The Australian Alps

The very highest of mainland Australia’s magnificent mountains are protected by eleven national parks and nature reserves. These iconic, winter-snow covered Australian Alps national parks include the headwater catchments of three of Australia’s famous rivers, the Murray, Murrumbidgee and Snowy Rivers (Figures 1 and 2). The fresh waters flowing from the Alps to the Murray-Darling Basin and to the coast generate economic benefits derived from agriculture, potable water consumption, hydro-electric power generation and river based adventure tourism. The downstream benefits associated with water from the Australian Alps have previously been indicatively estimated to be worth about $9.6 billion annually, highlighting that the Australian Alps are of national economic significance (Worboys et al., 2011).

These mountain protected areas are also nationally significant for their special natural values and their rich cultural heritage. Like other famous Australian protected areas such as the Great Barrier Reef, Uluru–Kata Tjuta and Kakadu, they are a National Heritage Listed Property. These iconic values are of intergenerational significance and part of the inheritance of future generations of Australians. There is nothing else like the Australian Alps nationally and globally. Its distinctive Australian alpine and subalpine animals include endangered species such as the Broad-toothed Rat (Mastacomys fuscus) and the Northern (Pseudophryne pengilleyi) and Southern Corroboree Frogs (Pseudophryne corroboree). A total of 293 vertebrate species are recorded from the Alps.

The Alps are also famous for their mountain scenery and summer wildflower displays across alpine landscapes. The diverse plant life of the region includes 850 vascular plant species (Worboys et al., 2011). Many of these flora and fauna species survived the last glaciation of 10,000 years ago and some are found nowhere else on Earth. The Alps have a rich living cultural heritage that dates back 22,000 years and they have been an iconic visitor destination for Australians and others for nearly 200 years.

Protected area management

The Alps protected areas span 1.64 million hectares and include the Namadgi National Park (Australian Capital Territory); Kosciuszko National Park (New South Wales) and the Alpine National Park (Victoria) (Figure 1). They are managed by State and Territory protected area organisations and the entire headwater river catchments are co-operatively managed for conservation under the guidance of the Australian Alps National Parks Memorandum of Understanding and the Australian Alps Liaison Committee. Conservation and protection of the catchments and their ecosystem services is one of the principal objectives for the reserves.

Water, precious water

Water provided by the Alps represents 29% of the annual average inflow of the Murray-Darling Basin and consequently contributes to generating $15 billion worth of Australia’s agricultural produce in the Murray-Darling Basin annually (MDBA, 2010). The Murray-Darling Basin produces 45% of Australia’s irrigated production ($5.5 billion); 56% of its grape crop; 42% of fruit and nuts and 32% of its total dairy production. Some 2.1 million Australians live there and 40% of Australia’s farms are found in the Basin (MDBA, 2010). Water from the Alps is important for water supplies of many towns along the Murray River including the residents of the City of Adelaide. At the worst of times for farmers and water users, such as during extreme droughts in eastern Australia, the reliable inland flowing water from the Alps becomes, by both volume and quality, even more important. Further research is required to quantify and value the attribution of specific watershed services from the Alps such as drinking water, hydroelectricity and water filtration.
Healthy, natural catchments

In addition to the economic benefits, the Alps catchments and their waters provide many environmental benefits. They help maintain the natural ecosystems of the high mountain catchments; provide sustainable environmental flows of high quality water for downstream rivers and they help to dilute the effects of salt and silt laden waters sourced from the greater Murray-Darling Basin catchments. The integrity of this high quality Alps water however is vulnerable. It is highly reliant on the high mountain catchments found in the Australian Alps national parks being in good natural condition. Degradation of these catchments may seriously impact water quality water yield and natural water flow regimes.

Climate change: A current and future threat

The current and predicted effects of climate change are of concern given their potential to adversely impact the Alps catchments. Modelling has identified that the Murray-Darling Basin, including the Alps, is “likely to be 10% drier than past experience” based on mean records, since records commenced and median 2030 projections (MDBA, 2010). The CSIRO estimates of future changes in runoff in Victoria’s catchments indicate that by 2030, catchments located in the north-east and south-east may experience up to 30% reductions in runoff (State Government of Victoria, 2008).

Higher temperatures are also likely to reduce the length of the snow season in the Australian Alps with a higher proportion of precipitation falling as rain rather than snow and earlier melting of snow on the ground.

The projected climate change impacts for the Alps for the year 2050 includes: increases in mean temperatures of 0.6 to 2.9 degrees C; less overall precipitation (and up to an estimated 24% reduction from 2005 levels); lower humidity, less snow cover, changed river flow regimes with the absence of the annual spring snow-thaw run-off; more frequent and hotter fires; more droughts; more severe storms and higher total ultraviolet radiation due to less cloud; and more sunlight in the mountains (Worboys et al., 2011).

The mountains need to be resilient to respond to such climate change effects in order to protect iconic values as well as ecosystem services and this needs them to be in a healthy natural condition. Changes in climate and resulting water and fire regimes across the Alps are likely to result in declines in catchment stability and reduce the level of cost effective ecosystem services and benefits provided or alternatively increase the costs to the community of providing these services.
Condition of the Australian Alps catchments

In 1957, the Australian Academy of Science completed the first ever Report on the Condition of the High Mountain Catchments of New South Wales and Victoria (AAS, 1957). The Report’s findings identified serious soil erosion in Australia’s high mountain catchments and its findings contributed significantly to the removal of stock from the highest parts of Kosciuszko National Park, despite vehement opposition from some graziers at that time.

