Chapter 19
pressures

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Introduction

Many pressures have the potential to threaten the significant values of the park; however, there is now better knowledge about the pressures and the state of the park's values than there was at the time of preparing previous management plans.

The purpose of reserving land as a national park in New South Wales (NSW) is..

> *'to identify, protect and conserve areas containing outstanding or representative ecosystems, natural or cultural features or landscapes or phenomena that provide opportunities for public appreciation and inspiration and sustainable visitor use and enjoyment …'*[1]

The Independent Scientific Committee (ISC) recognised that management principles for national parks in NSW are becoming more flexible, in common with those for protected areas elsewhere. Also, protected areas are tending to become more inclusive than exclusive in the activities that may occur within them. However, some of the uses are now far removed from traditional conservation priorities and original purposes of reservation, and these new uses bring new pressures, create new demands on managers and may compromise some values.[1]

Pressures vary in scale and intensity — they range from global pressures such as climate change to local pressures such as use of a particular track. Pressures may arise from indirect or underlying societal and economic processes or from activities that act directly on ecosystems (e.g. land clearing or pollution). Underlying societal pressures that lead to more people wishing to visit the park can translate into more specific, direct pressures; for example, demand for the construction of more tourism and recreation facilities in turn increases pressure on the park's land, water and ecosystem resources. Where there is pressure on a value, that value may be degraded unless the pressure is removed, reduced, or appropriately managed to mitigate its effects. There may be several different pressures acting on a value at any given time, and these pressures may interact, multiplying the end effect. Where significant values are degraded by more than one pressure, managing individual pressures alone may not reverse the degradation.

It is important to differentiate between pressures and their impacts. For example, a pressure might be 'increasing visitor numbers in wilderness areas' and its outcome or impact might be 'loss of experience of remoteness'.

The pressures discussed in this section are those identified by ISC members that relate to the park's values. Some pressures, such as climate change or land use change outside the park's boundaries, are clearly beyond the realm of the plan of management to control; nevertheless, the potential consequences of such pressures need to be understood.

Some of the pressures identified by the ISC would not have been important issues a decade ago, and it is inevitable that more pressures and impacts will be identified as time goes by.

This chapter considers the pressures and potential impacts caused by climate change, regional land use, development, visitor use and park management. It also looks at the way in which certain pressures may affect ecological processes and landscapes, at the cumulative effects of pressures and at values as pressures.

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[1] *National Parks and Wildlife Act 1974 (NSW), S.32E(1)*

Pressures and potential impacts

Climate change

Climate change is an important potential pressure that the ISC discussed, but was unable to address fully in the short timeframe under which it operated. The United Nations' Intergovernmental Panel on Climate Change (IPCC) has issued several reports over the past years, and refinements of its climate model have consistently increased the projected effects of global warming and the potential for changed climatic conditions within a few human generations. In addressing the World Summit on Sustainable Development in 2002, Rajendra Pachauri, IPCC Chairman, said:

> *It is now well accepted that under the most optimistic Kyoto outcomes a significant level of climate change is inevitable.*

Models have suggested that there will be warming of the atmosphere under an enhanced greenhouse effect and that this results, at least in part, from human activities. Although the inevitability of climate change is now recognised, the degree and direction of regional change is uncertain. Global warming may have profound effects on regional and local climates, but these will not necessarily be limited to changes in the minimum, maximum or mean temperatures. Effects may include increases or decreases in precipitation amounts, intensity, distribution or phase (rain, snow, hail, etc). Changes might be also be expected in the frequency and magnitude of floods, frosts and droughts.

Climate change and Kosciuszko National Park

Current thinking is that the climate and weather regime of Kosciuszko National Park will change, although the magnitude and time frames of the changes remain speculative. Changes will not be confined to changes in snow cover and alpine habitat, but will include increased temperature, reduced rainfall and higher UV levels. It is clear that global warming threatens some of the park's alpine species and the ski industry; less obvious are the potential impacts on all areas and ecosystems of the park. Climate change is likely to affect fauna (particularly geographically confined species such as the mountain pigmy possum), vegetation and endemic plant species (particularly those restricted to alpine habitats or dependent on specific rock types or soils that occur with limited spatial or altitudinal distribution), geomorphic processes, tourism and recreational activities, fire regimes, and road maintenance.

Specific pressures related to climate change that will impact on the values of the park were identified by the ISC; they include pressure on snow, habitat and species composition.

