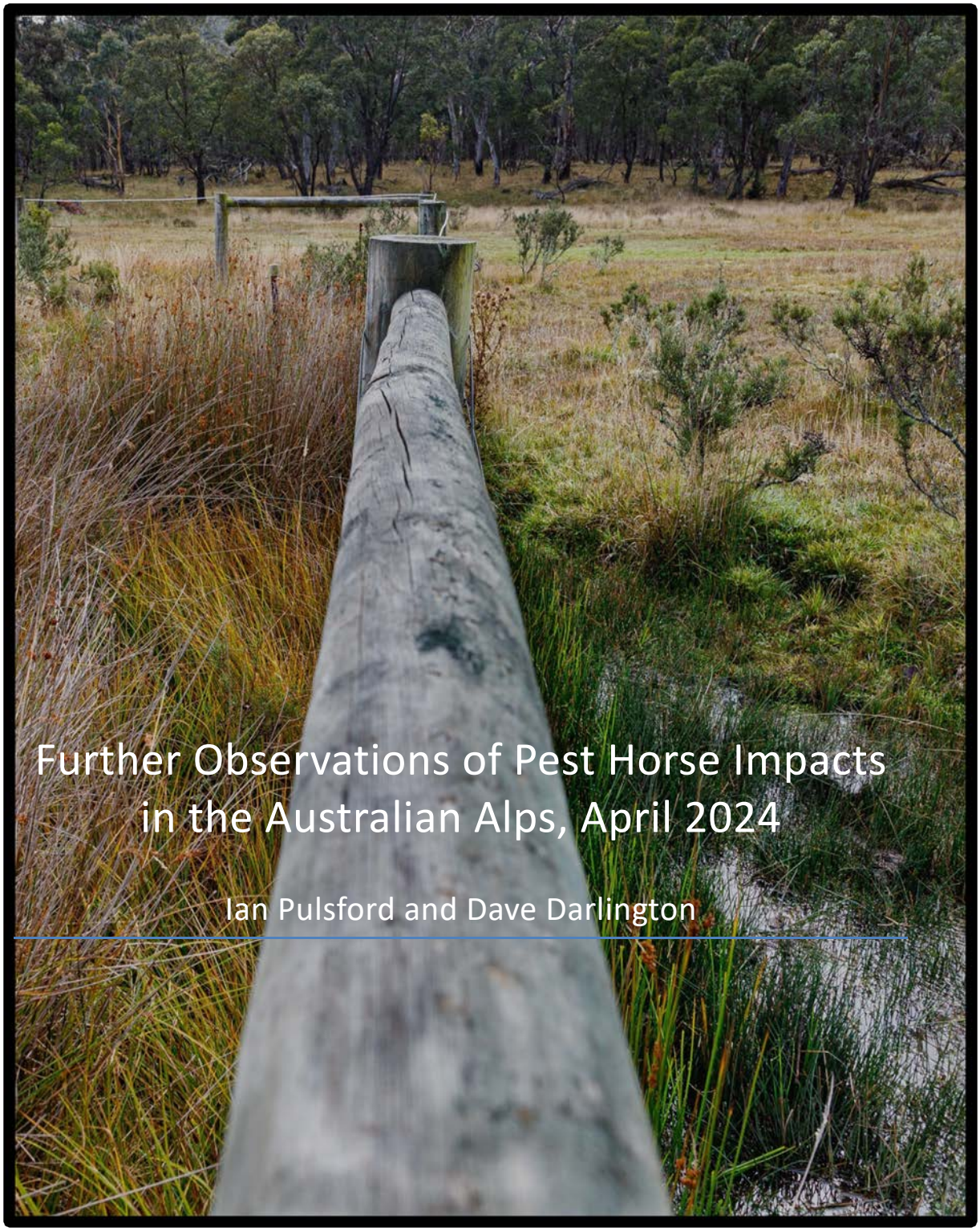

Further Observations of Pest Horse Impacts in the Australian Alps, April 2024

Ian Pulsford and Dave Darlington

Photo A: 2020 (left), and Photo B: 2024 cover photo (right).
Feral herbivore proof exclosure plot at Cowombat Flat in Alpine National Park, Victoria, one of several that were established in 1999. Note vegetation retained inside fenced plot:
Left: 21 years since grazing was excluded - 3 Mar 2020
Right: 25 years since grazing was excluded - 4 April 2024.
The surrounding area is accessible to grazing by feral horses that have caused pugging, compression and erosion of soil and destruction of native vegetation. Note: some recovery is seen in photo B. Carcasses of recently culled horses were seen nearby. (Source: Ian Pulsford).

This report is available at: http//

Important notice
This report is an update to an initial report by Worboys, G.L. and Pulsford, I. (2013).
Available at: https://theaustralianalpsnationalparks.org/wp-content/uploads/2018/06/horse_impacts_to_alps_catchments_worboys_pulsford2013.pdf
and a follow up report by Pulsford, I. Worboys, G.L and Darlington, D. (2020).
Available at: https://theaustralianalpsnationalparks.org/wp-content/uploads/2020/05/revisiting-pest-horse-impacts-to-australian-alps-catchments-2020.pdf

This report is produced for general information and is a record of personal observations made by the authors for the Pilot Wilderness area of Kosciuszko National Park in 2013 that were revisited in March 2020 and again March 2024. It has been prepared within the context of the authors participating in inspections of this area over a period of 51 years from 1973 to 2024 and should be read in conjunction with the 2013 report. For ease of comparison, some material in this report is a repeat and update of material in previous reports. Responsibility for the report contents rests with the authors. The inspection was carried out with the approval of the NSW National Parks and Wildlife Service.

