurred (Dyring 1990). This means that a group of four horses would only need to travel along the same route twice a day for five days to cause significant compaction.

Compaction of trails and wallow sites often leads to increased erosion, particularly in steep areas, as water races unchecked down the slopes. Exposed soil can also be prone to frost heave during winter months. Dyring (1990) found that the general soil loss from tracks in her study area averaged 40 to 156 cubic centimetres per metre squared. More soil was lost from the wider tracks, suggesting an increase in erosion with an increase in exposed soil surface. In wet, peaty areas erosion occurs through runoff and by the soil being displaced to the side of trails as hooves sink deeply into wet soil (Marshall & Holmes 1979, cited in Dyring 1991; Lance et al. 1989). Horses prefer to cross streams from more ‘solid’ ground beside an established crossing rather than risk falling on a churned up track, therefore stream crossings are constantly being widened.

Compacted areas on trails, in wallows, and in rest areas are considerably drier than adjacent untrampled areas as a result of greater evaporation from bare areas, decreased pore space in the soil from compaction, and reduced infiltration following compaction and greater runoff (Chappell et al. 1971; McGinty et al. 1971, both cited in Dyring 1991). This has flow-on affects for site rehabilitation.

Research shows that although dry soils are more likely to be compacted than wet soils, wet soils are more vulnerable to structural damage (Dyring 1990).

**Figure 5. Stream bank disturbance and siltation on Peppercorn Creek resulting from drinking and crossing by horses (Photo: G Wilks, 2007)**

## Impacts on treeless drainage lines

An Assessment of Feral Horse Impacts on Treeless Drainage Lines in the Australian Alps (Robertson et al. in prep.) found that:

- horses are widely distributed across the Alps
- areas where horses are present have significantly more damage to creek banks, pugging (soil compaction), more sediment on the creek bed and higher levels of grazing.

Analysis of the data from this project shows that on average, over the 50-metre long sites (G Robertson 2016, pers. comm.):

- 76% of the length of stream banks in sites where horses are present have some level of degradation, compared with 11% in sites where horses are absent
- 71% of the length of the streams in horse present sites show changes to the longitudinal form (such as a broadened channel), compared with four per cent in horse absent sites
- 56% of the length of stream beds have a moderate to high sediment load, compared with less than one per cent in the horse absent areas
- 82% of the length of streams have moderate to high levels of pugging in horse present sites, compared with one per cent in the horse absent sites
- 84% of the length of streams show some evidence of grazing, compared with eight per cent in the horse absent sites.

## Impacts on karst systems

Karst systems can only be protected by protecting the entire karst catchment. This is because karst systems are among the most vulnerable of ecosystems; if they are damaged it takes vast amounts of time for them to be formed again. Their integrity depends on the relationship between rock, water, soil, vegetation and air remaining essentially unchanged. Any interference with this relationship can result in their degradation. Karst ecosystems are at risk from the changes that come with the activities of introduced animals, including horses. These impacts include damage to vegetation and removal of vegetation which leads to erosion and silt clogging up the karst system.

## Impacts on cultural heritage

Wild horses have the potential and are known to have had negative impacts on historic cultural and Aboriginal heritage values within the park. A recent example is where wild horses have caused physical damage to Bill Jones' hut in the Cooleman Plain area, where there are high wild horse population densities (see 0). It is assumed that horses were either seeking shade shelter in the hut or were seeking out mineral salts in the hut's timber structure or earth floor. Fencing or railings are being considered to exclude wild horses from the hut. Similar damage has been documented to huts such as Tin Mines Barn and Charlie Carter's hut, and other structures show signs of wild horses rubbing or chewing for salt.

Concern around the physical damage caused to Aboriginal heritage sites by wild horses through trampling and erosion of physical sites (e.g. artefact scatters) was noted during the assessment of the community's understanding of park values and its views on wild horse management in the park (Straight Talk 2015).

**Figure 6. Damage to Bill Jones' hut, Cooleman Plain, caused by wild horses (Photos: G Stroud, NPWS, 2015)**

The assessment of heritage values of the wild horse population in the park (Context 2015) also highlighted that the presence or evidence of wild horses, as an introduced species, may conflict or detract from other values. These include values associated with Aboriginal spiritual significance, or similarly held intangible cultural values associated with wilderness or sense of 'wildness' or a pristine environment that many people within the community value within the park.

## Risks to visitor safety

Horses, as a large and highly mobile animal, pose a significant risk to motorists using the Snowy Mountains Highway, Elliott Way, Alpine Way and other roads within the park, particularly at night or during low visibility conditions. Horses regularly cross and travel along these roads. During winter, salt is frequently used to de-ice roads, and this salt stays on the road shoulder and can attract horses for the rest of the year.

The risk posed by free ranging wild horse populations along high speed road corridors should be considered in context to other road hazard risks such as native wildlife like kangaroos or wombats or other introduced animals such as deer. The risk from horses, however, cannot be discounted and is probably greater than other animals due to their size. Two recent fatalities in separate incidents near Townsville in far north Queensland involving a free roaming wild horse population on high speed public roads are indicators as to possible consequences.

NPWS has records of 26 reported vehicle collision incidents within the park involving horses since 2003, primarily on the Snowy Mountains Highway between the Eucumbene River crossing and Yarrangobilly River crossing, as well as incidents on Elliot Way and Alpine Way. Fortunately, none of these incidents have resulted in significant injury or death, however, some have resulted in vehicles being damaged beyond repair (see 0). It is considered that many incidents or 'near miss' incidents involving vehicle and wild horse interactions go unreported.

**Figure 7. Wild horses crossing roads in the park pose significant risks to motorists as evidenced by this vehicle accident involving a wild horse on the Cabramurra–Khancoban Road (Photos: M Bowden, 2009)**

Such risks on park estate are assessed using the standard NPWS Risk Assessment and Management Matrix. The matrix uses a relative measure of a 'likelihood' (likely through to rare) multiplied by the 'consequence' (minor through to major) to provide a risk score (either low, moderate, high or extreme). Using this method, the overall risk of adverse wild horse interactions with high speed traffic is ranked at moderate to high.

The NPWS approach to mitigating this particular risk has been to attempt to exclude horses from within high speed road corridor areas using trapping and removal. NPWS also liaises with NSW Roads and Maritime Services (which is responsible for the major road corridors of the Alpine Way and Snowy Mountains Highway) to encourage the placement and maintenance of wild horse warning and advisory signs. Discussions were held in regard to adjusting the speed limits to mitigate the risk of vehicle interactions with wild horses, however, this was not supported by the Traffic Committee.

In recent years, NPWS has received an increasing number of complaints from a range of park users who have felt that their safety has been threatened by the presence of wild horses, particularly at campsites where visitors are using small tents within wild horse areas. Horses can be large, and stallions or mares are known to act in an intimidating manner when they perceive there is a threat to their mob or during breeding season.

## Risk of spread of disease/health issues

The AUSTVETPLAN *Wild Animal Response Strategy* (AHA 2011) outlines the risk that wild horse populations pose in an emergency animal disease outbreak. Major emergency diseases listed that may affect wild horse populations include African horse sickness, anthrax, avian influenza, contagious equine metritis, equine influenza, Japanese encephalitis, rabies, Rift Valley fever, screw-worm fly, surra, vesicular stomatis and Hendra virus.

Anthrax and Hendra virus are diseases that affect both humans and animals. Horses and other livestock are also known to carry the parasite *Cryptosporidium parvum*, which can cause serious gastroenteritis in humans if it contaminates drinking water (TAMS 2007).

Exotic diseases such as equine influenza, equine encephalomyelitis, Potomac fever and other exotic infectious diseases would have a major impact on the Australian horse industry if they were to become established in the country (DPI 2005).

Due to the popularity of recreational horse riding in the park and the ease with which many of these diseases spread, an infectious disease could be passed from domestic horses to the wild horse population where it would be difficult to control. Not only could the disease then spread onto private properties or over state borders, but the welfare of the infected wild horses could become an issue.