Pressure of climate change on snow

- Snow depth and cover will change, with associated impacts on soil process, distribution of flora and fauna and hydrologic regimes.
- Decreasing snow depth and cover as a result of global warming may lead to pressure for even more snow-making infrastructure. Snow manipulation is known to have a range of negative effects on flora, fauna, soil process and hydrology. Reduced snow cover and duration may also change the style of winter tourism and/or reduce its level and associated revenue.
- Extreme winter weather may reduce quality of visitor experiences and safety of travel.

Pressure of climate change on habitat

- Habitat change as a result of global warming could lead to loss of already endangered alpine and subalpine species such as the Mountain Pygmy Possum. Species extinction is a real risk.
- Habitat and vegetation changes as a result of global warming may have a negative effect on visitor experiences and reduce their options for experiencing the natural environment.

Pressure of climate change on species composition

- Increase in UV radiation as a result of ozone layer depletion could be responsible for declines in range and population of alpine frog species.
- Global warming is expected to produce changes in alpine flora species composition and increase the likelihood that invasive species will impact on the integrity of native vegetation. Global warming may also change the position of the tree lines over a 100-year plus period, with inverted tree lines expanding into frost hollows and the alpine tree line ascending.

Research into the implications of climate change

The Australian Greenhouse Office, Cooperative Research Centre for Sustainable Tourism, and NSW National Parks and Wildlife Service have recently commissioned new studies to review the implications of climate change for the upland environments of southeastern Australia. CSIRO Atmospheric Research is further refining climate models for southeastern Australia.

In most climate change scenarios, large protected areas such as Kosciuszko National Park will become increasingly important as biodiversity refugia. Thus, the park should be considered a laboratory for evaluating climate change.

Clearly, the National Parks and Wildlife Service (NPWS) is not in a position to markedly influence the international or national approaches to the potential or actual progress of climatic change. It should, however, be in a position to:

- establish and maintain long-term research projects and benchmarks, as well as an environment where other anthropogenic variables can be held constant;
- establish a management regime that allows the NPWS to be responsive to adaptations that will be required to ameliorate (where possible) adverse changes to values, particularly biodiversity assets; and
- use climate scenarios in planning such aspects as species and plant community recovery, or development or decommissioning of facilities (e.g. ski resorts).

Key point

The Kosciuszko National Park Plan of Management needs to recognise the implications of climate change as a pressure on the park and incorporate a planned management response based on conservation of the park's values.

Regional land use

The regional setting of the park brings pressures, as intensified land use and new developments (often stimulated by the existence of the park) isolate the park as a natural area, and the ecological edge effects on the boundary areas of the park intensify. Table 19.1 summarises the pressures and potential impacts related to regional land use.

Table 19.1 Pressures and potential impacts due to regional land use

Pressure	Impact
Demands for managing fire in the regional context as a protection for neighbouring properties that are not consistent with fire as an ecological process essential to the park's natural values	Natural ecological processes within the park are disrupted
Regional land clearing	Severing of linkages to other parts of the Australian alps and loss of continuity of the alps wilderness areas; loss of habitat linkages
Increase in number of residents close to the park who use it as their primary recreation destination and commercial businesses that use the park as their primary business focus	Additional visitor impacts and potential visual and aural effects into the park

Key points

The regional setting of the park brings pressures as intensified land use and new developments (stimulated by the existence of the park itself) potentially isolate the park as a natural area, and create edge impacts on the boundary areas of the park. These pressures require an inclusive regional management approach by the park's management rather than an introspective one.

Development

As visitor numbers grow, it is predicted that there will be increased pressure for more access, further tourism infrastructure within the park (both for summer and winter visitor facilities and services) and commercial pressure to expand resort areas. In addition to infrastructure for tourism and recreation, there may be pressure from other organisations (e.g. Snowy Hydro, Transgrid, Roads and Traffic Authority) for further development in the park.

The ISC has identified pressures on natural and cultural heritage, social, tourist and recreational values from increased development. These are shown in Table 19.2. More detailed explanations are given in the chapters concerning individual values.

