Chapter 20
condition

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Introduction

The terms of reference required the Independent Scientific Committee (ISC) to identify, describe and report on the condition and trend in condition of the natural, cultural, recreational, economic and social values of Kosciuszko National Park. This chapter brings together the condition evaluations for all of the park's values.

The concept of 'condition' requires assessment of the state of the value, with reference to an appropriate baseline, such as its state at some previous time, or a defined desirable state. For some values, condition can be expressed with reference to a desired state; for example, for a threatened species of plant or animal, the desired state might be *restoration to a sustainable population*, and the trend in condition might be *declining in numbers.* It might also be appropriate to describe condition by reference to the state of that value at some previous time, used as a baseline. This might be 1788 (the year of first permanent white settlement in Australia), which was used as a reference point by some authors.

Comments on condition are included in the individual reports on earth sciences, soils, aquatic ecosystems, flora, fauna, fire regime, landscape (wilderness, aesthetics), cultural heritage, social values, recreation and economic use values. The remainder of this chapter summarises the information on the condition and trend in condition of the values of Kosciuszko National Park.

Earth science

Ordovician

Condition and trend in condition

Ordovician rocks are robust and in their natural condition. These rocks are a permanent feature of the landscape and, assuming quarrying and mining continue to be banned, no change in condition is expected. There may be some reduction in their scenic value if additional buildings and roads are created. To maintain their condition, no special management is required other than retention of the existing ban on prospecting, mining or unlicensed collection of samples.

Tertiary

Condition and trend in condition

The major landforms resulting from the geomorphic history of the Tertiary are generally robust, as is the Tertiary basalt. The surviving remnants of the Tertiary stream deposits are liable to loss by erosion. Evidence of deep weathering was clear in fresh road cuts made when the Snowy Scheme was under construction, but in many places rainwash, slumping and vegetation now obscure it.

While the scenery and the solid rocks will survive unchanged in terms of human lifetimes, there will probably be a gradual deterioration in the accessibility and visibility of rock exposures and mining evidence, as vegetation continues to encroach and explanatory notices become illegible. However, reasonable maintenance should maintain the surviving features indefinitely. Ironically, further loss of visible evidence of deep weathering in road cuts seems inevitable in view of soil conservation measures.

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Pleistocene

Condition and trend in condition

The glacial features are generally clearly visible, although the older ones have naturally lost much of their pristine form through natural erosion. Glacial erratics have become more difficult to find since the termination of grazing has encouraged vegetation to recolonise bare areas. The periglacial deposits are best exposed in road cuttings and quarries where they gradually become less identifiable because of rain wash, growth of vegetation and soil conservation measures. A road has cut through the block stream at Ravine.

Continued obscuring of relevant exposures through vegetation growth and soil conservation measures is to be expected. The quarry showing permafrost evidence near Mount Kosciuszko mentioned above will be concealed for reasons of conservation.

Holocene

Condition

Over most of the park, Holocene processes and deposits are generally in reasonably good condition, but there are limited areas of concern such as the heavily impacted summit of Mount Kosciuszko and much of the ski concessions. It has been feared that 'snow farming' in ski concessions could lead to changes to the natural surface and processes. While this may be true for vegetation and soil compaction, the depths of snow involved are substantially less than would be required for full nivation to occur. Active stream bank erosion below Blue Lake is cutting away sediments with potential value in dating.

In the last century and a half stock grazing, road construction, mining and engineering works have had major impacts on the area of the park. The completion of the Snowy Mountains Hydro-electric Scheme, soil conservation efforts and walkway construction have now helped to re-establish more natural, gradual Holocene processes. On the other hand, the increasing tourism in the park and the growth of skiing have inevitably added new pressures. The effects of the 2003 fires and the associated fire-fighting measures such as bulldozing access tracks will also adversely affect the condition for years to come. In future, nivation may be reduced if snowfall decreases as a result of climatic warming. However, no significant change in snow fall is yet apparent even though there has been some warming.

Soils

Condition and trend in condition

Surveys in the 1940s and 1950s[1] documented widespread soil erosion, attributed to the destruction of soil cover by fires and grazing. Improved fire management and progressive removal of grazing from 1944 to 1958 has been followed by natural stabilisation of most soils in the park, associated with an increase in the soil surface cover on a catchment scale to between 70–100% in amounts of at least 10 tonnes per hectare.

Associated soil measurements in some subalpine areas over a 20-year period show reduction in bulk density (ie increased porosity and infiltration of moisture) and increase in soil organic matter. In general, the recovery trend of the last 40–50 years has reached a plateau of relative stability, but has not always reached the former original condition. Where sufficient organomineral topsoil remained, near original conditions have been achieved, but not where topsoil loss advanced to residual stony erosion pavement stage. This stage will persist for a long time, probably centuries; fortunately, shrub regeneration on these stony sites is stabilising most of them. In the alpine zone, these stone pavements have reached stability as 'erosion' feldmarks.