Citation: Pulsford, I. and D. Darlington (2025). *Revisiting Observations of Pest Horse Impacts in the Australian Alps, April 2024*, 29p. Canberra.

Further Observations of Pest Horse Impacts in the Australian Alps, April 2024

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INTRODUCTION

Since 1973 we have observed the impacts of feral horses in the upper Thredbo River, Big Boggy, Cascade Creek, Ingeegoodbee River, Tin Mine Creek in Kosciuszko National Park and the Murray River headwater on the border between Kosciuszko and Alpine National Parks. We commenced photographing impacts at fixed locations for our first observations report in 2013 (Worboys and Pulsford 2013). Many of the same sites were rephotographed in March 2020 (Pulsford et al. 2020).

In 2013 we identified unprecedented, pervasive and destructive feral horse impacts for over 43 kilometres of frost hollow treeless drainage lines, especially in the Commonwealth-listed Alpine Sphagnum Bogs and Associated Fens Endangered Ecological Communities which occur in the high headwater catchments of the Australian Alps. We reported that "these impacts were the worst ever observed in 45 years of personal inspections of the Dead Horse Gap to Tin Mines section of the Pilot Wilderness of Kosciuszko National Park in New South Wales and at Cowombat Flat area of the Victorian Alpine National Park. Both parks form part of the Australian Alps national parks." (Worboys and Pulsford 2013).

In March 2020 we repeated our photo observations of the same sites to evaluate if changes in impacts had occurred since our last visits in 2013. This revealed that the condition of wetlands and sub alpine bogs on creek flats and river and stream banks in treeless drainage lines had continued to deteriorate due to the continued presence of large feral horse populations. Since our observations in 2013 horse population management had ceased in 2015 in the Pilot area. Conditions were also much drier in 2020 than during our 2013 inspection due to a prolonged severe drought. The areas we revisited were not directly affected by the mega-fires that burnt large areas of eastern Australia in January and February 2020. However, parts of the nearby western fall of the upper Murray and Geehi Rivers and slopes of the western fall of the Kosciuszko Main Range up to Dead Horse Gap on the Alpine Way were severely burnt.

Eastern Australia has experienced three consecutive years of La Niña conditions, spanning from 2020 to 2023, leading to record-breaking rainfall and widespread flooding across Queensland, New South Wales, Victoria, and Tasmania. This was considered one of the most impactful La Niña events in recent Australian history due to its prolonged duration and heavy rainfall patterns (Huang 2024).

After the ban on aerial culling of horses was lifted by the NSW Government in October 2023 aerial culling operations were carried out in designated areas in accordance with an amendment to the Kosciuszko National Park Wild Horse Heritage Management Plan (NPWS 2021) including the Pilot Wilderness. In April 2024 we rephotographed many of the same sites photographed in 2013 and 2020.

In April 2024 we repeated our photo observations of the same sites to evaluate if any changes in horse impacts had occurred since our observations in 2013 and 2020. This update report provides photo observations made on 3-5 April 2024 at many of the same sites and compares them with our 2013 (Worboys and Pulsford 2013) and 2020 observations (Pulsford, Worboys and Darlington 2020).

HORSE POPULATION ESTIMATES

Aerial surveys of feral horses in the Australian Alps national parks estimated a population of 5,200 in 2001; 2,369 in 2003; and 7,679 horses in 2009, a 21.65% per annum increase since the previous estimate in 2003 (Dawson 2009). In April-May 2014 and April-May 2019 the NSW National Parks and Wildlife Service (NPWS) conducted repeat systematic aerial surveys across three blocks covering the entire distribution of feral horses in the Australian Alps (Kosciuszko National Park and adjacent state forest areas in New South Wales and the Alpine and Snowy River National Parks in Victoria). These surveys were conducted by the NPWS and designed and analyzed by Stuart Cairns. The feral horse populations increased in these blocks from 9,187 in 2014 to 25,318 in 2019, an average increase of 23% per annum (Cairns 2019). The feral horse population in the Byadbo-Victoria (Snowy River and Alpine National Park) survey block, which included the Pilot Wilderness area, increased by 15% from 4,316 to 8,518 (Cairns 2019). Many horses in some areas such as the lower Snowy River perished during the 2019-2020 drought and wildfires.

The NPWS also conducted a separate series of 9 aerial index surveys between 2006 and 2019 to estimate the number of horses in 3,500 ha of subalpine ecosystems in the upper Thredbo River Big Boggy area of the Pilot Wilderness south of Thredbo. These repeat surveys carried out at the same time of year indicated that the population density had increased from 2.7 to 6.28 horses/km2 respectively (NPWS 2019). However, while annual park wide population estimate surveys have continued, the population index counts as carried out in areas such as Big Boggy have not been undertaken since 2021. In 2023 aerial park wide surveys recorded a best estimate of 17,393 (95% confidence interval 12,797 to 21,760) horses across approximately 365,000 hectares, or 53%, of Kosciuszko National Park (OEH 2023).

The Office of Environment and Heritage (OEH 2023) reported that the population of feal horses in Kosciuszko National Park, increased from 14,380 (with a 95 % confidence interval ranging from 8,798 to 22,555) in 2020 to 17,393 in 2023 (with a 95% confidence interval of 12,393 – 21,393 horses). This was due to a combination of factors including: (1) a high rate of natural population increases (2) lack of natural predators or diseases, and (3) inadequate horse control operations and cessation of horse control operations in Kosciuszko National Park for various periods for political reasons.