If any horse is suspected of having an infectious disease, Department of Primary Industries regulations will be followed. This will include quarantining both infected animals and other animals that are known to have come in contact with them, notifying the Emergency Animal Disease Hotline, and disinfecting all persons, vehicles and equipment involved in the trapping program.

# Strategic approach to wild horse control

The control of wild horses in the park is part of a broader, integrated regional pest management program for the NPWS Southern Ranges Region. The overriding objective of the Southern Ranges Regional Pest Management Strategy is to minimise the adverse impacts of introduced species on biodiversity and other park and community values while complying with legislative responsibilities.

A strategic approach to wild horse management will be achieved in the park by establishing:

- three **objectives** for wild horse management in the park – see Section 3.1
- a number of **strategies** to achieve these objectives – see Section 3.2
- which **control methods** will be used – see Section 3.3
- three geographic wild horse **management regions** (Northern, Central and Southern) – see Section 3.5
- five wild horse **management zone** types broadly based on the biosecurity model, each with specific objectives and strategies – see Section 3.6
    - prevention
    - elimination
    - containment and Population Reduction
    - key Environmental Asset Protection
    - public Safety
- management zone–specific **actions** for 23 localities that together cover the whole park – see Section 3.7.

The approach taken in this draft plan to divide the park into management regions, management zones and localities facilitates management of wild horses by ensuring that control efforts are focussed towards areas where wild horses pose the greatest actual or potential risk to environmental or other values and public safety, and where the greatest returns on investment can be achieved.

Dividing the park into specific zones and localities also allows diverse values in the park to coexist. Within these zones, different combinations of control methods may apply, using an integrated approach to increase effectiveness. This will include integration of wild horse management with other park management programs and operations, including those for other introduced species such as deer, pigs, goats, rabbits, wild dogs, foxes and cats as well as weed species.

## Objectives

This Draft Wild Horse Plan has three objectives:

1. To reduce the impacts of wild horses on the natural and cultural heritage values of Kosciuszko National Park by reducing the overall population of wild horses using a range of cost-effective and humane control measures.
2. To reduce and mitigate the risk of adverse wild horse interactions and incidents with park visitors and the public more generally.
3. To involve the community in the ongoing management of wild horses in Kosciuszko National Park through active participation in research, monitoring and control programs where possible.

## Strategies

The following strategies will be employed to achieve the plan and management zone objectives:

- Inform and better educate the broader community and stakeholder groups about the humaneness of different wild horse control methods, including the costs, constraints and operational challenges involved in each method.
- Implement a range of wild horse control measures as detailed in Section 3.3 where effective, appropriate and sustainable, given financial and other constraints.
- Employ a range of control methods, including lethal control methods, to reduce the overall wild horse population in the park to minimise impacts and mitigate associated risks. A lack of demand for domesticating wild horses should not hinder implementation of the plan.
- Effect elimination (e.g. of the Snowy Plains population) and prevent incursions of wild horses into the Central Region (e.g. onto Main Range) to achieve and keep the Central Region of the park free from wild horse impacts.
- Minimise impacts in the Northern and Southern regions by reducing the horse population in these areas, including in the Yarrangobilly and Cooleman Plain karst management units and other key environmental asset protection zones.
- Reduce the overall impact of the wild horse population by reducing it from 6000 to less than 3000 horses in five to 10 years.
- Reduce the overall population of wild horses to approximately 600 (400–800) horses within 20 years. This population will be permitted in acknowledgment of the cultural, economic and social values of wild horses in the park. This may be achieved more rapidly, and it is desirable from an ongoing animal welfare and resource requirement perspective that it be achieved as quickly as possible.
- Once the overall population has been sufficiently reduced, adopt an approach of minimal management intervention incorporating fertility control and small-scale, non-lethal harvesting (trapping, mustering, removal and rehoming). This approach will limit population growth and also reduce or negate the need to apply lethal control methods.
- Reduce the two-way movement and spread of wild horses between the park and neighbouring private properties and public lands.
- Implement animal welfare responses for wild horses at both the population and individual animal level guided by policies and approaches applied to other introduced or pest animal species. For example, the wild horse population will be subject to natural processes such as drought, fire and snow events. Populations lost through natural processes will not be re-established in the park. Supplementary feeding or watering, or removal for veterinary treatment and return to the park will not be undertaken. Sick, injured, diseased or distressed animals will be humanely euthanased.
- Remove horses from high speed road corridors, while providing opportunities elsewhere for park visitors to view wild horses safely.
- Encourage and facilitate continued research and development of wild horse population management techniques.
- Establish a scientific panel to design a wild horse survey methodology that quantifies the environmental damage caused by wild horses, in addition to estimating total wild horse numbers. This methodology will underpin future wild horse surveys, which are to be carried out every five years, the results from which will inform future reviews of the Kosciuszko National Park Draft Wild Horse Management Plan, with such reviews to be conducted every five years.

**Actions:**

1. Manage wild horse populations within the park in accordance with this plan, including the management zones described and mapped in this plan.
2. Establish information on the NPWS website on the heritage values of the wild horse population in the park, their impacts on other values and the objectives of the wild horse management program.
3. Establish an independent scientific panel to design a survey methodology to underpin wild horse surveys to be conducted every five years in order to quantify the environmental damage caused by wild horses, in addition to estimating horse numbers, with the results of these survey to inform future reviews of this plan.
4. Continue and expand the program monitoring wild horse impacts on environmentally sensitive areas and areas with cultural heritage values.
5. Integrate the wild horse management plan's planning and operational activities with other introduced species management programs wherever possible, and in particular those for deer, pig, goat and rabbit control.
6. Work with Roads and Maritime Services to minimise risks to motorists caused by wild horses.
7. Review the plan in conjunction with the Kosciuszko National Park Wild Horse Management Reference Group in five years.

## Control methods to be used in the park

A range of control methods and an adaptive management approach will be used in implementing this plan. All control methods will be implemented according to best practice and standard operating procedures, and may be modified and supplemented by new techniques where relevant.

An integral aspect of the wild horse management program in the park – like all NPWS pest and wildlife management programs – is to ensure that animal welfare is not compromised for either the target or non-target species. The Department of Primary Industry has produced codes of practice and standard operating procedures for the humane capture, handling, transport and destruction of feral animals, including horses. NPWS will ensure that contractors, agents or volunteers that work for or receive wild horses from NPWS are aware of relevant legislation, procedures and codes.

The control methods will be conducted according to all relevant national and State animal welfare legislation, regulations, codes of practice and standard operating procedures. These include Commonwealth codes and procedures:

- *Australian Animal Welfare Standards and Guidelines*: Land transport of livestock (AHA 2012)
- *Model Code of Practice for the Welfare of Animals*: Land transport of horses (SCARM 2003)
- *Model Code of Practice for the Welfare of Animals – Feral Livestock Animals: Destruction or capture, handling and marketing* (SCAAHC 2002).

NSW codes and procedures:

- *Model Code of Practice Humane Control of Feral Horses* (Sharp & Saunders 2014) and associated standard operating procedures:
    - *NSW HOR001 – Ground shooting of feral horses* (Sharp 2011a)
    - *NSW HOR003 – Mustering of feral horses* (Sharp 2011b)
    - *NSW HOR004 – Trapping of feral horses* (Sharp 2011c)
    - *NSW GEN 001 Methods of euthanasia* (Sharp 2013)

- *Prevention of Cruelty to Animals (Land Transport of Livestock) Standards* (NSW Government 2013)
- *Development of a Model Code of Practice and Standard Operating Procedures for the Humane Capture, Handling or Destruction of Feral Animals in Australia* (DPI 2004).

NPWS will consult and liaise with both the Department of Primary Industry and Local Land Services and refer to the AUSTVETPLAN *Wild Animal Response Strategy* in an emergency animal disease outbreak or other natural disaster such as bushfire that may affect the welfare of wild horse populations.

Animal welfare experts, including NSW RSPCA and veterinarians, will continue to be consulted during implementation of the plan. Their representation and involvement in the Kosciuszko National Park Wild Horse Management Program Reference Group will be sought to advise on horse and animal welfare issues during the life of the program.