On the Kosciuszko Main Range, and Gungartan and Bulls Peaks area to the north, some of these erosion 'hot spots' involved losses of up to half a metre of organomineral topsoil over a total area of about 1500 hectares. Soil losses from the Main Range between Mount Kosciuszko and Mount Twynam were recorded by the Soil Conservation Service of New South Wales (NSW) to be in the order of 1.2 million tonnes. Soil reclamation work by the Soil Conservation Service between 1954 and 1980 eventually stabilised most sites, but erosion problems requiring attention still remain there.

Incising and eroding peats and other groundwater soils require attention. Stream bank and stream bed profiles in subalpine valleys show continuing erosion, even though the initial disturbing agents are no longer present. Where there has been only minor incision, a slow upward trend is apparent.

Localised soil damage has occurred in many other areas, such as that arising from former engineering operations of Snowy Mountains Hydro-electric Authority; along transmission lines, roads and management tracks, four-wheel drive tracks, horse riding and walking tracks; and in development sites such as resort areas. Much of the former damage has been repaired, but continuous maintenance work will be required.[1]

On the areas where the ground is now exposed after the 2003 fire, pre-existing erosion scars are now clearly visible, without indication of significant soil restoration; in other words, the post-1950s stabilisation of these soils has arrested the continuing trend towards further erosion but has not improved the damaged condition. On an extensive catchment scale, the only practicable means of controlling soil erosion is through management of the type and amount of ground cover.

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[1] Surveys of the snow leases and permissive occupancies in Kosciusko State Park, carried out by the Soil Conservation Service of NSW of the snow leases and permissive occupancies in Kosciusko State Park

Aquatic ecosystems

Lakes

Physicochemical measurements indicate that water in all the alpine lakes is very fresh, with extremely low salinities, slightly acid pH and very low levels of nutrients. No other lakes in mainland Australia have lower salinities and few glacial lakes anywhere are as dilute. Salinity records taken in the late 1960s and early 1980s in Lake Cootapatamba are virtually identical. The nutrient levels in these lakes are low.

The only section of the aquatic biota to have been examined in detail in these lakes is the invertebrate community. Approximately 8–11 species of benthic invertebrates have been identified from deep (0.5–26 m) regions of these lakes and 15–26 species from samples taken in the shallow littoral region. Eight zooplankton species were recorded over two ice-free seasons in Lake Cootapatamba.

The invertebrates in these lakes are typically found in other upland regions in southeastern Australia, and species richness is comparable to that of highland lakes in Tasmania. Species richness is higher in lowland lakes and in many northern hemisphere lakes with similar rocky shorelines. It is thought that this relative impoverishment is a result of the small size of these lakes.

No indication of seasonal variation in the benthic fauna can be given because sampling has only occurred in summer. Therefore it is not possible to come to any specific conclusions about temporal trends in the invertebrate fauna of these lakes.

Given the nature of the habitat and the current very low concentrations of nutrients and ions, it seems unlikely that marked changes in physicochemical conditions have occurred since European settlement. As both the benthic and planktonic communities would be sensitive to changes in these conditions, it is reasonable to suggest that neither of these assemblages has changed greatly in the last 200 years as a result of changes in water quality. Random changes, however, in species composition cannot be excluded.

Streams and rivers

An expert panel commissioned in 1998 to assess the environmental flows of rivers affected by the Snowy Mountains Scheme concluded that the Snowy Mountains Scheme has affected the hydrological, geomorphological and ecological condition of many streams in the Snowy Mountains. These impacts are particularly severe in the Tumut, Eucumbene, Snowy and Gungarlin Rivers and some of the reaches of the Tooma and Geehi Rivers.

The impacts of the Scheme on stream flow in most of these rivers are:

- reduced flood frequency and magnitude;
- reduced volumes of flows at all times;
- reduced seasonal flow variability; and
- in some cases, unnaturally rapid and aseasonal changes in water levels from power station releases.

The geomorphological outcomes of these changes to stream hydrology have been:

- channel contraction due to reduced discharge;
- lack of channel adjustment to reduced flows in some reaches, resulting in isolation of the channel from riparian vegetation;
- loss of rapids, chutes and riffles in many reaches; and
- lateral isolation of pools and sedimentation.

Ecological integrity has been greatly affected by the Scheme, both directly (through changes to the natural flow regime) and indirectly (through the impacts of changes to hydrology, geomorphology and water quality).

Macroinvertebrate communities have changed from lotic to lentic in many areas where flow, habitat and water quality have changed those typical of a mountain stream to those typical of a lake or lowland stream. This indicates that important ecological processes have been disrupted, and ecological integrity is low.