MANAGEMENT OF HORSES

Low numbers of horses have been removed by various means from Kosciuszko National Park for many years (Figure 1.) These methods have mainly included the capture of horses for rehoming or sending to a knackery. Brumby running was banned in 1982 due to concerns about the welfare of the brumbies and safety risks to riders. Aerial culling was prohibited by the NSW Government in 2000.

Removal of horses from the Pilot Wilderness area in 2015 ceased completely prior to commencement of community consultation and exhibition of the draft Kosciuszko Wild Horse Management Plan in 2016 (OEH 2016).

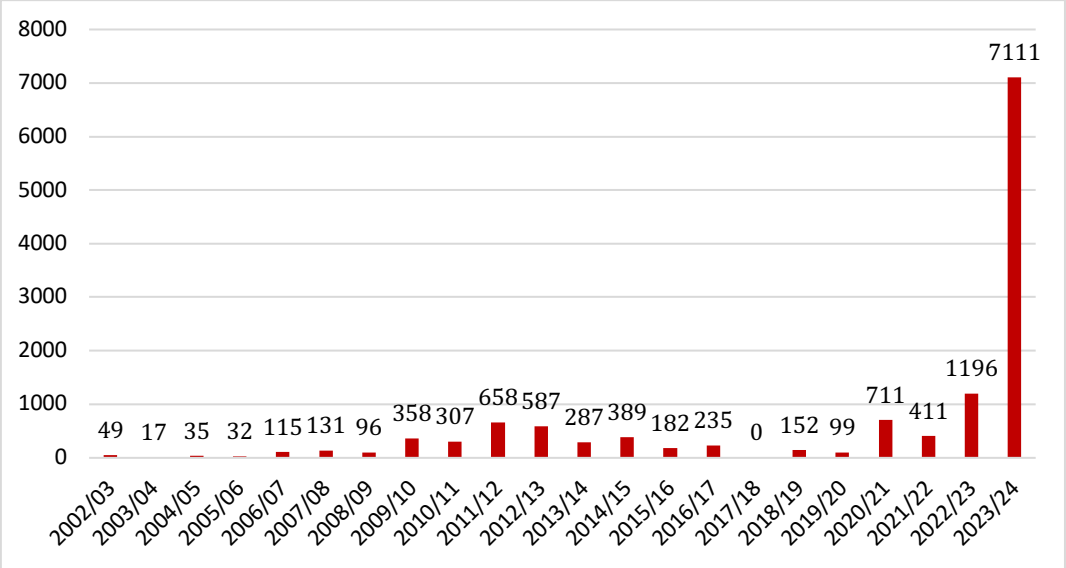

Figure 1: Numbers of feral horses removed by a range of means from Kosciuszko National Park since 2002. Aerial culling was approved as control measure in October 2023. (Source: Invasive Species Council). No specific estimates for numbers of horses removed from the Pilot Wilderness area are available.

As can be seen by the population estimates above, the low level of culling prior to October 2023 was not sufficient to reduce the numbers of feral horses in the park.

In 2021, the Kosciusko National Park Wild Horse Heritage Management Plan (WHHMP) was introduced. The Plan identifies 3 wild horse management areas in the park*:*

Wild horse retention areas (32% of the park)

- *Sustainable wild horse populations will be retained in these areas because they reflect the wild horse heritage values identified in section 3 of the plan.*
- *The wild horse population in these areas will be reduced to a size that ensures that wild horse heritage values are protected, and other environmental values of the park are maintained.*
- *Across the wild horse retention areas, a population target of 3,000 wild horses will be attained by 30 June 2027.*

Wild horse removal areas (21% of the park)

- *All wild horses will be removed from these areas. The population of wild horses in wild horse removal areas will be maintained at zero.*

Wild horse prevention areas (47% of the park)

- *These areas do not currently contain wild horses and will be maintained at a population of zero wild horses.*

All horses are to be removed from exclusion areas and a “sustainable” population of 3,000 horses is to be maintained across the retention areas which occupy 32% of the park. The Pilot and Byadbo Wildernesses were identified as southern wild horse retentions areas. The plan’s strategy is to reduce numbers and monitor the environment and determine what level of impact might be considered sustainable in the future. A see-how-we-go approach. The plan provides no guidance as to what is considered sustainable nor why the target of 3,000 horses was chosen.

On 27 October 2023, the NSW Government lifted the ban on aerial culling of horses in Kosciuszko National Park (Reardon and Petrovic 2023) and amended the 2021 Kosciusko Wild Horse Heritage

Management Plan (Environment 2023) to meet the requirements of section 5 of the *Kosciuszko Wild Horse Heritage Act 2018.*

Following a trial to test and confirm aerial culling protocols, an extensive aerial culling program, strictly controlled by laws and the Wild Horse Heritage Management Plan as amended in 2023, has been underway. While horse numbers have been reduced by the NPWS through aerial culling, thousands remain.

On 23 May 2024 the NSW Government reported that 8,718 feral horses were removed from Kosciuszko National Park since November 2021, by a range of means including shooting and re-homing, 6,179 of these were removed between October 2023 and 22 May 2024 (invasive Species Council 2024). Other large, introduced herbivores including deer and pigs were also observed during these aerial surveys and were culled in the subsequent aerial operations.