As well as the humane treatment of horses, it is also important to assess the safety of people involved in the wild horse management programs. All wild horse management operations will be assessed and conducted using established Work Health and Safety systems including risk assessments and job safety analyses. All injuries to personnel (including staff, contractors, volunteers and members of the public) will be recorded, investigated where appropriate and reported.

Different wild horse control methods suit different situations depending on factors such as mob size, age structure, geography, accessibility and season. As with the management of any invasive species or vertebrate pest, a variety or combination of different techniques will be used as part of an integrated approach to pest management to achieve the most effective results.

Based on the findings of the ITRG, which included an assessment of humaneness of various wild horse control methods, this plan will implement the following control measures (each method is described below and discussed in detail in the supporting Humaneness Assessment Panel report (HAP 2015)):

- trapping and removal from park for domestication or transport to knackery or abattoir
- trapping and culling on site
- aerial and/or ground mustering, yarding and removal from park for domestication or transport to knackery or abattoir
- aerial and/or ground mustering, yarding and culling on site
- ground shooting
- fertility control
- fencing.

The NSW Government has ruled out the use of aerial shooting and brumby running and roping in this plan.

The decision on when and where one or more of the seven methods above will be employed will be determined by NPWS based on a range of considerations, including:

- objectives established under this plan for the region, zone and location where the control operation is to take place
- season
- weather conditions
- animal welfare, including life cycle considerations (e.g. mares in foal or foals at foot)
- road and trail access
- transport distances and track condition
- numbers of horses to be controlled and size of horse populations

- fate and options for removed horses
- on-site carcass management
- cooperative cross-tenure management
- suitability/availability of trapping or mustering locations (e.g. suitable terrain)
- operator expertise
- level of public use, visitor access
- past interference/vandalism of traps/yards
- remoteness of the control site (e.g. need to use helicopters to fly personnel and equipment in and out of the site)
- vegetation type and terrain
- minimising impacts on the environment and the park's natural and cultural values
- fire history
- safety and injury risks to personnel
- cost.

### Trap and remove from park for domestication or transport to knackery or abattoir

This control method involves luring wild horses into portable and semi-permanent yards using mineral and salt blocks or molasses. Horses enter the yard of their own will, triggering a gate that traps them in the yard. Horses may be trapped singularly or in whole groups of up to 10 or more at a time.

Once trapped, horses are loaded directly onto a truck or trailer for removal from the park. Accordingly, this control method is only possible in areas that have reasonable vehicular access. Reducing the distance and/or time that wild horses spend in transit will reduce stress on the animals. As such, trap sites closer to the final destination (either domestication centre or knackery/abattoir) are most suitable for this method.

Trapping can be an effective method in forested country because it can draw horses from the forest into adjoining plains and open grasslands.

### Trap and cull on site

Wild horses are trapped as above and culled at the trap site. This method removes the stress of loading and transport to abattoir or knackery. This method can also be used when there is no suitable vehicle access to remove trapped wild horses from the park.

### Aerial and/or ground muster, yard and remove from park for domestication or transport to knackery or abattoir

This control method includes aerial mustering using a helicopter, or ground mustering using horse riders or all-terrain vehicles, or a combination of both.

Horses are mustered into a yard using long fences and suitable terrain to guide them to the yard. They are then loaded for transport and removed from the park for domestication or transport to knackery or abattoir. This method relies heavily on suitable road access and finding a suitable location and terrain for the muster. There are safety and injury risks to personnel and horses. It is possible to capture a large number of horses at one time where populations are dense.

Experience from other jurisdictions (Kaimanawa, New Zealand) shows that mustering using helicopters alone with no or minimal ground support (people on foot or horseback) is achievable if suitable terrain and placement of yards and wing fences can be established. Both aerial (helicopter) and ground mustering, or a combination of both, would be feasible

provided that people on the ground (on horseback or using all-terrain vehicles) stayed close to the yards to help funnel horses in.

### Aerial and/or ground muster, yard and cull on site

Wild horses mustered and yarded as above and culled at the yard site. This method removes the stress of loading and transport to knackery/abattoir. This method can be used when there is no vehicle access to remove mustered wild horses from the park.

### Ground shooting

Ground shooting uses trained and qualified shooters to find and dispatch wild horses in the park. Use of this method is generally restricted to more open areas, for example, grasslands, woodlands and forest clearings. Ground shooting is also used to euthanase injured or very ill horses.

### Fertility control

Several techniques of fertility control exist or are under development, and vary in cost and effectiveness. These include surgical de-sexing and contraceptive implants. All existing techniques require horses to be trapped or mustered and handled so the method has risk of injury to horses and personnel, as well as practical and financial limitations. Contraceptive implant controls also wear off over time, meaning horses need to be re-captured and re-treated every few years.

There has been some limited success in delivering contraceptives in an open free range situation using dart rifles through stalking or use of hides. It has only been applied in overseas situations where herd sizes are small and accessible, and the objective is to stabilise population growth rather than reduce population size.

Fertility control is therefore only a viable option where horse densities are already low and the objective is to gradually reduce or maintain the population at a low density. There are currently no fertility control methods that are feasible for the park, however, new advances may result in an appropriate broad-scale method being developed.

### Fencing

Fencing refers to the construction of fences that wild horses cannot cross in order to protect areas of designated high value vegetation, habitats or cultural sites (e.g. huts). Fencing can be an effective means of excluding pest animals such as horses from specific, small-scale areas (Dickman 2015). This approach is very unlikely to alter the size of the wild horse population, or ameliorate impacts other than those relating to herbivory and trampling in specific areas.

Fencing horses out of sensitive areas is only an option for very small areas of particular concern and would only be used on a temporary basis. It is not commonly used to control animals on public land because it can restrict public access and affects the movement of native species. For larger areas such as the alpine area, or along the Alpine Way or Snowy Mountains Highway, fencing would be prohibitively expensive to erect and very difficult to maintain. It would also have significant visual impacts and require grids for public access roads and trails and could hinder management operations such as firefighting. It could pose safety risks to the public in creating a barrier across the landscape and to horses that become stranded within a roadside fence. Many areas are not suitable for fencing due to terrain, vegetation and ongoing maintenance requirements.

# Other considerations

## Involving the community in ongoing management

NPWS has been involving the community and stakeholders in the management of wild horses in the park for over a decade, including through an informal reference group and providing trapped and removed horses for domestication or rehoming to suitable groups and individuals.

The community engagement project undertaken as part of the review of the 2008 Horse Plan reinforced the desire for the community and some stakeholders to be actively involved in the ongoing management of wild horses within the park. This was further reinforced in the cultural and community values assessment, which documented and recognised the strong cultural and social connections between the 'High Country' community and the wild horse population in the park.

NPWS will establish and formalise a Kosciuszko National Park Wild Horse Management Program Reference Group. The Reference Group will have a support function with a specific focus on wild horse management issues within the park. Reference Group members will include representatives from key stakeholder groups including: animal welfare groups; wild horse rehoming and rescue organisations; wild horse advocacy groups; environmental advocacy groups; and the Indigenous community. Members will also be sought to represent park users and park neighbours, local community and business, relevant scientific and technical expertise, and the NPWS Southern Ranges Regional Advisory Committee.

It is proposed that nominations and appointments to the Reference Group will be sought and made by the Office of Environment and Heritage.

The following key objectives are proposed to inform the role of the Reference Group:

- Perform a community advisory and reference role for the implementation of this Wild Horse Management Plan.
- Facilitate, promote and foster communication and a partnership between NPWS and the community in regard to the ongoing management of wild horse populations in the park.
- Provide community input, knowledge, skills and experience in the ongoing management of wild horse populations in the park.
- Promote and foster understanding and acceptance between and amongst the stakeholder groups, the community and NPWS in regard to the objectives and challenges of wild horse management in the park.
- Provide guidance, promotion and involvement with the wild horse management program, volunteer and community extension and education programs.
- Seek and investigate other ideas, proposals and opportunities for community and stakeholder involvement in the ongoing integrated and adaptive management of the wild horse population in the park.