Flora

Alpine — condition and trend in condition

Much of the area was damaged by grazing in the days of snow leases, but in the time since the leases were withdrawn and soil conservation work was completed there has been some recovery, especially of the tall herbfields. Loss of topsoil on parts of the Main Range has caused a change in vegetation that is virtually permanent, with feldmark species colonising bare erosion pavements. On the edges of these areas the remaining alpine humus profile is still subject to erosion and needs further conservation work. However most of the vegetation on the Kosciuszko plateau has achieved a relatively stable state, with changes being cyclic in response to short-term changes in climate. An exception is the continuing increase in some species such as ribbony grass *Chionochloa frigida* and the anemone buttercup *Ranunculus anemoneus* that were greatly reduced under stocking.

Grazing was withdrawn from the Kosciuszko plateau from as early as 1944, but north of this, legal grazing continued for another 14 years. Subsequent monitoring of changes to the vegetation in a limited number of sites suggests that recovery of *Sphagnum* bogs, and change from a grazing-induced disclimax short herbfield to tall herbfield is continuing.

Tree lines

Condition and trend in condition

Most of the tree lines of the park are intact as structural features. However, during the grazing era, a substantial length of natural inverted tree line was eliminated by ringbarking of trees and burning of forest. There has been relatively little reinvasion of trees into these areas. On the treeless side of the tree line, the vegetation is still in the process of recovery from grazing. In general the tree lines are in the process of recovery, the main exception being where cleared for ski runs. Little (2000) has suggested that soil calcium and manganese concentrations can be used to discriminate areas that have supported trees before the grazing era and those that did not. Soil microtopography and extrapolation along contours from surviving tree lines are other ways that could be used to locate the original tree lines. If such a reconstruction were achieved, improvement in the condition of tree lines could be measured as the proportion that is structurally intact.

Subalpine

Condition and trend in condition

As with many alpine areas at Kosciuszko, the subalpine tract suffered extensive damage from burning and grazing for the first 100-odd years of European occupation. This damage included large areas of deforestation, where livestock prevented the regeneration of snow gums after hot wildfires. The trend since 1958, when leases were withdrawn above 1400 m, has been one of slow but steady recovery. Areas still occupied by tussock grasses in 1958 are now still covered in grasses and a greatly increased number of other herbs. Areas that had been denuded of vegetation are now largely occupied by shrub species. Where some topsoil remained, there appears to be a slow decrease in shrubs and an increase in herbs, but where the soil profile had eroded down to pavement, the shrubs seem likely to persist.

Subalpine groundwater areas have, in some instances, seen an increase in bog mosses and shrubs as streamlines became blocked and the water table was locally raised. However, many streamlines had been deeply eroded and have reached a new entrenchment that is unlikely to be reversed without active conservation work.

Eucalypts

Condition and trend in condition

Most of the eucalypt forest and woodland in the Kosciuszko National Park has a minor component of introduced animal or plant species, and a large proportion has been structurally changed by a high fire incidence and grazing by stock. There is relatively little old growth forest compared to the likely situation in the mid-18th century. With stock grazing excluded and fire less frequent, it is on a trajectory back to its mid-eighteenth century condition. Trend in condition might be best measured by the proportion of old growth eucalypt forest and woodland, with the management goal being to have this increase to pre-European levels — a necessarily protracted process.

Condition of vegetation communities following 2003 fires

The subalpine bogs are in a sorry state. A few areas escaped the fires, but most of the bogs observed between Valentines and Snakey Plain were badly burnt, the odd hummocks of *Sphagnum* brown and undercut and the bog shrubs blackened sticks. The wetland sedges were sprouting from the base but it is hard to see how the bogs will recover in the short term.

The widespread fires in forest and woodland areas will put back plant successions there towards earlier stages characterised by shrubby understoreys and regrowth trees (seedling and epicormic/lignotuber regeneration). Many of the relatively few stands of near-old growth communities have also been affected in this way. Future management should give particular attention to the protection of surviving old growth communities and to the encouragement of successions elsewhere towards middle and old growth conditions.

Fauna

Condition of populations and habitat

It is difficult to assess condition and trends for the park's fauna at the general level. Amongst other elements, a systematic evaluation is required of the condition of the park's vegetation and fauna habitats.

Despite the majority of the land area having a positive to benign biodiversity management regime, populations of some species (and the taxa themselves) are declining or remain highly threatened. This is most notable in amphibians and some mammals in the alpine area and drier forests.

A species with threatened status at the national or state level suggests that there is evidence of the species' decline, as opposed to being naturally rare. Populations of some threatened species in the park may be declining, but there is insufficient knowledge to define their condition and the extent of impacts of the threatening processes.

For many threatened species, the condition of the park population remains unknown, and some may be partly dependent on the condition of regional ecosystem processes and habitats. For example, the large owls may be threatened across their broad range (by logging and land clearing), but populations in the park may not yet have changed in condition.

Recently, it has been discovered that bogong moths transport arsenic to the alpine regions, presumably from their 3–4 years as larvae in the self-mulching soils of western NSW. The effect of this on the condition of the moth population and the effects up the food chain have yet to be determined, but are possibly significant.

