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NSW Snowy Mountains region

- 4.1 On 17 February 2012, the Committee visited the New South Wales (NSW) Snowy Mountains region. The Snowy Mountains are part of the Australian Alps, which extend through NSW, Victoria, and the Australian Capital Territory (ACT), and include the highest peaks on the Australian mainland.
- 4.2 On the same day, the Committee took the opportunity to meet with representatives of the Great Eastern Ranges Initiative and its local partner organisation, Kosciuszko to Coast. The Committee also held a public hearing in Canberra on 2 March 2012 which largely focussed on issues relating to alpine biodiversity and landscape scale connectivity initiatives.
- 4.3 During its inspection of the NSW Snowy Mountains, the Committee was interested to see firsthand some of the unique biodiversity of Australia's alpine regions, which many submissions to the inquiry have noted is particularly vulnerable to climate change. Although there are high levels of uncertainty in climate models, the NSW Snowy Mountains are generally predicted to experience hotter and drier conditions under climate change.¹ Between 1950 to 2007, temperatures in mainland areas above 1500 metres increased by 0.74 °C – equivalent to a 100 metre change in elevation in the Snowy Mountains – and there has been a 30 per cent decrease in snow amounts.²
- 4.4 Under the climate change projections, the area of ground with snow cover for more than 60 days is predicted to reduce by between 38 and 96 per cent by 2050, potentially retreating to just a small area around Mount Kosciuszko.³ The winter snowpack has been observed to be thawing an

1 NSW Office of Environment and Heritage, NPWS (2006) *Kosciuszko National Park Plan of Management*, p. 38.

2 Green, K., 'Impacts of Climate Change on the Australian Alpine Zone', briefing paper.

3 NSW Office of Environment and Heritage, NPWS (2006) *Kosciuszko National Park Plan of Management*, p. 39.

average of 16 days earlier than when records began in 1954, and there have been no snow patches lasting from one winter to another since 1998.⁴ Ice cover on alpine lakes has been observed to be breaking up, and there have been significant changes to the timing of key ecological events such as the flowering of vegetation, the migration of birds, and the emergence of animals in spring.

Committee activities

- 4.5 The Committee's visit to the NSW Snowy Mountains region included inspections and briefings at Kosciuszko National Park, with a focus on threats to alpine ecosystems due to climate change. The Committee also received briefings from the Great Eastern Ranges Initiative and Kosciuszko to Coast groups near Michelago.

Charlotte Pass, Kosciuszko National Park

- 4.6 The Committee visited Charlotte Pass, which lies approximately 1840 metres above sea level in the alpine zone of Kosciuszko National Park. During the journey from Jindabyne, the Committee received briefings and commentary from semi-retired alpine ecologist, Mr Roger Good, and officers of the NSW Office of Environment and Heritage National Parks and Wildlife Service (NPWS). At Charlotte Pass, the Committee members walked to a lookout overlooking the Snowy River valley and the Snowy Mountains' Main Range. The Committee received briefings from the following NPWS officers:
- Dr Ken Green, Principal Research Scientist;
 - Pam O'Brien, Area Manager;
 - Gary Saunders, Manager, Planning and Performance Unit; and
 - Mel Schroder, Environmental Management Officer.
- 4.7 The following documents were provided to the Committee during the visit:
- *Caring for Our Australian Alps Catchments*, Australian Alps Liaison Committee, 2011.
 - *Caring for our Australian Alps Catchments: Summary Report for Policy Makers*, Department of Climate Change and Energy Efficiency, 2011.
 - *Snow: A Natural History; An Uncertain Future*, Australian Alps Liaison Committee, 1998.
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4 Green, K., 'Impacts of Climate Change on the Australian Alpine Zone', briefing paper.