Table 19.2 Pressures and potential impacts due to increased development

Pressure	Impact
Natural values	
Building, road construction, tracks, tunnels, bridges smoothing of ski runs	Damage to periglacial and other geological features and flora and fauna habitats
Clearing and infrastructure for ski runs	Destruction of tree lines and other native vegetation and fauna habitat
Demand for increased resort capacity or expansion of area of resort leases to accommodate users, requiring additional land and water resources	Direct impact on natural values of the park (eg landscape, subalpine vegetation, old- aged mature snow gums and aquatic ecosystems); and impacts on some natural values of the park (eg subalpine vegetation, potential introduction of pathogens and weeds, nutrients in aquatic ecosystems, increased feral animal populations, etc)
Inappropriate development in karst areas	Degradation of the values associated with karst
Damage to soil and vegetation by development	Loss of scenic amenity of geological features, and flora and fauna habitats
Demand for more visitor facilities and services within the park, and additional infrastructure associated with public safety	New development using park areas that are currently in a natural state.
Social values	
Developments within or outside park	Impingement on visual and aural fields causes loss of feelings of remoteness in wilderness and other areas of park
Increased development (especially holiday homes) around margins of park	Loss of recreational opportunities; threat of fire
Demand for further (inappropriate) facility development to meet rising visitor levels, resulting in new development costs and high maintenance cost	Loss of low cost accommodation and associated recreation opportunities for park visitors who cannot afford expensive accommodation
Tourism and recreation values	
Developments within or outside the park that are directly visible, or cause noise or light pollution in semi-remote and remote areas	Loss of experience of remoteness and reduced quality of visitor experience of area as a natural environment
Demand for further or inappropriate development to meet rising visitor levels	Reduced quality of visitor experience of natural environments
Expanded development outside the park in adjacent shires, creating additional source of increased numbers of visitors using the park	Direct impacts on natural values and decreased opportunities to experience natural environment and isolation
Increased visitation attracted to the region around the park	Visitors may impact on local communities; the exact nature of pressures should be investigated as part of study proposed to better understand local community groups and values, and it may be positive or negative
Structural change or innovations in visitor and or infrastructure provided (eg, as experienced with snowboarding and mountain bike riding) with consequent new demands for expanded visitor facilitates and services	New impacts on natural and recreational assets

Key points

Expansion of development within the park for increased access and tourism infrastructure, both for summer and winter facilities and services (motivated mainly by commercial reasons) will increase pressure on the park's values. There may also be commercial pressure to expand snowfields resort areas. Management of these pressures needs to give priority to conservation of the core values of the park, on which sustainable tourism and high quality visitor experience depends.

Visitor use

Increased numbers of visitors have direct impacts. The ISC has identified pressures from visitor use on natural and cultural heritage, social values, and tourist and recreational values. These are shown in Table 19.3. More detailed explanations are given in the chapters concerning individual values.

Table 19.3 Pressures and potential impacts due to visitor use

Pressure	Impact
Natural values	
Increasing annual visitor numbers	Reduced capacity of the natural environment to assimilate changes or to recover
Increasing visitor use in wilderness areas	Loss of diversity in visitor opportunities that depend on relatively low levels of visitation; formation of pads, tracks and degraded campsites, increased spread of feral animals, plants and pathogens, increased human waste etc. Soil compaction, soil erosion etc
Increased summer tourism in the alpine and subalpine areas	Increased number of tracks, soil compaction and soil erosion, faecal contamination, demand for water, loss of aesthetic amenity and disturbance, meaning an increase in weeds and pest animals
Increased visitation in karst areas	Degrading cave and surrounding environments at Yarrangobilly and Cooleman Plains, and the Indi area (which will require liaison with Victorian agencies)
Increased use of ski resort areas in winter and summer	Damage caused by new infrastructure/facilities including increase in tracks, soil compaction, faecal contamination, demand for water, loss of aesthetic amenity, disturbance- influenced increase in weeds & feral animals, soil compaction and erosion
Visitors causing increase in tracks, soil compaction, faecal contamination and demand for water	Damage to all natural areas particularly subalpine ecosystems and frost hollows; loss of aesthetic amenity, disturbance-influenced increase in weeds and feral animals
Tourism and recreation values	
Increasing visitor use in wilderness areas	Loss of diversity in visitor opportunities that depend on relatively low levels of visitation; formation of pads, tracks and degraded campsites
Direct visitor impacts on water quality in high use areas	Health risks for visitors with increase in the occurrence and distribution of human pathogens such as *Giardia* and *Escherichia coli*
Visitor damage to recreation sites, the cycle of site hardening, and overuse of existing facilities and lack of maintenance	Decreased quality of visitors' experience of the natural environment; declining quality of visitor experiences; reduction in recreation use value for particular groups of visitors
Overcrowding or visitor facilities and services, especially near wilderness areas	Reduction in recreation values for particular visitor groups; loss of diversity of visitor opportunities that depend on relatively low densities of visitors; conflicts between visitor activities and competing demands for access to the same area for incompatible recreation impact on visitor experience
Cultural heritage	
Damage to cultural heritage items by visitors	Gradual attrition of Aboriginal and other cultural landscape features and structures.