The extent of mature seral vegetation types and consequent critical resources (e.g. tree hollows) affects the distribution and abundance of many threatened fauna species and needs to be maximised by management. Fire regimes are a critical process for this and the distribution and abundance of other functional elements such as nutrient cycling fungi.

The concept of 'condition' of a fauna population includes the extent of depletion of a population, and the state of the remainder compared with the natural state. There is no standard measure of condition for the vegetation and/or habitats that support fauna populations, such as net change in extent and state, or the time that habitat recovery would take, but such measures are needed to develop an ecological policy. The broad condition is affected by the scale and effect of the threatening processes. Condition assessments are confounded because baseline data is generally not collected prior to the threatening processes operating.

Although the drier woodlands and forests of the park have received less attention than the alpine and subalpine areas, they should not be neglected, because large segments of the fauna of these environments are threatened in southeastern Australia. Historically, the park has suffered the most extreme extinction of vertebrate species where these species have declined at a continental scale. For example, a suite of woodland bird species is regarded as being threatened at the continental scale as a result of factors such as land-use changes and land clearing. Similar patterns may also be affecting reptiles. The decline or extinction of native medium-sized predators is significant in these environments, as is the replacement by feral predators (dogs and foxes).

To conserve the condition of fauna populations in drier woodlands and forests of the park, it is critical that management should achieve a closer surrogate of the pre-European habitats. Outside reserved areas, habitat loss such as depletion of fallen wood debris (estimated to now be 16% of the pre-European amount for woodlands because of threatening processes such as logging, firewood collection and fire management) depletes and changes the functional condition of a wide range of fauna habitats.

Future trends in condition

Critical ecological elements and processes that will affect the condition of the fauna populations in the park environments include:

- protection, reinstatement and enhancement of habitat and habitat continuity in the park and the regional management of populations as metapopulations;
- protection of wetlands and hydrology;
- control of introduced predators and restoration of a natural predator regime and predator–prey relationships;
- restoration of the natural grazing regime;
- increased research into invertebrates and their role in ecosystem function;
- restoration and protection of mature seral vegetation stages and tree hollows;
- reinstatement of appropriate fire regimes for habitats of dependent fauna (e.g. smoky mouse); and
- regional habitat changes that affect species with habitat requirements extending beyond the park's boundaries.

Fire

Fire has and will continue to influence the occurrence and distribution and condition of vegetation communities and some species. The fire regime is arguably the most significant element of the park's program of natural area land management, but there is still little or no knowledge of this component of the environment and the way in which management of fire will manipulate, modify or reduce the park's ecosystems.

Fire can have deleterious impacts on the condition of the soils of Kosciuszko National Park, particularly the organic soils of the alpine and subalpine zones (alpine humus and transitional alpine humus soils).

Fire regimes in Kosciuszko National Park over the last 40 years probably approximate the natural in alpine vegetation and closed-forest, in that fire has been largely absent from these ecosystems. Elsewhere in the park there are some areas that are frequently burned for hazard reduction, and these areas are probably burned more often than in the natural condition. There are also large areas that have probably been burned less often than in the natural condition. These regimes are taking place in vegetation modified from that which covered the country when occupied by gatherers and hunters.

Fire management in the park has developed from a very simplistic approach in the past of attempting to suppress all wildfire ignitions together with an annual program of fuel reduction. To maintain the condition of the park's natural ecosystems, the fire management regime should now be based on ecological principles that provide for sound nature conservation, catchment stability and the maintenance of an acceptable level of risk from wildfire impacts on infrastructure, neighbours and park users.

Landscape

Condition and trend in condition

Several tendencies, largely related to human activities at a global scale, have been recognised in the climate of Kosciuszko National Park and adjacent areas since 1900. These tendencies are: a decrease in winter rainfall; a decrease in snow incidence; an increase in temperatures; an increase in UV radiation. The balance of the evidence suggests that the proportion of years with low snow cover and duration are likely to increase during this century as a result of global warming.

Inputs of UV radiation depend on lower atmospheric conditions as well as the condition of the ozone layer. The present condition is poor, with UV-B circumstantially, and experimentally, implicated in the decline of frog species in Kosciuszko National Park. The medium and longer term prognosis is for improvement, as a result of international success in reducing the release of ozone-depleting substances.

At a landscape scale, the combination of burning and stock grazing that took place over most of the area occupied by dry and subalpine eucalypt forest and woodland for more than one hundred years has dramatically changed vegetation structure over much of the present park. In some cases this unnatural management resulted in the elimination of trees. In others it resulted in dense stands of regrowth trees where previously woodland with old growth trees predominated. The wet eucalypt forest seems likely to have been burned more frequently than in the natural condition, with some extensive landscape fires that have replaced older trees with younger ones happening even in recent decades. Most of the park is remote enough from settlement and mechanised human activity to allow the sounds, smells and feelings of the bush to dominate. However, unnatural sounds can penetrate large distances in particular weather conditions, even where there is no visual disturbance. No noise mapping or monitoring has been undertaken.