In 2010, a second assessment of the natural condition of the Australian Alps catchments was completed (Worboys et al., 2011). At this time, protected areas had been established for 66 years at Kosciuszko National Park (oldest) and for 30 years for what later became the Victorian Alpine National Park with stock grazing having been removed only 5 years previously in parts of the Alpine National Park.

A total of 235 sub-catchments were qualitatively assessed based on available expert and park manager knowledge, using three categories of condition (good, moderate or poor) applied to each sub-catchment (Figure 3). The trend in condition was also determined using three criteria: declining, no-trend-change or improving (Figure 4). Alarmingly, the assessment found 60% of the 235 sub-catchments were in a poor or moderate natural condition. Furthermore, the assessment found that only one-third were in a good and stable or improving condition.

Restoration work

The Australian Alps protected area agencies have undertaken considerable conservation management and restoration work for up to 66 years in places where stock grazing impacts ceased, but it will take many decades of active management to restore areas disturbed from this damaging practice. The cold climate of the high country means restoration of disturbed catchments is both seasonal, due to snow cover, and very slow, while new threats and pressures impact the natural condition of the mountains (see below).

In addition, those parts of the Alps occurring in the rain shadow on the lee side of the mountains are very dry. This combination of cold and dry conditions results in very slow recovery times. Responding to all of these threats and restoration requires significant financial and staff resources, a long term restoration plan and a clear understanding by all of the time that it will take for such restoration to be effective. The benefits are a resilient and effective catchment. However, the potential reduction of cost effective ecosystem services such as clean water, retained water yield and manageable flow regimes may result in increased costs to consumers.
Key threats to the Alps catchments

The 2010 assessment found serious threats to the Alps catchments including active soil erosion and increasing numbers of wild horses and deer that were contributing to soil erosion. Wild horse numbers had grown by 300%, from an estimated 2500 in 2003 to 7600 in 2009 despite some control actions (Dawson, 2009) and a further growth in numbers was predicted. The wild horses contribute to serious erosion and pollution in the very highest catchments by trampling, pugging, grazing, dirt bath development, the collapsing of stream banks and the causing of incision to mountain wetlands and streams (Worboys and Pulsford, 2013). Through such action, they directly impact endangered Sphagnum bog ecological communities, valley heath and wetlands and natural tussock grasslands and herbfields. Increased sedimentation of wetlands and waterways through trampling is likely to reduce the substantial value of clean water as an ecosystem service. The associated rich diversity of vertebrate and invertebrate Australian animal species that are found in such habitats are impacted including the Platypus (*Ornithorhyncus anatinus*), native fish (*Galaxia* spp.), the corroboree frogs and the Broad-toothed Rat.

Additional serious threats were identified by the survey that included frequent severe fires and the presence of four weed species with great potential to spread (blackberry, broom, hawkweed and willow). In their 2010 condition, the Alps catchments were assessed as being very vulnerable to predicted climate change effects. The management responses needed to fix the catchments was also considered.

Towards a climate change resilient catchment

In response to the catchment condition assessment, a *Caring for the Australian Alps Catchments Report* was prepared that recommended six priority actions to guide the Australian Alps Liaison Committee in preparing an adaptive management response for the Alps catchments (Worboys et al., 2011). The actions focused on halting catchment degradation; improving water quality; improving catchment resilience and optimising water flow regime and water yield. Improvements in the capacity to manage in a climate change environment were also identified and included introducing adaptive management techniques using new and improved management tools; monitoring the change in condition of the catchments; identifying threats and undertaking research into complex catchment management issues. The actions also identified targets that directly involved the people of the Alps with the implementation of adaptive management in the catchments.
Conclusion

The 2011 Catchments Report identified that the downstream benefits associated with ecosystem services (water) originating from the Alps catchments were of national economic importance with an approximate value of $9.6 billion per annum. This natural condition helped to deliver the high quality and reliable water supply, but climate change was considered a threat and was projected to reduce water yields and to produce altered precipitation events. The assessment also found that the natural catchment condition was being impacted significantly by wild horses, by soil erosion and by other animal and weed threats and in the early part of the 21st Century, it was not sufficiently resilient to deal with predicted climate change effects. The assessment underscored the immense importance of additional and adequately resourced active management to respond to stream and soil erosion, pest animal control, weed removal and other threats. This will be essential to restore the natural condition of the Alps catchments and to retain their optimum ecosystem services, particularly for water.

References


Figure 4. Trend in condition of 235 sub-catchments of the Australian Alps
Undisturbed Sphagnum wetland, Ginini Swamp, Namadgi National Park showing raised hummocky vegetation and Sphagnum with an associated small, clear, and undisturbed ponded water body. This is the ideal habitat of the iconic and endangered Northern Corroboree Frog (*Pseudophryne pengilleyi*) and it is also one of the very few remaining undisturbed sites where it is still possible for the ACT Parks and Conservation to release Corroboree Frogs bred from their endangered species recovery programme.

Wetland impacted by horses, Pilot Wilderness, Upper Ingeegoodbee River, Kosciuszko National Park. The wetland is highly disturbed, the Sphagnum habitat has been lost, the soil pedestal identifies soil loss, the water is disturbed and dirty and the surrounding vegetation disturbed.
Biography

Dr Graeme L. Worboys is a protected area management specialist with 41 years of national and international experience at practitioner and policy levels of management. He is the lead editor of IUCN’s 2015 compendium text book titled Protected Area Governance and Management and IUCN’s 2010 Connectivity Conservation Management: A Global Guide book.