In addition to the establishment of the Reference Group, a number of community extension and volunteer programs will be considered, including: research and monitoring ('citizen science'); participation in surveys, trapping and mustering; documenting cultural, community and social values of wild horses in the park; community cultural events; rehoming and domestication programs; and integration with other existing park management volunteer and community extension programs.

**Actions:**

8. Establish and formalise a Kosciuszko National Park Wild Horse Management Program Reference Group.
9. Involve the community in ongoing management of wild horses in the park through volunteer and extension programs.
10. Work with local communities to establish appropriate information and interpretive material on the heritage values associated with the wild horse population in the park.

## Cooperative control

NPWS has a responsibility to reduce, and where possible, mitigate the impact of introduced species moving across park borders into adjoining private property or other public lands, including Australian Alps national parks and reserves. For example, the Pilot–Byadbo wild horse population is contiguous with the population in the Victorian Alpine National Park (or 'East Alps' as referred to by Parks Victoria).

Allowing animals to cross into adjacent areas increases the environmental impacts in these lands and means the costs and resources associated with pest species programs in these areas are much higher. For this reason, the Wild Horse Management Plan will aim to reduce the numbers of horses in the park to lessen the impacts on adjacent lands, particularly where wild horse populations in adjacent areas are not established, or are in very low densities.

Wild horses are known to be moving across land tenure boundaries between the park and adjoining properties and state forests, including the Bago, Maragle, Bondo and Micalong state forests in the north, and Ingebirah State Forest in the south. In order to minimise movement of horses across park boundaries, and to help ensure the objectives of the program can be met, NPWS will liaise and work collaboratively with NSW Forestry Corporation and other neighbouring landholders. As part of this cooperative effort, NPWS may decide to introduce specific management strategies along park boundaries.

**Actions:**

11. Continue to participate, encourage and support the research and management programs established under the cooperative arrangement of the Australian Alps Liaison Committee – Wild Horse Working Group, which promotes cooperative and coordinated management programs across state, territory and tenure borders.
12. Continue to liaise and collaborate with Parks Victoria and ACT Parks and Conservation Service to develop complementary planning objectives, zoning and operational control programs for the Southern and Northern management regions of the park.
13. Continue to liaise with park neighbours, including NSW Forestry Corporation, regarding cooperative and integrated control of horses across boundaries.

### Carcass disposal

There are community concerns that carcasses that are left to 'let lie' may be a source of pollution, vectors of disease, or a source of food for scavenging pests (e.g. dogs, foxes, cats). Other concerns relate to the carcasses being 'wasted' rather than put to some use.

The disposal of wild horse carcasses that are subject to culling at trap sites or muster yards is a challenge. The use of helicopters to remove carcasses to a location where they can be disposed of is one option, but costly if large numbers of carcasses are involved. On-site processing and disposal through static pile composting is another option (Bonhotal, Harrison & Schwarz 2007).

Currently, when wild horses or other animals die in the park (e.g. from old age, injury, predation or natural events such as fire or heavy snowfall) there is no carcass disposal or recovery process/protocol for any of these animals except were they adversely impact the visitor experience. For example, a carcass of an animal in a high visitor use area such as a

picnic or camping area may be removed by staff to address concerns over the sight or smell of the dead animal.

Similarly, there are no protocols for disposing of animal carcasses resulting from roadkills, vertebrate pest control programs (e.g. pig shooting), recreational hunting, or non-commercial harvesting of kangaroos on private properties. These animals are routinely 'let lie'.

As such, NPWS will generally leave carcasses in situ (i.e. 'let lie'), but may consider other options as per AUSTVETPLAN *Operational Manual: Disposal* (AHA 2015) in certain operations.

**Actions:**

14. Encourage research and undertake investigations on best practice carcass management and disposal.
15. Investigate, seek expressions of interest and test the market for any commercial interest or viability for use of carcasses (e.g. for pet food, composted material, blood and bone or other carcass products).

## The fate of removed horses

NPWS regards the practice of domesticating or 'rehoming' wild horses as an integral part of the overall wild horse management program. It is one part of the integrated wild horse program for the park. It provides an important community link to the challenges of wild horse management and acknowledges both the cultural and social values of wild horses to the community. To date, the trapping and removal program has often been constrained by the lack of suitable demand for domestication or appropriate disposal options of wild horses that require removal from the park.

Currently, many more horses need to be removed to reduce the population (and associated densities and impacts) than can successfully be domesticated. Without a major increase in the numbers of horses that can be domesticated, NPWS must employ other control methods, including lethal control methods, to reduce the overall wild horse populations in the park to minimise their impacts and mitigate associated risks.

NPWS endeavours to ensure that wild horses that are removed from the park are treated humanely and in accordance with the relevant animal welfare legislation, procedures and codes of practice. However, there are inherent animal welfare issues in the domestication process as with any other control method. NPWS cannot monitor and be responsible for the long-term fate of wild horses that have been taken for domestication. There is no licensing or registration requirement for domestic horse ownership in New South Wales or Australia.

A long-term aim is to minimise the need for lethal control or 'harvesting' via capture and removal of horses from the park. In time, once the wild horse population has been sufficiently reduced, it is hoped that fertility control or small number removals for domestication will be the primary population control methods. Fertility control will only be effective once the existing population size and density is significantly reduced. Once overall horse populations are reduced within the park, the overall numbers required to be removed each year will better match domestication demand and capacity.

**Actions:**

16. Work with the community and stakeholders to maximise, where possible, the rehoming or domestication rate of wild horses that are removed from the park. However, implementation of the Wild Horse Management Plan will not be constrained by lack of demand or otherwise to rehome or domesticate horses.
17. Conduct an expression of interest process periodically to determine annual numbers of wild horses to be removed for rehoming or domestication.

18. Investigate and test the market to try and minimise the transport times and distances for horses that are removed from the park and destined for knackery or abattoir.
19. Encourage, where possible, proposals for establishing local wild horse rehoming or domestication programs and appropriate facilities.
20. Encourage all wild horse rehoming or rescue groups to meet all current animal welfare legislation, regulations and codes regardless of the animals' fate, and to develop their rehoming and domestication operations.
21. Establish, incorporate and promote information on the wild horse management program and domestication process via the NPWS website.

## Wild horse management regions

For the purposes of this plan, the park is divided into three wild horse management regions: Northern, Central and Southern. These regions are bounded by major public roads and reflect the current distribution of wild horses in the park; specifically, where horses do and do not occur. See 0.

### Northern Management Region

The Northern Management Region is about 290,000 hectares and encompasses all areas north of the Snowy Mountains Highway, Link Road and Khancoban–Cabramurra Road. It includes a number of wilderness areas (see 0).

The grassland country in the east of this region includes the highest density of wild horses in the park, predominantly around Long Plain, Tantangara, Currango and Cooleman Plain (see C1 and A2 localities on 0). Vehicle access to the edges of the plains on established management trails is reasonable, although mostly limited to four-wheel drive vehicles.

The Nungar Plain, in the south-east of this region (see E2 on 0) has very low numbers of horses that have only been established in recent years east of Tantangara Road – Pockets Saddle Road.

Much of the north-west and northern area of this region in the Bogong Peaks, Goobarragandra, Bramina and Bimberi Wilderness areas is very steep, with tall open forest that tends to have almost continuous canopy in some areas. Much of the area is marginal horse habitat and the density of horses here is much lower than the south-east grasslands.