- *Impacts of Climate Change on the Australian Alpine Zone*, briefing paper, K. Green.
 - *Factsheet: Feral Horse Management*, Australian Alps National Parks, 2010.
 - *Kosciuszko National Park*, briefing paper, NPWS.
 - *Kosciuszko National Park Plan of Management*, Summary of the Plan of Management, pp. xvi–xviii, and Section 6.2—Climate, pp. 37–42, NPWS 2006.
- 4.8 The Kosciuszko National Park was declared in 1944 and covers over 670 000 hectares.⁵ It contains Australia's highest mountain range, including Mount Kosciuszko, unique glacial landscapes, and a range of unique flora and fauna. It also contains some of the headwaters of the Murray–Darling river system and is an important winter and summer tourist destination.⁶
- 4.9 The Kosciuszko National Park Plan of Management identifies climate change as 'one of the greatest potential threats to the values of the park'.⁷

5 NSW Office of Environment and Heritage, NPWS, 'Guide to Kosciuszko National Park, 2011', <http://www.environment.nsw.gov.au/resources/parks/southern/Kosciuszko_National_Park/1KosiGuide2012Intro.pdf> viewed 24 April 2012; NSW Office of Environment and Heritage, NPWS, 'Kosciuszko National Park', <<http://www.environment.nsw.gov.au/nationalparks/parkhome.aspx?id=n0018>> viewed 24 April 2012.

6 NSW Office of Environment and Heritage, NPWS, 'Kosciuszko National Park', briefing paper.

7 NSW Office of Environment and Heritage, NPWS (2006) *Kosciuszko National Park Plan of Management*, p. 38.

Figure 4.1 View from Charlotte Pass lookout: The headwaters of the Snowy River with Australia's two highest mountains, Mount Kosciuszko and Mount Townsend, in the background



Photograph courtesy of committee secretariat

Meeting with Great Eastern Ranges Initiative and Kosciuszko to Coast

- 4.10 The Great Eastern Ranges (GER) Initiative is a landscape connectivity project seeking to reduce ecosystem fragmentation along the length of Australia's eastern ranges. Kosciuszko to Coast is a regional partner organisation that is working to implement the GER Initiative's broad vision at a more local level within the Snowy Mountains region.
- 4.11 The Committee received briefings from the following representatives of the GER Initiative and Kosciuszko to Coast at a property overlooking the Murrumbidgee River near the small town of Michelago:
- GER Initiative – Mr Ian Pulsford, founding manager (2007–10), and currently a private Environment, Protected Area and Linking Landscapes Specialist; and
 - Kosciuszko to Coast – Mr Geoff Robertson, President; and Ms Lauren van Dyke, Facilitator.

4.12 The Committee was provided with the following documents during the visit:

- *Connectivity Conservation and the Great Eastern Ranges Corridor*, NSW Department of Environment, Climate Change and Water, 2010.
- *Australia State of the Environment 2011 – Connectivity Conservation in Australian Landscapes*, Department of Sustainability, Environment, Water, Population and Communities, 2011.
- *Australia's Great Eastern Ranges: Our Vision to Protect Them Forever*, DVD, NSW Department of Environment and Climate Change, and International Union for the Conservation of Nature, World Commission on Protected Areas.
- *Australia's Great Eastern Ranges*, brochure, GER Initiative.
- GER Initiative, factsheet series:
 - ⇒ *What is the Great Eastern Ranges Initiative?*
 - ⇒ *What is Connectivity Conservation?*
 - ⇒ *A Project Built On Partnerships.*
 - ⇒ *Fast Facts: Why the Great Eastern Ranges Are Important.*
 - ⇒ *Landholders: Questions and Answers.*
 - ⇒ *A View from the Land – Feedback from Landholders.*
- *Climate Change: How will it Affect the Natural Environment?*, brochure, NSW Department of Environment, Climate Change and Water, 2009.

Issues explored in the NSW Snowy Mountains

Economic importance of water from the Mountains

4.13 During the visit to Charlotte Pass, the Committee's attention was drawn to the recent *Caring for Our Australian Alps Catchments* report, which examined the value and current health of catchments in the Australian Alps.⁸ In economic terms, the value of the water flowing from the Alps has been estimated at around \$10 billion annually.⁹ Waters from the Alps catchments contribute to the Murray–Darling Basin's agricultural production (worth about \$15 billion annually), which represents about

8 Worboys, G. L., Good, R. B. and Spate, A. (2011) *Caring for Our Australian Alps Catchments*, Australian Alps Liaison Committee, Canberra.