Since the 2019 aerial survey of the park 7,111 horses were culled using a mixture of live trapping and aerial culling (Figure 1). The southern part of the park was closed for aerial feral animal control operations in November and December 2023, and again in March 2024. Ground shooting has also occurred in this part of the park. At the time of writing the NSW Government had not yet released the results of recent aerial survey counts of horses across the park.

The NSW Dept of Climate Change Energy Environment and Water (DCCEEW) published on its website that 8,953 horses were removed from the park between 24 November 2021 and 31 December 2024 including the southern horse retention block which includes the Pilot Wilderness (Table 1). In 2023/24 over 1,800 deer, pigs, cats, foxes and rabbits were also removed (National Parks and Wildlife Service 2024).

Area	Rehoming	Knackery	Other deaths	Aerial shooting	Ground shooting	Shooting in yards	Tranquilisation followed by bolt gun in yards	Euthanised
Northern block	1,008	672	16	4,607	759	109	70	39
Snowy Plains block	0	0	0	5	122	0	0	0
Southern block	0	0	0	1,356	186	0	0	0
Cabramurra	0	0	0	1	0	0	0	0
Total – Method	**1,008**	**672**	**16**	**5,969**	**1,067**	**109**	**70**	**42**
Total – Removed								**8,953**

Table 1: Numbers of horses removed from the park from 24 November 2021 to 31 December 2024, The Pilot Wilderness area is included in the Southern block. (Source: Environment and Heritage 2024).

VEGETATION IMPACTS

The upper Thredbo River Big Boggy, Cascades Creek and Tin Mines areas that we investigated are on the watershed of the Great Dividing Range in the Pilot Wilderness area. The WHHMP designates the Big Boggy section as horse removal area and the rest of the Pilot Wilderness as a horse retention area. The area contains subalpine woodland, treeless drainage line frost hollows, wetlands and montane forests. In 2013 we reported that large numbers of horses were observed to be destroying wetland habitats along treeless drainage lines in subalpine native vegetation. This was best illustrated in 2013 at exclosure plots established at Cowombat Flat Alpine National Park in 1999. These four exclosures are 25 years old and are in an upper headwater stream of Australia's longest and most economically important river, the Murray, just a few kilometres from its source. The impacts were visually very clear in 2013, and the images below demonstrate that

the condition of the vegetation has continued to decline because of continued grazing by large numbers of horses and to a lesser extent by deer, and drought. We observed relatively little disturbance by pigs.

As reported in our 2020 observations report: *A study of impacts of herbivore grazing in nearby lower elevation white cypress pine – white box communities along the lower Snowy River Valley within the Pilot Wilderness was investigated by Jessica Ward-Jones and colleagues in 2018. In 2013 and 2017/2018 fenced exclosure and paired grazed plots, which had been constructed 1984 were surveyed to assess the severity of impacts on vegetation, soil and invertebrates using a range of techniques including Landscape Function Analysis. Dung counts conducted in 1987 and 2018 were used to assess the relative presence of herbivores. There was four times more dung recorded in 2018 than in 1987 (total dry weight). Horse and deer dung was absent in 1987 but dominated in 2018. Dung transect data collected in the grazed plots and adjacent grazed landscape showed that 84% of dung was from horses, 13% from deer, 2% from macropods and 1% from rabbits. The herbivore exclusion plots, fenced for 34 years, exhibited significantly higher soil and vegetation condition than the grazed plots, as well as invertebrate abundance. Vegetation structure and composition, and soil stability and function within the plots was improving, whereas soils outside the plots were bare and eroding in broad sheets across slopes and in gullies. Dense networks of tracks and tramping by horses were most evident with damage to steep creek banks caused by deer (Ward-Jones et al. 2019).*

In 2015 the most extensive study to assess the impacts of horses throughout public land in the Australian Alps was undertaken by Robertson et al. (2015). Their study demonstrated that feral horses are having a significant impact on the condition of drainage lines across this range. Almost all sites assessed within the broad horse distribution showed evidence of horse presence, and all the sites in poorest condition were occupied by horses. They found that, on average, about 28 metres of the streambed in each 50m site they measured had a moderate to high sediment load in horse present sites, compared to horse free sites where banks were stable due to the presence of undisturbed fringing vegetation. They concluded the loss of stability, modification of stream banks and vegetation structure had significant impacts on the conservation of fauna including a range of listed threatened and other species including Alpine Bog Skink Pseudemoia cryodroma, Alpine She-oak Skink Cyclodomorphus praealtus and Alpine Tree Frog Litoria verreauxii alpina. As a consequence, this has led to the listing of "Degradation and loss of habitats caused by feral horses (Equus caballus)" as a potentially threatening process under the Victorian Flora and Fauna Guarantee Act 1988. On 30 Nov 2018 the NSW Threatened Species Scientific Committee listed "habitat degradation and loss by Feral Horses (brumbies, wild horses)" as a key threatening process under the NSW Biodiversity Conservation Act, 2016.

Mastacomys fuscus mordicus (Broad-toothed Rat (mainland)) was listed nationally in the Endangered category of the threatened species list under the EPBC Act, from15 November 2023, and on 24 May 2024 the species was listed as endangered in the threatened species list under the NSW Biodiversity Conservation Act.