The desired outcome for the condition of physical ecosystem processes is an increase in the degree of their naturalness.

Wilderness

Condition and trend in condition

The National Wilderness Inventory provides a technique for measuring the components of the wilderness resource. The results of initial mapping using this technique indicate variable quality in the wildernesses of Kosciuszko National Park.

The wilderness areas of Kosciuszko National Park are traversed by vehicle tracks, contain a wide variety of human artefacts, have substantial populations of introduced organisms, and have large areas of soil and vegetation modified by human use since the European invasion of Australia. On the positive side, the tracks are not available to recreational vehicles; the artefacts, with a few exceptions, including huts, are no longer functional; the introduced organisms form a small component of the biomass; and the modifications have largely ceased.

The removal of post-Aboriginal cultural disturbances, such as stock grazing, that changed the soils and vegetation of much of the wilderness areas has placed these areas on a trajectory of recovery to naturalness. Limited data from snow gum woodlands in the nearby Australian Capital Territory (ACT) suggest that the post-1970 incidence of fire was similar to that in the 18th century, after an intervening period of massively increased incidence. This, if maintained, would also tend to result in a return towards naturalness.

Aesthetic

Condition and trend in condition

View fields are the critical variable in gauging the natural scenic condition. A technique developed to calculate disturbance to the view field provides a visibility disturbance score based on the percentage of the arc of visibility from the highest point in a grid square that contained roads, quarries, artificial impoundments, cleared land, buildings or forestry activity. In deriving an ultimate score, the types of disturbance are weighted, with roads, quarries and human artefacts weighted more heavily than less visually disruptive disturbances.

The present natural aesthetic condition of Kosciuszko National Park varies from extremely poor in the vicinity of ski resorts, hydroelectric infrastructure and roads in open country, to poor where impoundments, cleared land and forestry activities are visible, to excellent in the heart of much of the wilderness country.

Unfortunately, the areas that have the least natural views (ie the poorest natural scenic condition) are among the most visited areas of the park.

The trend in condition is negative as a result of the ongoing development of skiing facilities and development outside the park that is visible within it.

Cultural — Aboriginal heritage items

Condition and trend in condition

There is insufficient evidence to assess the condition of Aboriginal heritage items within the park. There have been no systematic surveys of these items and no overall assessment of their condition has been undertaken. What follows is therefore necessarily generalised.

The condition of both physical remains and the cultural traditions and uses associated with them has declined dramatically since European settlement because of the loss of continuity and control by Aboriginal people. Aboriginal connections and traditions — the non-tangible values connected with Aboriginal history and heritage — have been violently and significantly damaged in the past by the processes of the European settlement and dispossession.

Presently, lack of formal Aboriginal involvement can be considered to be seriously affecting the condition of this value and the present management plan does not acknowledge these issues nor provide adequate management. Over the last two decades, gradual recognition of Aboriginal traditions, the employment of Aboriginal staff and research and documentation in this area have improved the chances of preventing the loss or further damage to these values, but this trend requires active augmentation and management support.

Physical remains of Aboriginal history and heritage have been destroyed since the park was created, because of lack of proper consultation and of systematic surveys.

Because of the widespread nature of the items and lack of comprehensive information about them, management practices and any new development have the capacity to damage them.

While the condition of the majority of the known physical remains is relatively stable and the management regime which is now in place goes some way to ensuring less inadvertent destruction than previously, many of the physical remains are also subject to natural weathering and erosion.

Overall, it would appear that the condition of Aboriginal heritage items within the park is at best average and in many cases degraded or in danger of being so.

Cultural — historic heritage places

Condition and trend in condition

Data and methodology

At present, it is not possible to adequately or accurately assess the general condition of the heritage items within the park. In Australia, the only relevant condition assessment methods for cultural heritage are those which have been designed for Australia's State of the Environment Report 2001, which used defined criteria to assessed physical condition. No overall survey of condition has been carried out for the cultural heritage of the Australian Alps, or Kosciusko National Park, and the regional strategies do not assess condition overall.

An overall assessment of condition requires comparative data and a consistent methodology. A regional framework is needed, into which to fit this suite of items, systematic identification of many types of sites, especially archaeological sites, and recognition and documentation of the many intangible items especially relating to the traditions and social history of the park.

Many assessments have been carried out, mainly on a needs basis, of certain major items such as the huts, past and present resorts, homestead complexes and the Kiandra cultural landscape.