9 Dr Graeme Worboys, Committee Hansard, Canberra, 2 March 2012, p. 2.

45 per cent of Australia's irrigated production.¹⁰ The report found that Alps catchments provide about 29 per cent of the Murray–Darling Basin's average yearly inflow yield.¹¹ During drought years, the contribution of alpine water is even greater due to the relatively guaranteed source of supply, accounting for around 60 per cent of Murrumbidgee River flows and 33 per cent of Murray River flows; these flows are essential for primary production.¹² The downstream social and environmental benefits of this water are also significant, albeit difficult to quantify.¹³

- 4.14 During its visit to Charlotte Pass, the Committee heard that alpine trees are net producers, rather than consumers, of water, for reasons including their ability to capture frost. The loss of tree cover can therefore have a measurable impact on water flows. It is estimated that since the introduction of alpine grazing, there are 17 000 fewer hectares of tree coverage, which equates to a net loss of \$12 million of water per annum.
- 4.15 According to the *Caring for Our Australian Alps Catchments* report, climate change is predicted to be the 'single greatest threat to the natural values of the Australian Alps catchments as we know them today'.¹⁴ Dr Graeme Worboys, one of the report's authors, illustrated this point at the Committee's public hearing in Canberra:

... the natural condition of the Alps actually leads to the water yield, the water quality and the water flow regimes of the catchments. So you do not allow that natural condition to be disturbed because, in effect, you are playing around with the generation of the water, which is worth so much money and affects so many people. That is a really key point ...

... a smart society does not let Australia's critical water catchments, worth something like \$10 billion annually, be trashed in a climate change world.¹⁵

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- 10 Worboys, G. L. and Good, R. B. (2011) *Caring for Our Australian Alps Catchments: Summary Report For Policy Makers*, Department of Climate Change and Energy Efficiency, Canberra, p. 53..
- 11 Worboys, G. L. and Good, R. B. (2011) *Caring for Our Australian Alps Catchments: Summary Report For Policy Makers*, Department of Climate Change and Energy Efficiency, Canberra, p. 53.
- 12 Worboys, G. L., Good, R. B. and Spate, A. (2011) *Caring for Our Australian Alps Catchments*, Australian Alps Liaison Committee, Canberra, p. 122.
- 13 Worboys, G. L., Good, R. B. and Spate, A. (2011) *Caring for Our Australian Alps Catchments*, Australian Alps Liaison Committee, Canberra, p. 122.
- 14 Worboys, G. L., Good, R. B. and Spate, A. (2011) *Caring for Our Australian Alps Catchments*, Australian Alps Liaison Committee, Canberra, p. 3.
- 15 Dr Graeme Worboys, *Committee Hansard*, Canberra, 2 March 2012, p. 2.

Committee comment

4.16 The Committee acknowledges that, in addition to their intrinsic natural values, the Australian Alps and its catchments are of immense economic value to the nation, and that it is vital to maintain biodiversity for both water production and the maintenance of its quality downstream. The Committee also notes the critical importance of this water to supporting biodiversity in ecosystems downstream, along the entire length of the Murray and Murrumbidgee Rivers.

Feral animals and invasive weeds

- 4.17 During the visit to Charlotte Pass, the Committee heard that introduced animal and plant species are threatening the ecosystems of the Kosciuszko National Park. For example, wild horse numbers are causing widespread damage to ecosystems in the area. Horse numbers were estimated at over 7000 in 2009, and are predicted to increase to nearly 15 000 in 2012.¹⁶ Assisted by a warming climate, it is predicted that feral horses will be in the alpine (that is, above the tree line) parts of the National Park within around five years, and that immense damage could be caused by their presence.
- 4.18 The Committee heard that the Park does not currently have an effective method of controlling horse numbers. Managers currently rely on trapping and removal of horses, some of which are rehabilitated but with most transported to abattoirs. It was suggested that although aerial shooting would be a more effective, humane and economical way to control horse numbers, previous community opposition has prevented its adoption. At the Canberra public hearing, the Committee heard that, given the community's resistance to those methods, 'the biggest muster in the Southern Hemisphere' needs to be undertaken in order to deal with the horse problem.¹⁷
- 4.19 The Committee was advised of the increasing threat posed by deer, particularly in the Victorian parts of the Australian Alps, and the similar challenges faced by park managers in controlling deer numbers. Options for shooting or poisoning are limited in their effectiveness, and are not widely accepted by the community.
- 4.20 Rabbits were identified as being less of a problem for ecosystems in the alpine areas of the National Park, however, they have been observed to be moving to higher altitudes in recent years due to the warming climate.