Consistent with our own observations in the Mt Pilot area, Robertson et al. (2015) concluded that the most critical impact of feral horses in the Alps is the damage they cause to Alpine Sphagnum Bogs and Associated Fens along treeless drainage lines. This is an endangered ecological community listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. We found that these habitats have continued to decline to an alarming degree with the continued presence of feral horses. This highly endangered community provides habitat critical for the preservation of endangered species and as well as importantly filtering large quantities of clean water which is released slowly into streams enhancing catchment value and preventing soil erosion.

PHOTOGRAPHIC OBSERVATIONS OF HORSE IMPACTS

The photographs on following pages were recorded in **A** March 2013, **B** March 2020, and **C** April 2024. They clearly illustrate the changes over time and extent of the ongoing damage to sub alpine Sphagnum Bogs and Associated Fens along treeless drainage lines of the upper Thredbo River Big Boggy, Cascade Creek, Ingeegoodbee River, Tin Mine Creek and Murray River headwater catchments, Kosciuszko National Park mostly from feral horses.

Figure 2. Location of photo point observations in the Mt Pilot area of Kosciuszko National Park and Alpine National Park in the Australian Alps 3-5 April 2024. (Source: 2025 Google Imagery: TerraMetrics).

Photo 1A: 23 March 2013. Murray headwaters drainage line vegetation severely impacted by grazing and trampling by horses surrounding a fenced herbivore proof exclosure plot that was constructed in 1999. The herbivore proof exclosure retains its protected sward of sedges and grasses, Cowombat Flat, Victorian Alpine National Park, near the NSW border (Source: Graeme L. Worboys).

Photo 1B: 3 March 2020. Bare soil trampled and compacted by horses at the same fenced exclosure plot above that was constructed in 1999 retaining a protected sward of sedges and grasses, Cowombat Flat, Victorian Alpine National Park adjacent to the Victorian/NSW border and Kosciuszko National Park. (Source: Ian Pulsford).

Photo 2A: 23 March 2013. Fenced herbivore exclosure plot constructed in 1999 with protected and grazed sedge (left) and grassy heavily grazed vegetation (right), Cowombat Flat, Victorian Alpine National Park, near the border with NSW and Kosciuszko National Park (Source: Graeme L. Worboys).

Photo 2B: **3 March 2020.** Exclosure plot fence with protected ungrazed sedges inside plot (left) and low grassy vegetation and exposed and mud that has been heavily and trampled and pugged by horses (right), Cowombat Flat, Victorian Alpine National Park, near the border with NSW and Kosciuszko National Park (Source: Ian Pulsford)

Photo 2C: 4 April 2024. Exclosure plot fence with protected (left) and unprotected sedge and grass (right), Cowombat Flat, Victorian Alpine National Park following a high rainfall summer. Recently culled horse carcasses were observed nearby. (Source: Ian Pulsford).

Photo 3A: 3 March 2013. Severe degradation of Murray River headwater stream by horses as it emerges from a dense protected sward of sedges and grass within a herbivore proof exclusion plot constructed at Cowombat Flat, Alpine National Park, Victoria in 1999. (Source: Ian Pulsford).

Photo 3B: 3 March 2020. The same Murray River headwaters stream site impacted by horses as it emerges from a dense protected sward of sedges and at Cowombat Flat in Alpine National Park. Note compaction, bank disturbance and erosion have increased, vegetation cover is shorter and less complex than inside the exclosures. Grazing impacts at these plots have been described by Prober and Thiele (2007) and Wild and Poll (2012). (Source: Ian Pulsford).

Photo 3C: 4 April 2024. The same Murray River headwaters stream site impacted by horses as it emerges from a dense protected sward of sedges and grasses within an exclusion plot constructed in 1999 at Cowombat Flat in Alpine National Park. Horse carcasses observed nearby provided evidence of control measures to reduce horse population. (Source: Ian Pulsford).

Photo 4A: 23 March 2013. Horse dust roll bath, Cowombat Flat, Victoria, 100 metres south and east of the NSW border. Note hard compacted ground and very short-cropped grasses due to grazing by horses. (Source: Graeme L. Worboys).

Photo 4B: 3 March 2020. The pugged and broken edges of the banks of the upper Murray River headwater stream form a muddy eroding pool trampled by horses near its headwaters. This is the same pool seen in the centre right of the above photo (4A). Cowombat Flat, Victoria 30 metres south and east of the Victoria/NSW border. (Source: Ian Pulsford).

Photo 5A: 3 March 2020. Destroyed subalpine sphagnum bog on treeless drainage line on Cascade Creek that has been grazed and trampled by horses, about 650 m north of Cascade Hut. (Source: Ian Pulsford)

Photo 5B: 3 April 2024. The same bog photographed from slightly different angle showing no signs of recovery. (Source: Ian Pulsford).

Photo 6A: 22 March 2013. Destruction of vegetation, stream bank collapse and soil pugging by horses grazing and crossing the headwaters of the Ingeegoodbee River near Tin Mines (Carters) Hut, Kosciuszko National Park. (Source: Graeme L. Worboys).

Photo 6B: 3 March 2020. Trampling and degradation of the same stream banks in photo 6A above by horses in the Ingeegoodbee River near Tin Mines (Carters) Hut, Kosciuszko National Park. (Source: Ian Pulsford).

Photo 6C: 4 April 2024. Horse trampling impacts to the stream banks in photos A and B above, Ingeegoodbee River near Tin Mines (Carters) Hut, Kosciuszko National Park. Note, some stabilization and recovery of stream bank vegetation. Recovery of vegetation stabilizing the stream bank has occurred since a 0.3 ha fenced plot (in background) was constructed by the NPWS in 2023 surrounding the site to exclude horses. This appears to demonstrate that recovery can commence once horses are removed. Source: Ian Pulsford)

Photo 7A: 23 March 2013. Stream bank collapse and widening of stream due to trampling and grazing by horses, headwaters of the Ingeegoodbee River near Tin Mines (Carters) Hut, Kosciuszko National Park. (Source: Graeme L. Worboys).