A sample survey would provide a basic condition assessment of the tangible heritage items of Kosciusko National Park. The closest we can get to a condition survey is to look at the data on the Kosciusko Huts. It is not clear from the literature whether the total figure (239) is the result of systematic survey and represents all huts previously built in the park, but it is assumed that most of them, or their sites, have been located. The spread between huts that are intact, in ruins or no longer in existence is an indication of condition. Because cultural heritage is of its nature subject to decay and change it is not appropriate simply to characterise this figure as poor condition. More than half the huts have been ruined or destroyed. Less than half are intact. About 30 huts have been lost in the past 30 years, some deliberately destroyed, but most lost to fire. Since 1993, both loss of huts and their active management has been in evidence.

This study points out the fragility and vulnerability of the cultural items in the park.

Current condition

Only a sketchy and somewhat subjective assessment can be given of the condition of some of the historic heritage places.

Places of high public visibility and current use (including active interpretation) that have been subject of specific conservation work tend to be in relatively good condition. They include:

- historic homesteads;
- huts in current use;

- resort buildings in current use;
- the infrastructure of the Snowy Mountains Scheme currently in use; and
- historic walking tracks and recreation facilities currently in use.

Some other major items such as Yarrangobilly Caves House, while not in current use, are stabilised and currently have priority for restoration.

The past history of park management has affected the condition of some of its cultural values and has lead to their diminution. Previous lack of understanding or sympathy among park managers for cultural heritage items, augmented by a lack of resources, and in some cases their misguided destruction or neglect has led to the diminution of some values.

In some cases, management practices aimed at conservation of natural values have been in conflict with the conservation of cultural values. As a result, the condition of a number of cultural heritage items is poor, or they no longer exist. These include buildings, ruins and landscape features.

There has also been the loss of legitimacy and acknowledgment suffered by those whose way of life relates to the heritage values of Kosciuszko's pastoral era. People feel unduly blamed for damage that has occurred to the park as a result of pastoralism, and the hostility of some members of the community to the establishment and management of the park has compounded these problems, causing the loss or diminution of some of the social aspects of the park's cultural heritage.

Heritage places do not renew themselves, and especially if they constitute evidence of the past rather than being in current use, their natural tendency is towards change or decay. Although their condition is not naturally stable, an aim of good management is to make them as stable as possible. Some cultural landscapes are being lost or diminished as revegetation, control of introduced species, and the general diminution of signs of human activity occur. Many minor elements of these landscapes, such as mine workings, small structures, ruins and archaeological sites, are in an average to poor condition and the trend is towards a significant decline in condition. Most of the buildings of 19th century Kiandra have disappeared but the New Chum and other mine sites, storage dams and leads are still clearly visible.

Trends in condition

The condition of cultural heritage values in the park is improving in some respects:

- The level of knowledge and of management of the park's cultural heritage has improved during the period of the present plan, with contributions by management staff within the organisation at all levels.
- The newly drafted regional strategies indicate recognition of cultural heritage as a legitimate value, and of priority being given to its management. They have identified needs for specific sites and identified priorities for site management. The strategies identify a number of encouraging trends, including a growth in interest in cultural tourism, development of an integrated (natural and cultural) landscape approach to management, increasing prevalence of surveys of sites ahead of proposed development, the development of centres which will emphasise historic and Aboriginal heritage and the consideration of huts in their landscape setting.
- The Australian Alps Liaison Committee's research work focuses on values common to all the Australian Alps national parks, but has provided a great deal of basic information about the cultural values of Kosciuszko National Park and consequent management recommendations, especially within the themes of mining, science and cultural landscape management. This information now needs to be incorporated into the Kosciusko management regime.
- Overall, the trend in condition of historic heritage places is improving, but it starts from a very low threshold. There is a need for proactive consolidation and augmentation because lack of active management for restoration and stabilisation, or of regular monitoring and corrective action at many sites, and a similar level of attention to non-tangible items, will lead to their inevitable decline.

Social

The social dimensions of park management are given limited recognition in legislation, yet they are a key component of management practice. There are a number of significant social barriers to effective and holistic management of the park. From the beginning, there has been a series of major problems in local relationships, and sometimes deep and long-enduring resentment of the park. The problems primarily centred on the change in land tenure to a protected area that required cessation of grazing, and resulted in loss by the cattlemen of part of their commercial operation. In particular, although leaseholders received compensation, many of their workers lost both their job and their highly valued lifestyle. For many, the mountains and the mountain lifestyle had been their family tradition and their heritage, which is valued and is continued, where possible, to this day.

The park as a place of natural and cultural heritage can sit in an uneasy relationship to the park as a place of industrialised snow sports.

A great deal has been done by the National Parks and Wildlife Service (NPWS) in recent years to build bridges with the mountain community, although a dogged minority still maintain their hatred of the park. At local, state (and national) level, it appears that the park and its staff have gained increasing community respect. This is due very largely to the commitment of the on-ground staff who have direct responsibility for shaping visitor experience. This respect is not only from visitors, but also from

local communities, including some of the earlier antagonists, who see that staff are making enormous efforts to work, and develop relationships, with neighbours. Complaints about the perceived heavy-handedness of the park bureaucracy may well be due in part simply to lack of effective communication or to generalised characterisations from deeply seated community attitudes to parks and bureaucracies.