16 Australian Alps National Parks (2010) 'Feral Horse Management', factsheet.

17 Dr Graeme Worboys, *Committee Hansard*, Canberra, 2 March 2012, p. 7.

There are concerns that rabbits could become a more serious threat to the region's biodiversity in years to come.

- 4.21 The Committee is aware that while many species will be threatened by climate change, others will thrive as they react to more favourable conditions. The species most likely to thrive are species which have evolved outside the alpine area and are therefore more capable of adapting to a range of conditions, at the expense of locally evolved species. This includes many invasive weed species.
- 4.22 The Committee heard that there is a lack of resources for combating environmental weeds in Kosciuszko National Park. Weeds such as blackberry and willows require constant management by Park authorities, whilst other more recent threats from weeds such as hawkweed and oxeye daisy are placing new strain on existing management resources.¹⁸

Committee comment

- 4.23 The Committee notes that there is an apparent lack of resources for combating the threats to biodiversity posed by feral animals and environmental weeds. With the additional impact of climate change, these threats are expected to worsen, and it is evident that addressing the shortfall of resources for removing invasive species will need to become a priority in the years to come.
- 4.24 The Committee also notes the prominent role that community attitudes play in the development of sensible management decisions, particularly in response to reducing feral animal numbers, such as horses and deer. Successful community engagement is required in order to address any future changes in policy with regard to these matters.

Other possible effects of climate change in alpine environments

- 4.25 During its visit to Charlotte Pass, the Committee heard about a wide range of other impacts on biodiversity that may result from climate change in the alpine regions, including:
- Potential loss of species, particularly invertebrates, that are adapted to living only in high altitude ecological niche conditions. These species would be vulnerable to even relatively small increases in the average temperature.
 - Potential drying out of alpine bog and fen ecological communities, threatening endemic species and reducing their ability to store and filter large volumes of water.
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18 NSW Office of Environment and Heritage, NPWS, 'Kosciuszko National Park', briefing paper.

- Earlier thawing of the ice cover on Kosciuszko National Park's glacial lakes, threatening endemic organisms that have adapted to a layer of ice lasting into early summer. For example, while ice break-up on Blue Lake has been recorded during most of the twentieth century as occurring in November or December, it now generally occurs in October, and in 2006 occurred in September. This has affected the chemical makeup of the lake and exposed species to higher levels of ultraviolet light in the spring.¹⁹
- More frequent and intense bushfires. The Committee heard that some species, such as alpine ash, will be less able to recover in the long term if they are burned more frequently.
- Changes to the level of the alpine tree line due to increasing temperatures. The Committee was informed that unlike other mountainous parts of the world, tree lines in Kosciuszko National Park are not moving up in a linear manner. The Committee was shown sites where small numbers of trees had rapidly established higher along a slope before 'backfilling' down the slope with larger numbers of trees.
- Reduced snow cover, impacting certain species that depend on it. Earlier melting of snow reduces the amount of cold water flowing over plant species, which may affect species that have evolved to require this cold water flow.
- Changes to the phenology of alpine species due to seasonal shifts and increased levels of ultraviolet light due to fewer cloudy days. Flowering times, hatching times, migration times and times of emergence from 'hibernation' may all be affected, causing mismatches in normal species to species interactions. For example, the Committee heard that the endangered mountain pygmy-possum (*Burramys parvus*) feeds mainly on the Bogong moth (*Agrotis infusa*) in spring and summer. Earlier thawing of snow cover triggers pygmy-possums to emerge from their winter homes under alpine boulders earlier in spring, while the moths emerge later, in response to different cues from the environment. This leaves the pygmy-possums vulnerable to starvation and increased predation as they are required to look further afield for alternative sources of food.