Photo 7B: 3 March 2020. Horse trampling and incision of stream banks causing bank collapse, headwaters of the Ingeegoodbee River near Tin Mines (Carters) Hut, Kosciuszko National Park (Source: Ian Pulsford).

Photo 7C: 4 April 2024. Same location as photos 7A and 7B in headwaters of the Ingeegoodbee River near Tin Mines (Carters) Hut, Kosciuszko National Park. Stabilization and early stages of recovery of stream bank vegetation has occurred since an exclosure fence (in background) was constructed in 2023 to exclude horse grazing and trampling. (Source: Ian Pulsford).

Photo 8: 23 March 2013. A subalpine riparian bog that has been trampled and transformed into a large mud pan by horses in the upper headwaters of the Ingeegoodbee River. We were unable to revisit this site in 2020 due to heavy rain. (Source: Ian Pulsford).

Photo 9A: 22 March 2013. Subalpine bog destroyed by grazing and tramping by horses between Cascades Hut and Tin Mines (Carters) Hut, Kosciuszko National Park, (Source: Graeme L. Worboys).

Photo 9B: 3 March 2020. The same wet heath and subalpine bog destroyed by grazing and tramping by horses between and between Cascades Hut and Tin Mines (Carters) Hut, Kosciuszko National Park, (Source: Ian Pulsford).

Photo 9C: 3 April 2024. Note considerable growth in forest since 2013 (see photo A above), however there is no improvement in the condition of the bog which continues to be trampled mainly by horses. Note: no recovery of the vegetation is apparent in this image even though culling of horses by NPWS occurred between 24 November 2021 to 31 December 2024. Clearly, sufficient horses remain in this area preventing any recovery. (Source: Ian Pulsford).

Photo 10A: 23 March 2013. Bare muddy soil and a grassy topped remnant soil pedicel (centre) in a bog that has been trampled and destroyed by horses near Tin Mines (Carters) Hut, Kosciuszko National Park. (Source: Ian Pulsford).

Photo 10B: 4 March 2020. Trampling and pugging impacts by horses to the same wetland bog near Tin Mines (Carters) Hut surrounded by compacted closely cropped grasses, Kosciuszko National Park, with remnant grassy covered soil pedestal, centre. (Source: Ian Pulsford).

Photo 10C: 4 **April 2024.** Trampling and pugging impacts by horses to the same wetland bog near Tin Mines (Carters) Hut surrounded by compacted closely cropped grasses, Kosciuszko National Park. Note some early signs of recovery of soil cover and the sedge covered soil pedestal, centre. (Source: Ian Pulsford). The site is within a 0.3 ha horse exclusion fenced area (in background) erected by NPWS in 2023.

Photo 11A*:* **3 March 2020.** Subalpine *Sphagnum* and *Carex* bog in a treeless drainage line destroyed by horses tramping, grazing and pugging underlying peat and soil on Cascade Creek flats near Cascade Firetrail. (Source: Ian Pulsford).

Photo 11B: 3 April 2024. *Sphagnum* and *Carex* bog destroyed by horses tramping and grazing exposing and pugging peat and soil, Cascade Creek flats near Cascade Fire trail. (Source: Ian Pulsford).

Photo 12: **3 April 2024.** Another similar dried out bog impacted by horses grazing and trampling in treeless subalpine tussock grassland on the upper Thredbo Big Boggy river flats. (Source: Ian Pulsford).

