Day Two – Mountains For The Future
Landscape - Level Conservation For A World Heritage Site In Nepal

Pralad Yonzon

Resources Himalaya

Abstract

Despite eight natural world heritage sites in the Himalayas (India 4, China 2, and Nepal 2), many countries including Nepal request for more. Recently, Shey Phoksundo National Park (SPNP) in west Nepal, has been proposed. This study suggests that Dolpo of SPNP and Mustang of the Annapurna Conservation Area (ACA), are similar in geology, soil, climate, rainfall and vegetation. In addition, Mustang and Dolpo form a single block of tertiary sedimentary zone in Nepal. Comparatively, Mustang is much richer in flora and fauna than Dolpo. Twenty-eight endemic plants are localized in ACA against the 14 species of SPNP. Of 18 endemic butterflies of Nepal, 8 species of butterflies come mainly from Mustang and one from Dolpo. Rare species like argali (Ovis ammon hodgsoni), brown bear (Ursus arctos), kiang (Equus kiang) and Tibetan gazelle (Procapra picticaudata) are found only in Mustang. In summary, the checklist overwhelms in favor of Mustang for its high endemism, species richness and diversity. Therefore, recognizing SPNP alone for its inscription is not comprehensive. Conversely, Dolpo and Mustang, collectively called Nepal’s Tibetan marginal land which also constitute the southern margin of the Tibetan Plateau, can be proposed as one world heritage site, to benefit many mountain communities through landscape-level conservation.

Background

Despite eight natural World Heritage Sites (WHS) in the Himalayas, which are also protected areas (India 4, China 2, and Nepal 2), many countries press for more. WHC site inclusion still has a great media appeal and tourist attraction because of significant economic benefits through volume tourism. With these benefits, there is also a profound responsibility to protect and manage the site, which is held in trust for the entire world community (Hogan, 2001).

Nepal contains four WHS: two cultural and two natural. Of the two natural sites in Nepal, Sagarmatha National Park (area: 1,148 km²) was declared a world heritage site in 1979 in recognition of the significance of the world’s highest peak Mt. Everest (Sagarmatha), its associated flora and fauna, and the unique Sherpa culture. The Royal Chitwan National Park (area: 932 km²), enlisted in 1984 in the WHS, has outstanding universal value as it harbors endangered rhinos and tigers.

In 1999, the Ministry of Forest and Soil Conservation of Nepal proposed Shey Phoksundo National Park (SPNP, area: 3,555 km²) (Figure 1) to WHC for inscription. The report entitled ‘Nomination of Shey Phoksundo National Park for Inclusion on the World Heritage List’ produced six criteria for its inscription: three natural and three cultural. Under the natural criteria, the Park is considered to have biological uniqueness because of climatic differences, altitudinal variation, trans-Himalayan conditions, and different zoo-geographical regions.
This paper is based on the earlier Habitat Himalaya write-up, entitled “The inseparable Tibetan landscape of Nepal” (Yonzon, 2001). The intent of such re-examination of Shey Phuksundo National Park and Mustang of the Annapurna Conservation Area (ACA; area: 7,629 km²) (Figure 2), both belonging to one contiguous trans-Himalayan region, is to suggest landscape-level conservation of Nepal’s Tibetan marginal land is much better option for WHS than to protect a single protected area.
Cultural Context

The southern margin of the Tibetan Plateau, constitute Mustang of ACA and Dolpo of SPNP, collectively called Nepal’s Tibetan marginal land. Key areas of SPNP are Crystal Mountain, Lake Phoksumdo, and Shey Gompa, collectively referred as Dolpo (also, inner Dolpo). Mustang of ACA, is epitomized by Lo Manthang — one of the last remaining walled cities in Asia and a frontier for mountain tourism in the Himalayas (Gurung and DeCoursey, 2000). Established in the 15th century, the walled city (35 ha) has some 200 households and two 15th century gompas: Thubchen and Jhyampa (Rai, 1989).

Local history suggests that the Lo Kingdom entered into cultural and political relations with Bhutan and Ladakh in the 16th century. The Dholwa (residents) of Dolpo, show close similarities in their social structure to the Loba (residents) of Mustang as Dolpo was once under the dominion of Lo (Rai, 1989). Lo had intensive socio-political engagement with Tibet before it came under the sovereignty of Nepal at the end of the 18th century. Mustang was one of the 15 vassal states (Raiya) of Nepal, where the chief (Raja) was required to pay an annual tribute (Sirto) to the government and appropriate the remaining land revenue for himself (Regmi, 1978).

Physical Similarities

Mustang and Dolpo are characterized by similar geology, soil, climate, rainfall and vegetation. For example, the rain shadow of the Nepal-Himalaya is an area with under 400 mm of annual rainfall, which lies north of Kanjiroba, Dhaulagiri and the Annapurna massifs. This is where both Mustang and Dolpo form one contiguous area (8,793 km²) (fig. 3). It is important to note that the Crystal Mountain, Lake Phoksumdo, and Shey Gompa of SPNP and most of Mustang including Lo Manthang and Damodar Kund, lie in the rain shadow. The middle portion between Dolpo and Mustang is Tscharka Bhot. Similarly, of six geological zones in Nepal (Siwalik, Lesser Himalayan Crystalline, Lesser Himalayan Sediments, Central Crystalline, Major Tertiary Granites and Tertiary Sediments), Mustang and Dolpo form a single block of Tertiary Sedimentary zone (Land Resource Mapping Project. 1986) with an area of 11,843 km² formed between the Cambrian to Cretaceous period containing limestone, shale and quartzite (Fig. 4).