Key points

Increasing visitor use has widespread implications for loss or degradation of the park's values. In particular, the increase in visitors in the alpine and subalpine areas in summer is seen by the ISC as the highest priority pressure that needs to be addressed by management of the park.

Management

Staff numbers, resources and skills need to be adequate to manage the identified values; however, the high demands of public expectations and administrative requirements are making inroads into the resources available for field management of the park. The loss of Kosciuszko National Park 'corporate knowledge' cannot be ignored as a factor that will affect the conservation of the park's values. Knowledge and expertise are being lost due to both reducing numbers of personnel and changes in employment patterns (e.g. the introduction of short-term employment opportunities).

Pressures identified by the ISC related to aspects of management of the park are shown in Table 19.4.

Table 19.4 Pressures and potential impacts due to management

Pressure	Impact
Management activities	
Activities such as weed spraying in karst areas, uncoordinated feral animal control, inappropriate fire regimes and road de-icing	Direct impacts on natural values
Management knowledge and skills	
Insufficient park management competencies across the agency in social and recreational aspects of management, and economic and concessions management; limited recognition of the full significance of natural, scientific and cultural values of the park in management	Degradation of values related to natural and cultural heritage; diminished recreational and social experience
Insufficient monitoring and research conducted by or for NPWS in relation to the natural and cultural values of the park	Degradation of values through inappropriate conservation practice
Management roles and resources	
Inadequate park management budget for the tasks of managing the values	Service's restricted ability to manage values and pressures
Expectation that NPWS should raise fees through tourism development to help meet costs of management	Diverts effort and causes conflict between the organisation's roles in values conservation

Key points

The park will need to institute a program of continuous development and retention of appropriate and adequate skills, knowledge, competencies and resources to manage the park's values; otherwise the process of management will itself be a pressure on the park's identified values.

Pressures on ecological processes

Pressures identified by the ISC on the natural ecological processes of the park include those related to catchment and hydrological processes, introduced plants and animals, and the fire regime. Each of these is a vast issue, for which the assessment carried out here has only been able to provide indicative comment. Table 19.5 summarises the pressures and impacts on ecological processes.

Table 19.5 Pressures and potential impacts on ecological processes and landscapes

Pressure	Impact
Catchment and hydrological processes	
Damming/diversion of rivers and streams	Vegetation invading riverbeds, major changes to aquatic ecosystems in many rivers, and 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. Ecological integrity has been greatly affected by the Scheme, both directly (through the changes to the natural flow regime) and indirectly (through the impacts of changes to hydrology, geomorphology and water quality).
Disturbance to catchments	Increased nutrient levels and sedimentation leading to change in species composition in the park's lakes and streams.
Introduced species	
Weed invasion	Loss of natural character leading to decrease in visitor experience of natural environment; increase in disease, fungi and pathogens that affect native species; displacement of native riparian vegetation by blackberries and willows; decline and potential loss of native species; changes in vegetation form and composition; alteration to animal behaviour including feeding, breeding, etc
Trampling and grazing by feral horses, pigs, deer, hares and rabbits	Changes in vegetation species composition and abundance for karst areas, riparian tracts, in lower subalpine areas and along roadsides in higher areas as a result of feral horses and rabbits; in frost hollows as a result of feral horse and pig disturbance. A general decline in habitats (at variance from the 'natural' condition) and may destroy some components, such as bogs, if left unchecked.
Introduced predators and their management	Various impacts (eg in alpine and subalpine areas, pigs and fox predation on broad-toothed rat; fox and cat predation on mountain pygmy possum), complicated by interrelationships between introduced species (dingoes, dogs, foxes, cats) and their impact on control programs aimed at one of the species
Introduced fish	Change in invertebrate species composition and elimination of native galaxiids in streams and lakes due to trout.
Fire	
Inappropriate fire management regime and fire suppression activities(eg use of heavy earth moving plant, back burning, prescribed burning, cumulative effects of imposed fire regimes)	Numerous and widespread impacts including fire suppression with heavy earth-moving plant damaging Pleistocene and Holocene landscapes, subalpine vegetation; inappropriate prescribed burning can kill snow gum stands, maintain understorey species composition and structure in a primary successional stage, enhance the spread of weed species; autumn prescribed burning may leave catchments bare, increasing turbidity and sediment loads in streams and rivers; wildfire suppression operations, particularly backburning, can destroy cultural sites.
Social and political misperception of appropriate solutions to fire hazard problems.	Reluctance to engage in ecological burns which are necessary to maintain or improve naturalness.
High fire intensities in karst areas	The presence of forest and understorey and steep slopes may result in high fire intensities and some destruction of surface karst features and some sediment transfer into caves and dolines
Fire regimes that cause the death of older eucalypts	Threat to the transition to old growth, disrupt large continuous eucalyptus sequences and prevent genetic interchange between separated communities.