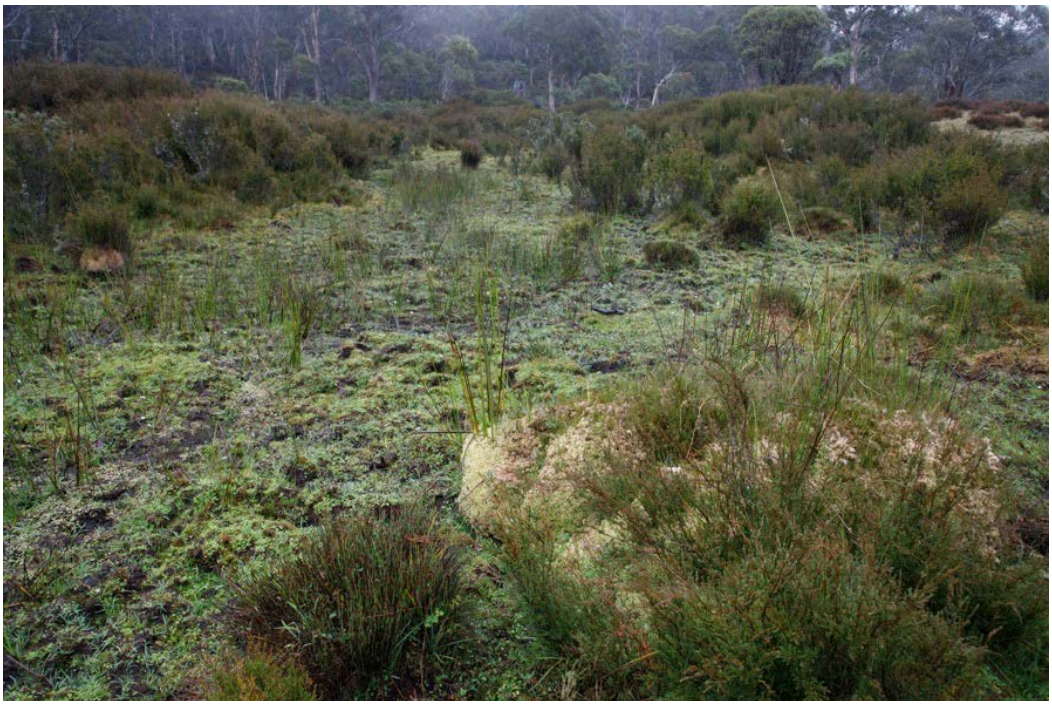

Photo 13A: 3 March 2020. Subalpine bog of Spreading Rope Rush *Empodisma minus* and creamy coloured Sphagnum Moss *Sphagnum cristatum* hummock and emergent shrub (foreground right) and surrounding shrubby habitat destroyed by horses tramping and grazing in a drainage line near Tin Mines (Carters Hut). (Source: Ian Pulsford).

Photo 13B: 4 April 2024. The same location the subalpine bog consisting of Spreading Rope Rush *Empodisma minus* and Sphagnum Moss *Sphagnum cristatum* hummock (foreground centre) and surrounding habitat destroyed by horses trampling and grazing in a drainage line near Tin Mines (Carters) Hut. Note further reduction in the sphagnum hummock caused by continued grazing by horses since March 2020 (photo 13A). (Source: Ian Pulsford).

Photo 14A: 4 March 2020. Hard compacted vegetation (left) compared to Bog Snow-grass *Poa costiniana* that was protected from grazing by horses by an exclosure fence constructed by the NPWS in Nov 2011 southwest of Tin Mines (Carters) Hut. Note the strip within the exclosure grazed by horses reaching into the plot. (Source: Ian Pulsford).

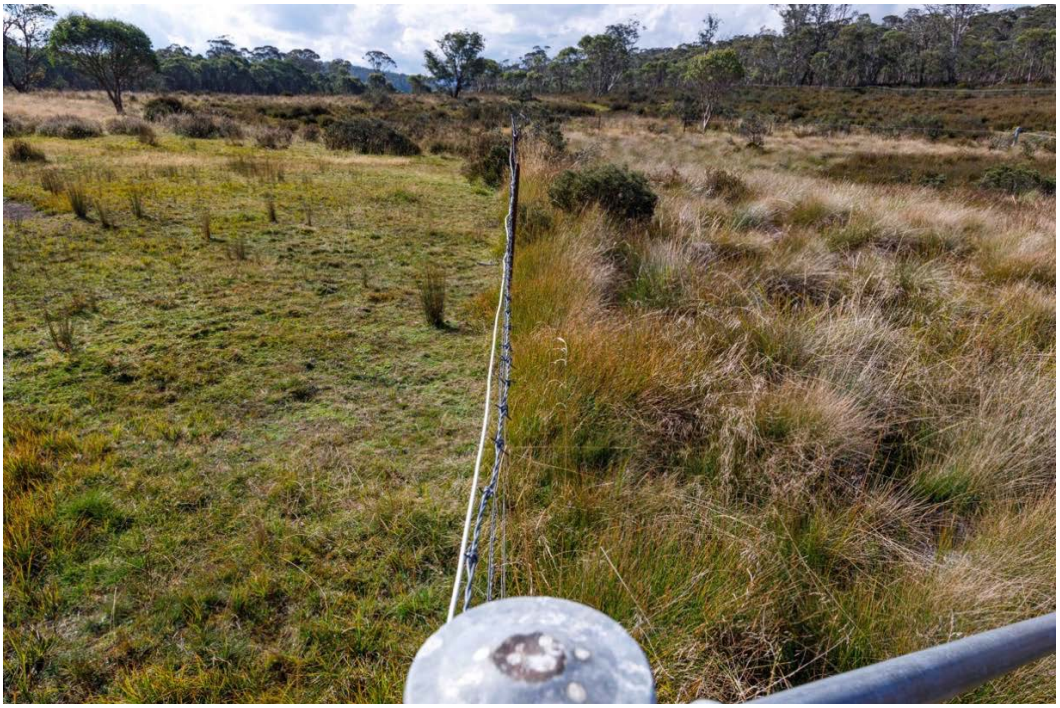

Photo 14B: 4 April 2024. The narrow strip of Cord-rush *Baloksion australe* and Snow Grass *Poa costiniana* next to the fence has regrown since horses were removed from the area surrounding this small plot fenced in 2011 because the NPWS constructed a 7 ha fenced area surrounding it in 2023. Also note that due to exclusion of horses there has been some improvement in the condition of ground cover vegetation outside the small plot within 12 months. (Source: Ian Pulsford).

Photo 15A: **4 March 2020.** A 1.8 m tall hummock of Spreading Rope-rush *Empodisma minus*, Mountain Cord-rush *Baloskion australe* and Sphagnum Moss (*Sphagnum cristatum*) on the other side of the same exclosure plot in 14A-B**.** It demonstrates that recovery from horse grazing is possible even after the almost complete loss of bog vegetation outside the plot. Destruction of bog (mire) vegetation has occurred along all subalpine creek lines in the area due to grazing and trampling mostly by horses and the more recently reported increase in deer populations. (Source: Ian Pulsford).