As the park gets older it becomes more significantly entrenched in people's minds as a park rather than for its former uses and status. In general, new groups moving to the region for lifestyle reasons tend to be more sympathetic to nature conservation as a land use.

However, for the people who use the park, there is steadily increasing ambiguity about the basic nature of the park as both a site of great natural and cultural heritage values and a major tourism destination.

Recreation

Condition and trend in condition

Natural attraction

The extraordinary aesthetic scenic and natural heritage of Kosciuszko National Park is one of the primary tourism and recreation attributes of the park.

The park is scenically very diverse. There are many large natural areas where the natural scenery is in very good condition. Some other areas are impacted on by power lines, urban areas and car parks within the ski resorts and the many human made features of the Snowy Scheme. Some areas are degraded, including the nation's highest peak, Mount Kosciuszko, where further rehabilitation works are required. Natural scenery is very important for tourism and recreation.

Tourism and recreation has impacted on native wildlife. Habitats of endangered species have been modified in the ski resorts. There are road kills, and many species are influenced by visitors throughout the park; for example, bats may be disturbed in caves, and breeding populations of snakes and other species may be disturbed by walkers. Special management is needed for the ski resorts, including managing their impact on aquatic organisms.

Slashing of native vegetation in the ski resorts and trampling of alpine area plants are two impacts that need managing. There are water quality issues for streams downstream from urbanised facilities in the park, and other streams may contain waterborne parasites. Management of water quality needs action to help maintain minimum standards of water quality, especially in remote areas.

Access to the caves in the park is by a permit system or by ranger-guided tour, and this system appears to be working satisfactorily.

Non-natural noise is usually very low, but this is an issue that may affect visitors within the ski-resort areas, near the major dams and transmission lines of the Snowy Scheme and along the highway routes. The helicopters used by NPWS may be an issue in remote areas. Non-natural light pollution is usually very good, with the exception of the ski resort areas.

Cultural attraction

Many Aboriginal heritage sites are in the same locations as visitor-use sites and need careful management. Some sites need repair; others are in a satisfactory condition.

Many historic sites within the park need constant work. The Kosciusko Huts are maintained through voluntary work with the Kosciusko Huts Association. Yarrangobilly Caves House has been renovated and repainted. Locations such as Kiandra need work to conserve heritage features.

Educational activities

Whilst there is a range of educational programs linked to the park, there could be far more. The park has unique infrastructure that could be used far more in facilitating education programs. The resorts could play a new role in the future. The range of potential educational opportunities available is considered to be poorly adopted.

Diversity of tourism and recreation opportunities

There is a wide range of recreation opportunity settings within the park. Recent (2002) expansion of wilderness areas has consolidated this diversity with the additional protection of the most vulnerable recreation opportunity setting type — the facility-free, disturbance-free areas.

NPWS has no active management planning guidance or policy to control the nature of facilities provided at particular settings. In the absence of such guidance, there is a strong probability of incremental damage to sites over time.

Access to Kosciuszko National Park

Improvements of highways between Sydney and Kosciuszko National Park, and the recent improvements to the Kosciuszko Alpine Way have helped to reduce travel times and make travel safer. Access by air is somewhat diminished due to the infrequency and uncertainty of regional air service to Cooma, and the distance between Cooma airport and Kosciuszko National

Park. The competitive advantage achieved at Mount Hotham ski resort in Victoria as a result of the Dinner Plain airfield adjacent to the snowfields has placed some competitive pressures on NSW ski resort operators. The absence of regular bus services to many areas in the region and in the park, particularly in summer, detracts from low cost access to the park and the region.

The highway system servicing the park has been improving with time. Travel times to the snow fields are consistently being reduced through better road systems. Public transport systems to the snowfields and the park are generally less than satisfactory. The exception is the outstanding service provided by Skitube from Bullocks Flat to Perisher Valley and Blue Cow.

Access within Kosciuszko National Park

Recent improvements to the Alpine Way and the general consistent maintenance of the gravel public access roads within the park have contributed to the quality and reliability of access for tourism and recreation. The absence of regular bus services within the park, particularly in summer, detracts from low cost access to the park and region. The construction by the Snowy Mountains Hydro-Electric Authority has provided visitors to Kosciuszko National Park with an outstanding public road access system. More recent access facilities such as Skitube have considerably assisted skier access to snow. Access to the ski fields is generally acceptable, to better than satisfactory. However, poor weather conditions and icy roads easily disrupt traffic flows. Access to recreation opportunity settings is excellent for the park.

Services and facilities

There is a high diversity of recreation facilities and services within the park. The 1988 Kosciusko National Park Plan of Management provides a detailed inventory of those facilities.