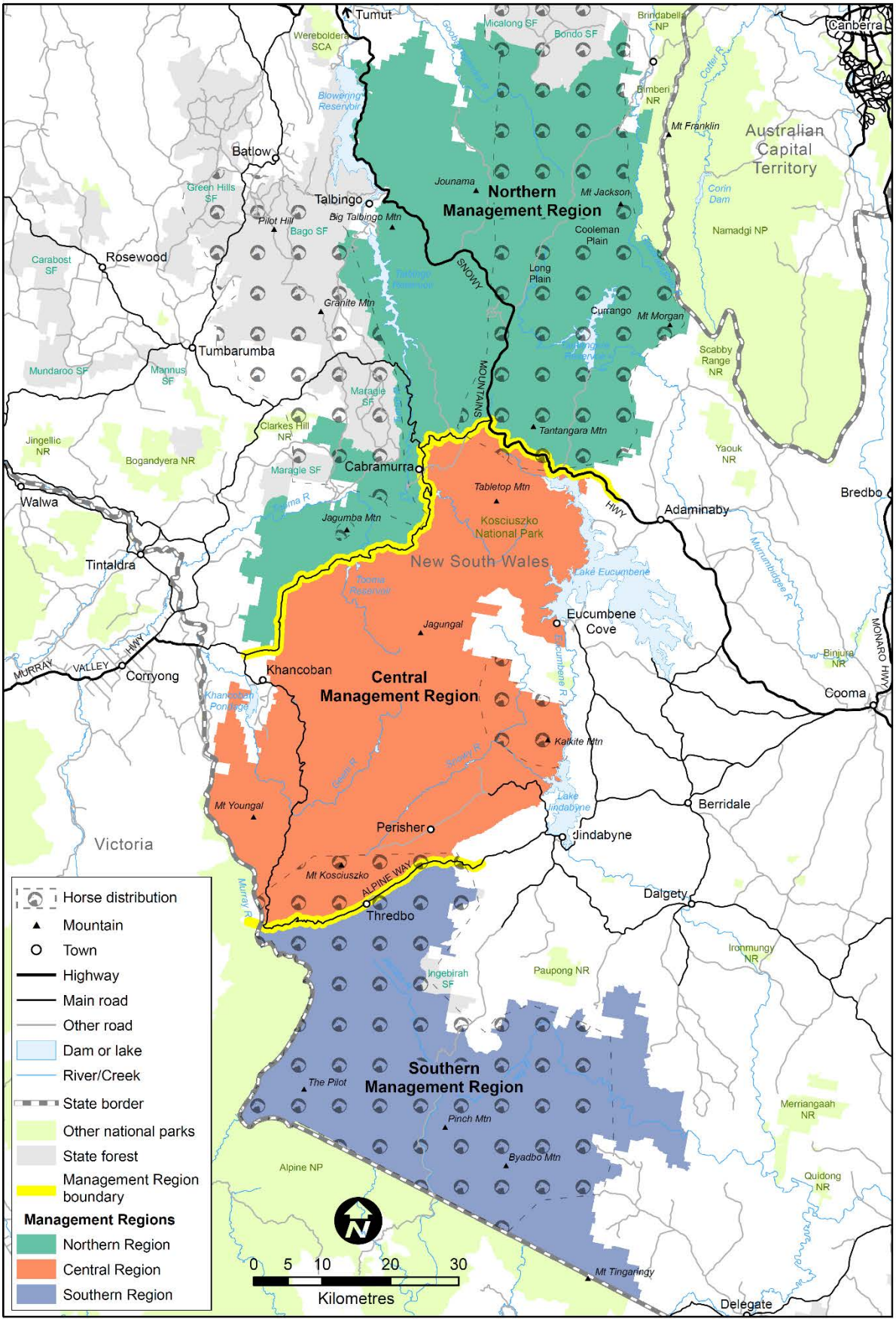



**Figure 8. Management Regions**

Most of the north and north-west area of the region is regarded as 'horse free' or has very low horse densities. It is very difficult to manage horses in this area due to the nature of the vegetation, the terrain and limited vehicular access.

The Northern Region also contains the Yarrangobilly (18,122 hectares) and Cooleman Plain (10,500 hectares) karst management units (see A1 and A2 on 0). These two areas, along with the Main Range Management Unit in the Central Region, were identified by the 2006 *Kosciuszko National Park Plan of Management* as areas of exceptional natural and cultural significance from which horses should be excluded.

In the south of the region, in the World's End area south-west of Cabramurra, horses from the adjacent Maragle State Forest cross the Khancoban–Cabramurra Road into the park.

## Central Management Region

The Central Region is about 230,000 hectares and includes the Main Range Management Unit, Snowy Plain, and the Jagungal, Indi and Western Fall wilderness areas. The southern boundary of this region is the Alpine Way, from Bullocks Flat in the east to Tom Groggin in the west.

The majority of the region is currently horse-free except for a low density population at Snowy Plain and seasonal incursions into the north and south of the region. In the north, there are seasonal incursions from the Northern Region into the Central Region around the Mt Selwyn – Four Mile Hill area, and toward Mount Tabletop.

The Main Range Management Unit (20,800 hectares) is located in the southern area of this region around Thredbo – Dead Horse Gap and extending to the north of Geehi Dam. As noted above, this area was identified by the 2006 *Kosciuszko National Park Plan of Management* as having exceptional natural and cultural values from which horses should be excluded. While there are currently relatively few wild horses here, small mobs of approximately six to 10 horses are now annually pushing up into this area during spring and summer. Their removal would significantly reduce the potential for ongoing incursions of wild horses from the Southern Region establishing new populations and expanding their distribution in this Central Region. Horses have been seen in the relatively flat and open high alpine plateau above the tree line, such as the Ramshead Range or headwaters of the Swampy Plains River and Wilkinsons Valley.

Wild horses from Snowy Plain also seem to be spreading further west and north-west into the horse-free areas of Finns River and the Jagungal Wilderness Area.

The western edge of Central Region, between the Murray River and Alpine Way, is currently relatively horse free and is likely to remain so if there is management of adjacent areas.

## Southern Management Region

The Southern Region, at approximately 170,000 hectares, includes the Pilot and Byadbo wilderness areas. It stretches from the Alpine Way to the Victorian border. Wild horses occur at medium density in the plains and grassy areas around water sources associated with frost hollow valleys and clearings within the open forest areas in this region, and also along the Lower Snowy River corridor.

The elevated subalpine plateau of the Upper Thredbo River, Chimneys Ridge and Brindle Bull areas currently support medium to high density wild horse populations. Horses are known to traverse the steep forested areas of the Upper Murray or Indi River valley, as well as the similar steep forested areas in the Pinch and Jacobs river valleys. However, this is not regarded as optimal habitat, particularly as a result of relatively dense understorey regrowth after the 2003 fires.

East of the Barry Way, the rain shadow woodland is relatively low with an open canopy and limited understory. There is no road access to areas in the Byadbo Wilderness. Horses from

this region are spreading onto adjoining state forest and private property in the Ingebirah, Numbla Vale, Mowamba and Little Thredbo River areas along the eastern edge of the park.

## Wild horse management zones

The three wild horse management regions are further subdivided into management zones broadly based on proven, best practice approaches used to manage biosecurity. See 0 for an overview of the zones. Figures 10, 11 and 12 show localities in each zone for Northern, Central and Southern management regions respectively.

Horse management zones described in this plan are generally consistent with both NSW and Victorian government approaches to prioritising the management of invasive species such as wild horses (see DPI 2013). The biosecurity model used by both governments indicates the appropriate response to each stage of invasion by a species. These responses are: prevention, eradication, containment, and asset protection.

The return on investment depends on the stage of invasion. A high return on investment is achieved through preventing entry of the invasive species, followed by early intervention and eradication if it appears. Lower returns on investment are associated with managing widely established invasive species (DPI 2013) when management approaches move from eradication to containment and asset protection. Containment and asset-based protection both involve sustained control, an ongoing process that can limit, but not entirely prevent, damage caused by the invasive species. Sustained control requires perpetual control costs and continual intervention.

The general meaning of each biosecurity approach is provided below, along with the specific horse management zone, objectives and actions that will apply to the park. In some cases, the biosecurity model approach has been adapted to suit particular situations in the park. For example, an additional management zone has been included to address public safety concerns.

A summary of the five management zones, the area and proportion of the park they cover are included in 0.