Photo 15B: **4 April 2024**. Note further substantial increase in size of the tall hummock compared with March 2020 (photo A above) due to ongoing recovery of vegetation in the plot because grazing by horses has been excluded since Nov 2011. This evidence suggests a substantial level of habitat recovery is possible if horses are permanently removed from these sensitive treeless drainage line wetland communities. (Source: Ian Pulsford).

Photo 16A: Dec 1986. Ingeegoodbee River Flats, south of Freebody's Hut in during a time of lower horse population numbers. (Source: Di Thompson).

Photo 16B: March 2013. Comparison of impacts by horses at the same site almost 27 years later, Ingeegoodbee River Flat wetlands south of Freebody's Hut. (Source: Graeme L. Worboys).

Photo 16C: 5 April 2024. The same site on showing some limited improvement in condition of wetland vegetation on the Ingeegoodbee River Flat south of Freebody's Hut. (Source: I Pulsford).

Photo 17: 5 April 2024. After limited aerial culling during the previous summer horses remain and continue grazing on Ingeegoodbee River Flats south of Cascades Hut. (Source: Ian Pulsford).

Photo 18: **5 April 2024** Banks of Ingeegoodbee River broken by horses trampling south of Tin Mines (Carters) Hut. (Source: I. Pulsford).

Photos 19 and 20: 5 April 2024. Habitat, nesting sites and tunnel-like runways of the endangered Broad-toothed Rat *Mastacomys fuscus mordicus* in dense sedges and grasses near the Ingeegoodbee River that are easily destroyed by trampling of horses and grazing of habitat. (Source: I. Pulsford).

CONCLUSIONS

The increase in numbers of feral horses in Kosciuszko National Park in recent years is well documented especially from 2003 until aerial culling was introduced after October 2023. This increase was due to a combination of factors including: (1) a high rate of natural population increases (2) lack of natural predators or diseases, and (3) inadequate horse control operations and cessation of horse control operations in Kosciuszko National Park for various periods for political reasons. While horse numbers have been reduced substantially since aerial culling was reintroduced, thousands remain.

Our photographic observations of subalpine habitats along treeless drainage lines in the Pilot Wilderness, which commenced in 2013, clearly illustrate the ongoing severe impact by horses on endangered sphagnum bogs and fens, other riparian vegetation and stream banks. Between 2013 and 2020 the condition of many of the photo observation sites further degraded (Pulsford et al. 2020).

We also observed that in 2020 the impact of drought on vegetation was less severe in the Pilot wilderness area than elsewhere in the park due to its relatively high elevation, ruggedness, cooler and moister conditions. These factors may have allowed more horses to survive here than in drier southern areas of the park such as the lower Snowy River, where many dead horses were observed during the 2019/2020 drought (pers. obs.).

In April 2024 we rephotographed the same sites as in 2013 and 2020, less than 12 months after aerial culling of horses by the NPWS had commenced in the Pilot Wilderness. This followed a succession of three La Niña above average rainfall years from 2021 to 2024. We observed that at two sites (see photos 6C and 10C, and 14B) some early signs of stabilization and recovery of vegetation were apparent, however, most sites were just as degraded or in a worse condition than they were 2020. This is attributed to the exclusion of horses from an area of (1) 0.3 ha within a fenced area constructed in 2023 near Cascades hut (Photos 6C and 10C), and (2) a 7 ha fenced area constructed in 2023 that surrounds a small exclosure plot (see photo 14B) near Tin Mines (Carters) hut. The small fenced exclosure plot was constructed by the NPWS in 2011. Further photo monitoring at these sites is required to confirm this trend.

The continuing degradation of most sites demonstrates that even after some aerial culling since October 2023, horses continue to graze and trample these fragile treeless riparian wetlands and bogs. Dyring (1990) demonstrated that only a few horses in a week can create, with 20-50 passes, a significant impact track in these fragile subalpine riparian communities. We note that, given the observed behaviour of feral horses in Kosciusko National Park, it is likely that even if horse numbers are reduced to very low levels, the few remaining horses will continue to gravitate to and damage their preferred sites in the riparian habitats along creeks in treeless drainage lines that provide water and favoured food plants.

Complete recovery of catchment integrity of these nationally important threatened ecosystems is not possible until culling operations eliminate horses and any other feral pest species. Retaining horses in these areas is simply not compatible with the recovery of these important sub alpine communities which are also habitat for many wetlands dependent species. These include the endangered the Broad-toothed Rat *Mastacomys fuscus,* Alpine Bog Skink *Pseudemoia cryodroma,* Alpine She-oak Skink *Cyclodomorphus praealtus and* Alpine Tree Frog *Litoria verreauxii alpina.*

The condition and ecological integrity of the headwater catchments of the Murray River, Australia's longest and most economically important river that provides water vital for irrigation and electricity, will continue to degrade without further significant reduction or complete removal of horses. Climate change will further intensify these threats.

RECOMENDATIONS

We recommend that photo point observations should be continued. These observations should be supported by carefully designed quantitative longitudinal monitoring studies of feral horse and deer populations and the response of vegetation to grazing and trampling pressure in treeless drainage lines in the Pilot Wilderness.

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End Note

The authors have the highest regard for horses and appreciate and support their place in areas of Australia such as farms, towns and sporting tracks. We understand, appreciate and share the delight and companionship horses bring to many people. This report is not an attack on horses per se. Rather, it is about raising awareness of too many feral horses in, and the unacceptable impacts in one of Australia's most important conservation areas, the Australian Alps national parks.

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