4.26 Overall, the Committee heard that while climate change will harm some species, others will benefit, or be relatively unaffected. However, the biodiversity of the Alps will be disrupted by changes to the natural distribution of ecosystems and fragmentation of habitats, which will threaten the ecological niches upon which many endemic species depend.

19 Green, K., 'Impacts of Climate Change on the Australian Alpine Zone', briefing paper.

The species that are likely to benefit or be more resilient to climate change are those that have evolved outside the Alps, while species that are uniquely adapted to alpine environments are more likely to be threatened by climate change.

Committee comment

- 4.27 The Committee has gained some appreciation of the complexity of interactions taking place in the alpine environment in response to the changing climate. While precise outcomes for individual species and ecosystems are difficult to predict, the mix of biodiversity in the Alps will undoubtedly change, and some species will be threatened with extinction. Ongoing research and monitoring is needed in order to better understand these interactions.

Active management across jurisdictions

- 4.28 Kosciuszko National Park has undergone rehabilitation work since its declaration in 1944. Netting and mulching have encouraged natural ecosystems to develop, particularly in response to damage from alpine grazing, phased out after the Park was established. The Committee was informed that human interventions in the environment can have complex and unpredictable results, particularly under a changing climate. Sound research and ongoing evaluation of management efforts is required, which may require more resources to be allocated.
- 4.29 At the public hearing in Canberra, Dr Worboys called for more active management. He advised the Committee about the need to establish a 'quantitative understanding' of the resources being managed in order to 'measure and understand change', whether positive or negative, and to be able to adapt to deal with the changes.²⁰
- 4.30 Another management issue identified to the Committee during the visit to Charlotte Pass was the need for effective management of issues across political borders. The Committee heard that the Australian Alps Liaison Committee is part of a four government partnership (Commonwealth, NSW, Victoria and the ACT) that provides a forum for managers from each jurisdiction to exchange information and establish best practice management techniques. Responsibility for day to day management of the National Parks remains with the relevant agency.
- 4.31 At its public hearing in Canberra, the Committee heard that there is scope for strengthening cooperative arrangements across the alpine areas. Mr Roger Good told the Committee that while the Australian Alps Liaison

20 Dr Graeme Worboys, *Committee Hansard*, Canberra, 2 March 2012, p. 2.

Committee (in which he is a long term participant) has 'engendered research over the years on specific cross-border issues', it is not set up to facilitate program delivery across the Alps. Currently based on a memorandum of understanding, a greater capacity to deliver and coordinate a whole-of-alps program may arise from a formal agreement between all parties.²¹

- 4.32 Also at the public hearing, Professor Ary Hoffman from the University of Melbourne told the Committee that the Liaison Committee was constrained by a severe lack of funding. He indicated that this funding needs to be substantially boosted to allow for the collection of data for research purposes to aid in the management of the alpine region as a whole.²²

Committee comment

- 4.33 The Committee agrees with inquiry participants that active, effective management will be required to respond to threats posed to alpine biodiversity by past, present and future challenges; threats which will be exacerbated by climate change. Underpinning this, greater resources and more research will be needed, and effective systems will be necessary to monitor ecosystem responses to management techniques.
- 4.34 While the Committee recognises that the Australian Alps Liaison Committee provides a good mechanism for information sharing, there is scope to strengthen the current cooperative arrangements to allow joint management. This would enable cross-border programs to be funded to tackle threats to biodiversity that extend across all jurisdictions, such as weeds and feral animals. There may be a role for the Commonwealth in facilitating or delivering such programs.

Great Eastern Ranges and Kosciuszko to Coast landscape connectivity projects

- 4.35 The Great Eastern Ranges (GER) Initiative, established in 2007, seeks to improve landscape connectivity between protected areas along the Great Dividing Range and the Great Escarpment, from the Victorian Alps to the Atherton Tablelands in Far North Queensland. The ranges extend over 2800 kilometres of eastern Australia, incorporating three World Heritage Areas, and house such iconic threatened species as the Wollemi pine and the brush-tailed rock wallaby. The Committee heard that around half the length of the ranges is public land, and the other half private.
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21 Mr Roger Good, *Committee Hansard*, Canberra, 2 March 2012, p. 7.