**Table 2. Summary of management zones in the park**

| Management zone | Approximate area (ha) | % of the park [1] | % of current wild horse distribution in the zone [2] |
|---|---|---|---|
| Prevention | 329,933 | 48% | 1% |
| Elimination | 35,164 | 5% | 11% |
| Containment and Population Reduction | 228,110 | 33% | 58% |
| Key Environmental Asset Protection | 76,768 | 11% | 17% |
| Public Safety | 11,374 | 2% | 13% |
| Other (water bodies, leases etc.) | 8,251 | 1% | 0% |

[1] Park area is 689,600 hectares.

[2] Current wild horse distribution in the park is 331,000 hectares = 48% of the park.

## Prevention Management Zone

Prevention involves preventing an invasive species from establishing in an area, and offers the most cost-effective approach to managing the threat posed by a high risk invasive species.

Objective for this zone:

- Prevent new wild horse populations from establishing in this zone.

Strategies for this zone:

- Carry out rapid and decisive control of wild horses that spread into this zone from adjacent areas to ensure the zone remains horse-free.

**Actions for this zone:**

22. Prevent new incursions or the establishment of wild horses in the zone.
23. Monitor for wild horses spreading into the zone.
24. Control all wild horses within 12 months of detection in the zone.
25. Control all wild horses that are making incursions into the zone.

## Elimination Management Zone

From a biosecurity perspective, eradication involves removing every individual of the target species from an area and preventing recolonisation. Eradication is generally only feasible for small, isolated populations, often in the early stages of establishment. The eradication of wild horses from the park is not achievable, although their complete elimination and exclusion from certain parts of the park is possible. The standard 'eradication' phase under the biosecurity model is described as 'elimination' to reflect this approach. This plan specifies elimination or 'localised' elimination where the objective is to completely remove wild horses from a number of specified localities.

Objectives for this zone:

- Completely remove wild horses from the zone.
- Protect high value natural and environmental assets such as the Main Range and karst management units.
- Protect or restore the values within or adjacent to the management zone.

Strategies for this zone:

- Remove the threat of expansion of wild horses into adjacent wild horse–free zones/areas and impacts on neighbouring land owners.
- Undertake concentrated and sustained control effort to achieve nil wild horse density in the management zone.

**Actions for this zone:**

26. Remove all wild horses from this zone within five years.
27. Continue to monitor and maintain this zone as horse-free once elimination has been achieved.
28. Remove all wild horses that make incursions into this zone within five years and prevent re-incursions.

## Containment and Population Reduction Management Zone

From a biosecurity perspective, containment involves preventing the spread of an invasive species beyond the boundaries of the core population (generally those that are too large and well established to eradicate). This approach also involves eradicating outlying (satellite) populations beyond the boundaries of the core population.

For the purposes of this plan, 'population reduction' has been included to indicate that as well as stopping the spread of wild horses beyond the boundaries of this zone, the intention is to also reduce the population of wild horses within this zone. A low density population will be permitted in this zone in acknowledgement of the cultural, community and social values of wild horses in the park. The target density for this zone is less than 0.4 horses per square kilometre.

Objectives for this zone:

- Prevent existing wild horse populations from expanding into adjacent areas currently unoccupied by wild horses.
- A reduced population of horses within this zone will be permitted in recognition of the cultural, community and social values of wild horses in the park.

Strategies for this zone:

- Minimise expansion and spread of wild horse populations and reduce negative impacts on park values associated with high densities by reducing the overall wild horse population densities.
- Reduce the impact and spread of wild horses onto adjoining lands by reducing wild horse populations.
- Undertake specific and localised management responses within this zone in response to impacts on karst systems, threatened species and public safety, or in relation to weed management.
- Integrate management practices with ongoing research and monitoring.

**Actions for this zone:**

29. Reduce the overall density of wild horses within this zone.
30. Integrate the control program with ongoing monitoring and research.
31. Monitor and deter the movement and expansion of wild horses from this zone into adjoining areas.
32. Work cooperatively with adjoining private landholders and relevant government agencies (e.g. NSW Forestry Corporation, Parks Victoria) to limit the expansion and reduce the density of wild horses in this zone.
33. Encourage fertility control research on wild horses to determine fertility control delivery and efficacy in a free-ranging situation.

## Key Environmental Asset Protection Management Zone

Key environmental asset protection involves focussing efforts towards protecting and restoring specific high value assets. The target density for this zone is <0.2 horses per square kilometre.

Objective for this zone:

- Protect natural and other assets by reducing impacts of wild horses.

Strategy for this zone:

- Reduce impacts to high value assets such as threatened ecological communities (e.g. bogs and fens, river corridors, rainforest) by reducing overall wild horse densities.

**Actions for this zone:**

34. Reduce overall density of wild horses in the zone.
35. Continue to monitor and encourage research on impacts of wild horses on assets to inform and adjust target densities for the zone.
36. Monitor and deter movement of wild horses from adjoining zones into this zone.

37. Form a buffer between Namadgi National Park to the east and the Containment and Population Reduction Zone to the west.
38. Work cooperatively with ACT Parks and Conservation, adjoining landholders and Parks Victoria to limit the expansion, reduce the density and limit the movement of horses across tenures.

## Public Safety Management Zone

This zone is not a standard biosecurity zone, but has been included in the plan to address public safety concerns by reducing or mitigating the risks posed by wild horses along high speed or main roads and visitor use areas. This is an 'overlay' zone in that it applies in addition to the other management zones. The objectives and actions for this zone also apply as required to visitor use areas (e.g. remote camping areas) which are not shown on the zone maps. The target density for this zone is less than 0.2 horses per square kilometre.

Objective for this zone:

- Minimise horse presence within road buffer areas and other key visitor use areas.

Strategy for this zone:

- Reduce and remove threats of wild horses causing public and road traffic safety issues within high speed road corridors and other visitor nodes where public safety may be an issue (e.g. camping areas).

**Actions in this zone:**

39. Reduce overall density of wild horses within the road buffer and visitor use areas as required.
40. Monitor and deter movement of wild horses from adjoining areas into this zone.