Key points

Pressures caused by disturbance of catchments, the managed fire regime, and by introduced plant and animal species are causing substantial impacts on the park's biodiversity and the natural ecological communities by disturbance of the ecological processes on which their conservation depends.

There are major pressures on the ecological integrity of the park caused by catchment and hydrological pressures, invasive introduced species and inappropriate fire regimes that interrupt the natural ecological processes. Some of these pressures need the understanding of the community and there is need for a program that builds the community's capacity through involvement and understanding of the issues.

Cumulative effects of pressures

The ISC found that many of the park's identified values are subject to a number of pressures, and the cumulative, and possibly synergistic, effect of these needs to be considered in management. For example, the mountain pygmy-possum faces habitat loss from climate change and the demands of visitor use (ski resort development), and direct predation by foxes.

Key points

The cumulative effect of pressures on the park's values needs to be considered in management; most values are experiencing more than one pressure.

Values as pressures

Some pressures have been identified that might also be related to or part of some values of the park. Examples include the natural fire regime which is a value of the park as a natural ecological process, but the fire regime that is imposed in the park to achieve other management objectives can be a pressure on the natural values of the ecological communities.

Key points

Some pressures have been identified that might also be related to or be part of other values of the park; these need careful consideration and management.

Findings — pressures

The ISC makes the following findings in respect of pressures on the park's identified values.

General

- The park's natural heritage values underpin the majority of its other values, thus the pressures on its ecosystems and fundamental ecological processes such as increased development, fire management and introduced species have the greatest potential to affect the values of the park. The impacts increase in severity when these pressures are overlayed with increase in visitor use and intensification of regional development.
- While all parts of the park are affected by individual or cumulative pressures, the alpine and subalpine areas are the most vulnerable, and increased pressures from tourism and recreation activities and facilities are of particular concern.
- The pressures on the park's values demand adequate capacity within the NPWS and the understanding and support of the community to effectively manage the full range of the park's values.

Climate change

- The Kosciuszko National Park Plan of Management needs to recognise the implications of the climate change as a pressure on the park and incorporate a planned management response based on conservation of the park's values.

Development

- Expansion of development within the park for increased access and tourism infrastructure, both for summer and winter facilities and services (motivated mainly by commercial reasons) will increase pressure on the park's values. Management of these pressures needs to give priority to conservation of the core values of the park, on which sustainable tourism and high quality visitor experience depends.

Visitor use

- Increasing visitor use has widespread implications as the direct or indirect cause of loss or degradation of the park's values. In particular, the increase in visitors in the alpine and subalpine areas in summer is seen by the ISC as the highest priority pressure that needs to be addressed and mitigated by park management.

Park management

- The park will need to institute a program of continuous development and retention of appropriate and adequate skills, knowledge, competencies and resources to manage the park's values; otherwise the process of management will itself become a pressure on the park's identified values.

Pressures on ecological processes

- Pressures caused by disturbance of catchments, the managed fire regime, and by introduced plant and animal species are causing substantial impacts on the park's biodiversity and the natural ecological communities by disturbance of the ecological processes on which their conservation depends.
- There are major pressures on the ecological integrity of the park caused by catchment and hydrological pressures, invasive introduced species and inappropriate fire regimes that interrupt the natural ecological processes. Some of these pressures need the understanding of the community and there is need for a program that builds the community's capacity through involvement and understanding of the issues.

Regional land use

- The regional setting of the park brings pressures as intensified land use and new developments (stimulated by the existence of the park itself) potentially isolate the park as a natural area, and create edge impacts on the boundary areas of the park. These pressures require an inclusive regional management approach by the park's management rather than an introspective one.

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- The cumulative effect of pressures on the park's values needs to be considered in management; most values are experiencing more than one pressure.

Values as pressures

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