22 Prof. Ary Hoffman, ARC Laureate Fellow, Departments of Genetics and Zoology, University of Melbourne, *Committee Hansard*, Canberra, 2 March 2012, p. 22.

- 4.36 The initial focus of the GER Initiative is in NSW, where state government funding has been secured. Mr Rob Dunn, the current Chief Executive Officer of the Initiative, told the Committee that discussions about the possible take-up of the GER Initiative are currently underway with the Victorian and Queensland Governments.²³
- 4.37 In NSW, the GER Initiative is being delivered through five regional partnership organisations and in collaboration with Greening Australia, Bush Heritage Australia, OzGREEN, the Nature Conservation Trust of NSW, the NSW National Parks Association, and the NSW Department of Environment and Heritage.²⁴ The Committee heard that the GER Initiative funds the employment of facilitators for its partner organisations to bring together local individuals and organisations to work towards the Initiative's goals.
- 4.38 Kosciuszko to Coast is the GER Initiative's regional partner in southeast NSW. The Committee heard at its meeting that Kosciuszko to Coast predates the GER Initiative, and originally began as a group of individuals working around the Scottsdale Reserve, purchased by Bush Heritage Australia for conservation purposes in 2006. Kosciuszko to Coast has partnerships with 11 other organisations active in conservation in the region, working under the broader vision of the GER Initiative. Kosciuszko to Coast helps facilitate conservation projects that individual organisations may not be able to undertake, and assists local landowners with revegetation on their property. A large part of the organisation's work involves motivating and educating landowners about the roles their properties can play in private biodiversity conservation. The Committee heard that there is generally a small amount of money invested on each individual property.

Committee comment

- 4.39 As with the Gondwana Link project in Western Australia, the Committee sees great potential for the GER Initiative to play a positive role in biodiversity protection in the mountainous areas of eastern Australia. Although earlier in its implementation than Gondwana Link, the Committee saw that the GER Initiative is already making solid progress in southeast NSW through its regional partner, Kosciuszko to Coast. A particular strength of the GER model is that it enables the numerous existing biodiversity conservation organisations in local areas to work together towards a single goal. The Committee will continue to observe

23 Mr Rob Dunn, *Committee Hansard*, Canberra, 2 March 2012, pp. 13–14.

24 Great Eastern Ranges Initiative, 'What is the Great Eastern Ranges Initiative?', factsheet.

the GER Initiative as it develops, and particularly whether the Initiative is adopted in the other eastern states.

Concluding remarks

- 4.40 The NSW Snowy Mountains, as with alpine areas in other states, are recognised as being particularly vulnerable to climate change. The region is predicted to become warmer and drier under climate change scenarios, and this trend has already been observed. Snow cover, for example, has reduced by 30 per cent since the 1950s. The Committee recognises that, over time, this will not only affect winter tourism in the area, but it will also lead to significant impacts on alpine biodiversity and on the quantity and quality of water flows into the Murray–Darling basin.
- 4.41 As outlined above, in the context of a changing climate, there are a range of complex challenges that will need to be addressed by those responsible for managing the Alps. These challenges include dealing with increasing numbers of weeds and feral animals, more frequent and intense bushfires, and the loss of niche habitats for unique alpine species. Responding to these challenges will require concerted and adaptive management efforts, underpinned by robust scientific research and regular monitoring.
- 4.42 Beyond protected areas such as Kosciuszko National Park, the GER Initiative and its partner organisations are providing leadership in building the resilience of the landscape to be able to cope with changing climate conditions.
- 4.43 The Committee sincerely thanks all the individuals who made their visit to the Snowy Mountains region possible. Particular thanks go to Mr Roger Good for sharing his broad expertise in alpine ecology with the Committee during its travels; Mr Dave Darlington for making NPWS staff available at Charlotte Pass to talk with the Committee; and Tony and Gill Robinson and Ms Lauren van Dyke for facilitating the Committee’s meeting with the GER Initiative and Kosciuszko to Coast.