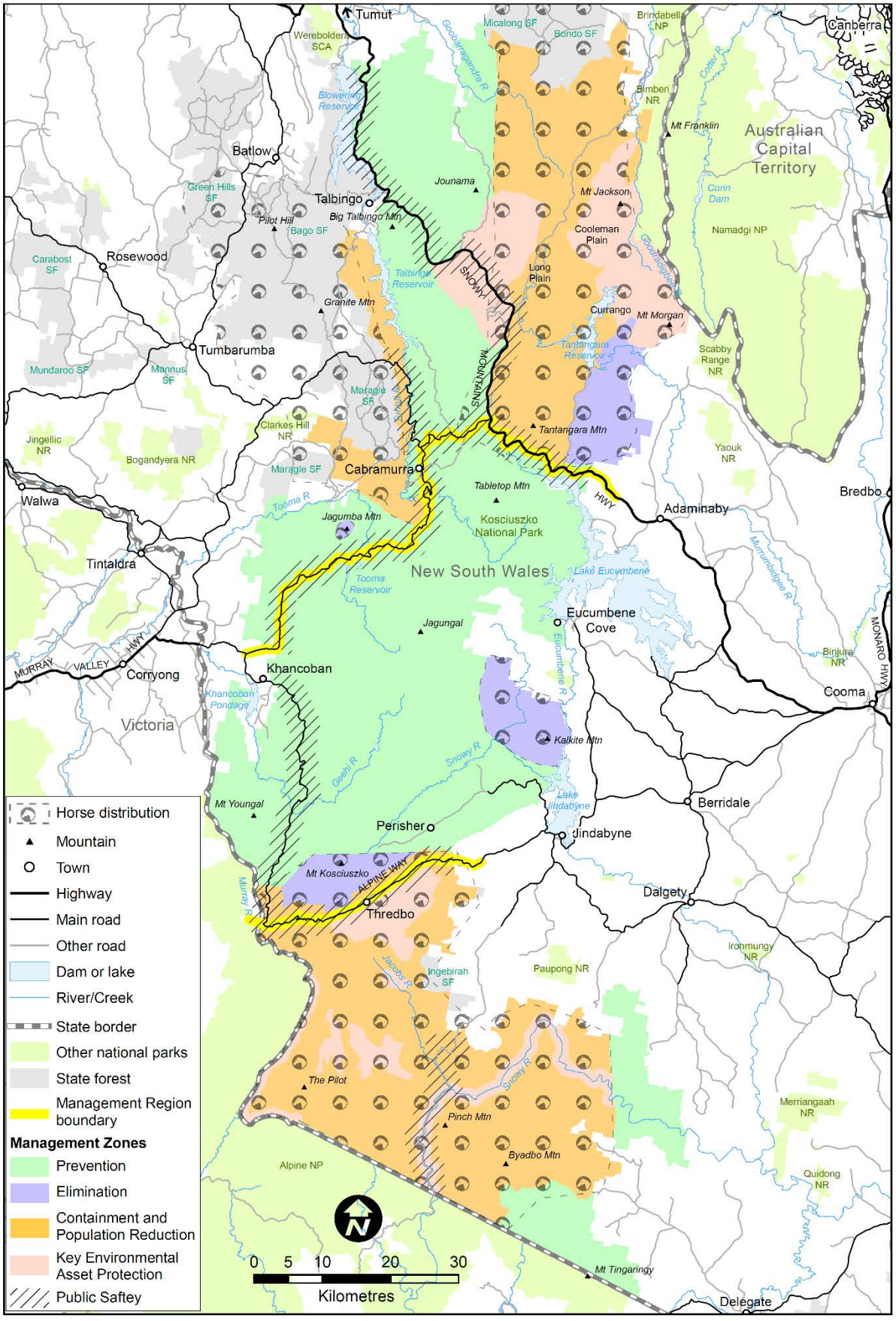



**Figure 9. Management Zones overview**

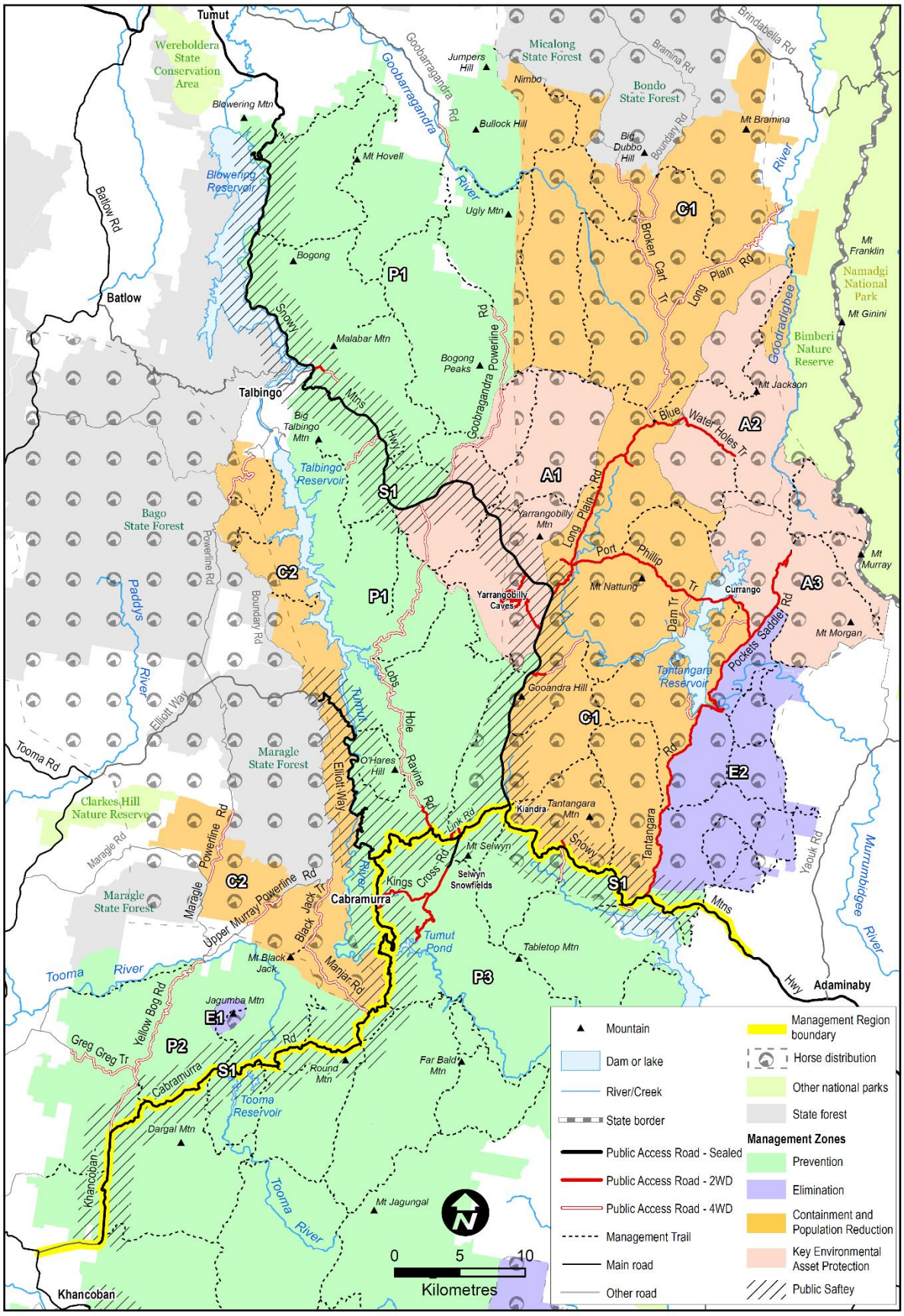



**Figure 10. Management Zones in Northern Region *(see Table 3 for key to localities)***

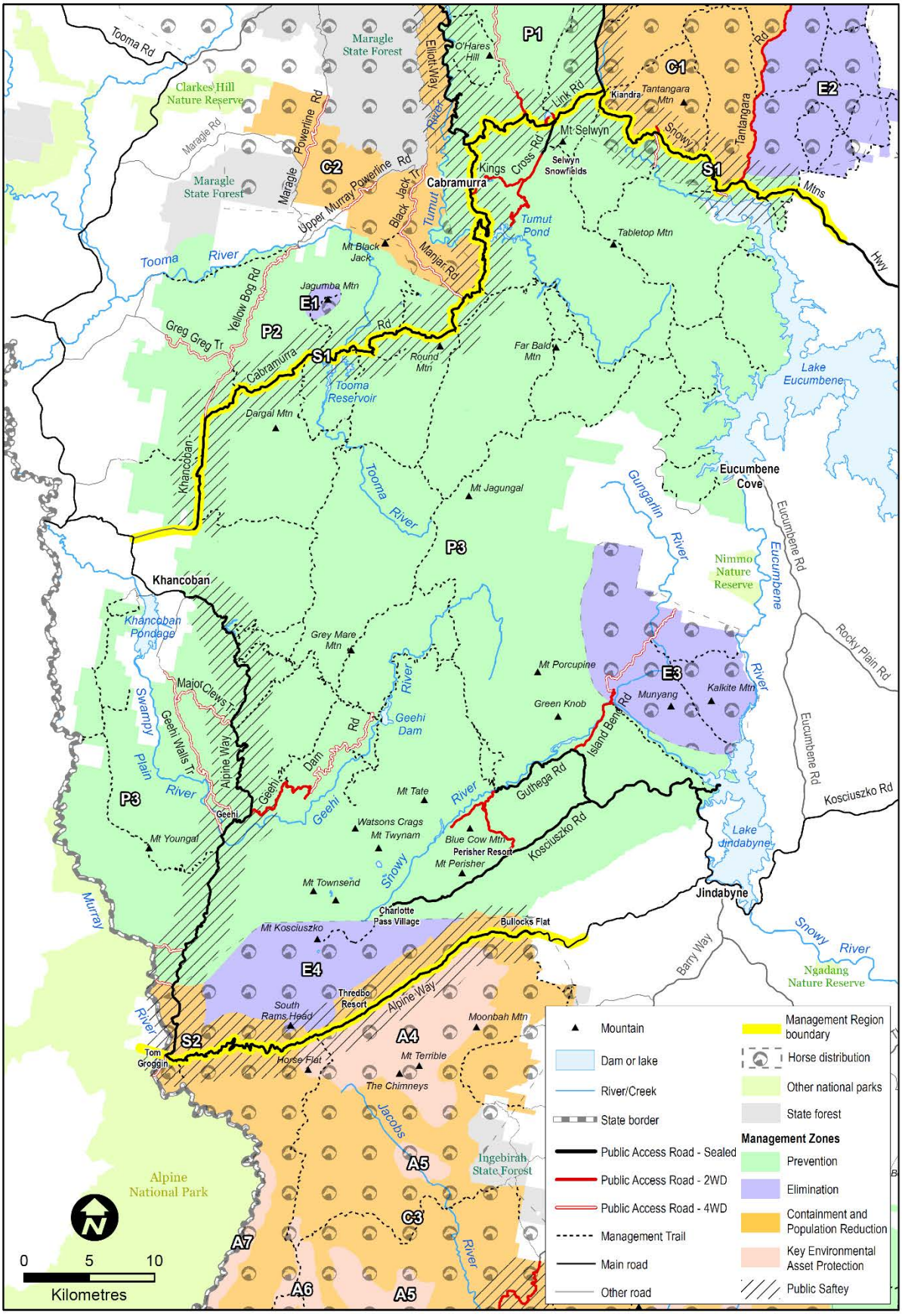



**Figure 11. Management Zones in Central Region *(see Table 3 for key to localities)***

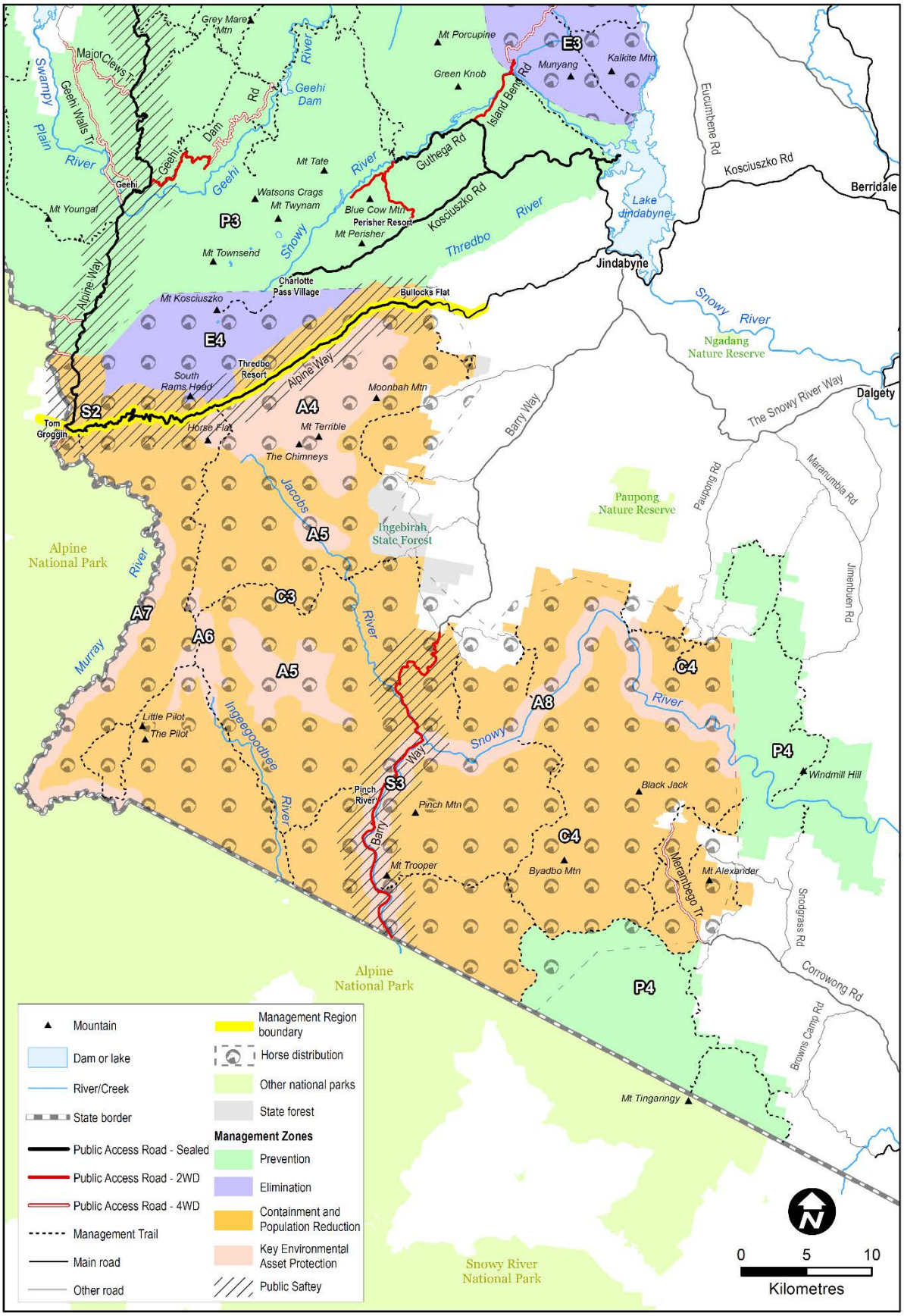



**Figure 12. Management Zones in Southern Region (see Table 3 for key to localities)**

**Table 3. Key to localities shown on zone maps**

| Zone/Code<br>Region | Locality<br>Area (ha) |
|---|---|
| **Prevention** | |
| P1<br>Northern | Bogong Peaks – Lobbs Hole – Cabbramurra<br>80,875 ha |
| P2<br>Northern | Tooma River – Greg Greg<br>24,033 ha |
| P3<br>Central | Jagungal<br>209,188ha |
| P4<br>Southern | Tingaringy – Numbla Vale – Windmill Hill<br>15,837 ha |
| **Elimination** | |
| E1<br>Northern | Jagumba<br>533 ha |
| E2<br>Northern | Nungar<br>15,318 ha |
| E3<br>Central | Snowy Plan<br>12,784 ha |
| E4<br>Central | Main Range Management Unit<br>6,529 ha horse occupied |
| **Containment and Population Reduction** | |