The settings in Kosciuszko National Park are diverse, ranging from ski resort areas with urban style facilities to wilderness areas with no facilities. The literature describing recreation opportunity settings describes certain services and facilities that are appropriate to different recreation opportunity setting classes; however, NPWS currently lacks a formal system for dealing with this.

Incremental damage to visitor sites is a potential management problem. Good planning can overcome this issue. Limits of visitor use reflect that there is a limit to the number of people that a site or area can accommodate at any given time. A planning framework is available that should be adopted to provide a rationale and process for such decision making. The nature of the visitor services and facilities provided is generally satisfactory.

Impacts of use

The condition and trend in condition of 'impacts of use' for Kosciuszko National Park can be expressed relative to the global environmental criteria identified by Agenda 21 for the travel and tourism industry, and subsequent work by the Co-operative Research Centre for Sustainable Tourism.

The condition status analysis indicates how well particular environmental management performance criteria are managed, to minimise either primary or secondary impacts of visitor use to the park. It is clear that 'impacts of use' in the park can be managed better.

Energy consumption is relatively high for snow-based tourism that is underpinned by snow making. Transport to and from the ski fields consumes energy, as does the heating for accommodation and the energy consumed in treating sewage. Electricity consumption based on coal fired power stations contributes to greenhouse gases and global warming. Reduction targets for the park in tonnes of carbon per year may be possible. Currently, there are no known tourism programs in place for energy conservation or greenhouse gas reduction from tourism in the park. Greenhouse gas reductions can be achieved by lowering energy consumption in all aspects of travel and tourism operations, and energy reduction means cost savings for companies and authorities.

A reduction in the amount of solid waste could be achieved through systems that minimise waste generation, recycling and reuse. This would mean less waste going to landfill (and thus less pollution), less energy used to manage the waste and cost savings for the managing authority. There is no known program in place for the strategic reduction of solid waste generated for the park.

Liquid waste reduction could be achieved through reduced water use, which would mean less wastewater to be treated. All ski resorts discharge into subalpine streams within the park. Licensed disposal standards being met reflects on the quality of treatment achieved, but some discharges have not met licensing performance standards. Some pollution incidents have been associated with ski resort management. There is no known program in place for the strategic improvement of liquid waste generated within the park.

Reduction in potable water use will benefit the natural flow regimes of the mountain streams that provide water supplies to service visitor use facilities. There is no known program in place for the strategic reduction in potable water use within the park

Social criteria currently focus on local employment created through travel and tourism. This criterion is considered satisfactory, and there are active programs of employment generation locally through tourism.

There is no known program for noise reduction in place for the strategic reduction of non-natural noise within the park.

There are a number of biodiversity conservation programs and specific species conservation initiatives within the park. There is no known program in place within the park for the strategic improvement of biodiversity conservation developed as a joint initiative with the travel and tourism industry.

There are no known supplementary indicators specific to Kosciuszko National Park in place within the park for the strategic improvement of 'impacts of use' developed with the travel and tourism industry.

Affordability

Demand and supply needs to be carefully managed, consistent with the sustainable limits of visitor use established for recreation settings for Kosciuszko National Park.

Competition for the provision of services and facilities for visitors appears to be generally effective.

There is a need for the tourism industry and Government to work together over pricing and charging for services.

Regional recreational opportunity settings

The tourism and recreation values of the Snowy Mountains Region surrounding the park could be managed in a more integrated way. Evaluation of more sophisticated, urban-style tourism and recreation facilities and services outside the park suggests that there is a greater opportunity for such facilities for the greater region outside of the park.

Economic

Use values

The park's catchments provide water for western agricultural areas through the Snowy Mountains Scheme.

The annual value of irrigated agricultural production varies with seasonal conditions and world prices. Despite these variations, it could be expected that, in real terms, the value of production over the last few decades would have increased because of improvements in production efficiency.

Power generation

Snowy Hydro Limited now operates in the national electricity market in the eastern states of Australia. A key feature of this market is the variability of electricity spot prices that are based on half-hour intervals and respond to market conditions, which change rapidly. As such, it is difficult to determine how Snowy Hydro Limited's income from power generation is likely to change in the future.

Findings - condition

Unless the condition of the park is known, it cannot be adequately managed. The condition of the park is the combined expression of the condition and trend in condition for each of its identified values.

It is not possible to make a meaningful single statement on the condition and trend in condition of the Kosciuszko National Park because there are different ways of expressing the condition of different values, and some values have become degraded, or are threatened with degradation, while other values are in good or improving condition.

Understanding the condition of the park's values is important; but more critical is understanding trends in condition. Monitoring of condition is essential to understand whether a value is improving or degrading, and to allow management actions to focus on restoration, repair and reinstatement of the values that are at risk.

The overall management aim for the condition of the park should be to ensure that it is progressively made more healthy, robust and resilient to changes that are caused by disturbance.

As the largest national park in NSW, Kosciuszko has the opportunity to create a framework for monitoring of condition that can be an example for other parks in NSW and for the other Australian Alps national parks.