| C1<br>Northern | Long Plain – Tantangarra – Currango<br>79,707 ha |
| C2<br>Northern | Manjar – Maragle<br>20,634 ha |
| C3<br>Southern | Pilot / Thredbo<br>81,791 ha |
| C4<br>Southern | Byadbo<br>45,978 ha |
| **Key Environmental Asset Protection** | |
| A1<br>Northern | Yarrangobilly Karst Catchment Management Unit<br>19,349 ha |
| A2<br>Northern | Cooleman Karst Catchment Management Unit<br>11,926 ha |
| A3<br>Northern | Murray Gap<br>13,418 ha |
| A4<br>Southern | Big Boggy – Upper Thredbo River<br>9,984 ha |
| A5<br>Southern | Pinch River – Jacobs River – Black Sassafrass Forests<br>4,569 ha |

| **Zone/Code**<br>**Region** | **Locality**<br>**Area (ha)** |
|---|---|
| A6<br>Southern | Ingeegoobee – Tin Mines<br>1,956 ha |
| A7<br>Southern | Indi River – Karst<br>3,862 ha |
| A8<br>Southern | Lower Snowy River Corridor<br>11,704 ha |
| **Public Safety** | |
| S1<br>Northern, Central | Snowy Mts Hwy – Elliot Way – Cabramurra – Khancoban Rd Buffer<br>6,974 ha |
| S2<br>Central, Southern | Alpine Way Buffer<br>3,092 ha |
| S3<br>Southern | Barry Way Buffer<br>1308 ha |

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