Figure 3. Rain shadow in SPNP – ACA region (Resources Himalaya, 2001)  
Figure 4. Tertiary sedimentary zone in SPNP – ACA region.
Issues of Conservation

The nomination report recognizes that Mustang of ACA, is probably similar to SPNP. Nonetheless, its subject matter hinges on Dolpo’s lower human population density, higher mean altitude and remoteness to suggest that isolation maintains ecology and culture intact. These are difficult to prove where a long history of human-related disturbance prevails (Yonzon, 1990). For that reason, remoteness and human-disturbance are not mutually exclusive. Regarding mean altitude area, Mustang is prominent, and not Dolpo (Table 1).

Table 1. High altitude areas with scant rainfall (Resources Himalaya Database, 2001).

<table>
<thead>
<tr>
<th>Elevation Gradient (m)</th>
<th>Rain Shadow Area with &lt; 400 mm of Annual Precipitation (sq. km)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Mustang (ACA)</td>
</tr>
<tr>
<td>2,000-3,000</td>
<td>65.7</td>
</tr>
<tr>
<td>3,000-4,000</td>
<td>753.2</td>
</tr>
<tr>
<td>4,000-5,000</td>
<td>1,198.4</td>
</tr>
<tr>
<td>&gt; 5,000</td>
<td>1,723.8</td>
</tr>
</tbody>
</table>

The report becomes contentious because Dolpo is championed unduly for its biological riches. For example, SPNP and ACA are known to contain 74 endemic plants which is 31% of the total endemic plants of Nepal (246 species) (Shrestha and Joshi, 1996). As 28 species are localized in ACA against the 14 endemic plants of SPNP, endemism is decisively higher in ACA than in SPNP (Table 2).

Table 2. Nepal’s endemic plants in the Tibetan marginal land (Shrestha and Joshi, 1996).

<table>
<thead>
<tr>
<th>Locality</th>
<th>No. of Endemic Plant Species</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Localized</td>
</tr>
<tr>
<td>ACA</td>
<td>28</td>
</tr>
<tr>
<td>SPNP</td>
<td>14</td>
</tr>
</tbody>
</table>

The report is even more failing in fauna. Butterflies are immensely influenced by high relief, narrow habitats and environmental constraints such as low ambient temperature and trace rainfall. Hence, they are biological indicators of specific environment. Of 18 endemic butterflies of Nepal, half of them, occur in Dolpo – Mustang region (Smith, 1994) suggesting the Tibetan marginal land is extremely important for endemism. Of 9 endemic butterflies, 8 species come mainly from Mustang while Dolpo has only one species that does not occur in Mustang (Table 3).

Table 3. Nepal’s endemic butterflies in the Tibetan marginal land (Smith, 1994).

<table>
<thead>
<tr>
<th>Endemic species/subspecies</th>
<th>Globally Known Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paralas nepalica</td>
<td>Dolpo</td>
</tr>
<tr>
<td>Parnassius cephalus horii</td>
<td>Dolpo and Mustang</td>
</tr>
<tr>
<td>Polyommatus nepalensis</td>
<td>Mustang</td>
</tr>
<tr>
<td>Albulina orbitulus lobbichleri</td>
<td>Mustang</td>
</tr>
<tr>
<td>Coenonympha amaryllis forsteri</td>
<td>Mustang</td>
</tr>
<tr>
<td>Parnassius epaphus capdevillei</td>
<td>Mustang</td>
</tr>
<tr>
<td>Parnassius acodris laurentii</td>
<td>Mustang</td>
</tr>
<tr>
<td>Synchloe sherpaee</td>
<td>Mustang</td>
</tr>
<tr>
<td>Crebeta lehmani</td>
<td>Mustang and Manang</td>
</tr>
</tbody>
</table>
Similarly, the Kali Gandaki River Valley, world’s deepest valley, is an integral part of Mustang, where all six Himalayan pheasant species are found and not in Dolpo. Regarding mammals, rare species like argali (Ovis ammon hodgsoni), brown bear (Ursus arctos), kiang (Equus kiang) and Tibetan gazelle (Procapra picticaudata) are not found in Dolpo. But, Mustang has it all (BCD Project, 1993; Koirala and Shrestha, 1997; Shah, 2001). Also, a new mouse hare (Ochotona lama) was discovered here (Mitchell, R. and Punzo, F. 1975). In summary, the list overwhelms in favor of Mustang whose importance cannot be denied for its high endemism, species richness and diversity.

Development Through Conservation

Historically, the Tibetan marginal land is recognized as one of the key physiographic regions of Nepal (Hagen, 1960; Bista, 1991) . However, only High Himalaya, High Mountain, Middle Mountain, Siwalik and Terai are recognized today and such impulsive planning have had isolated Nepal’s Tibetan marginal land and its people from many forms of mainstream development. Perhaps, recognizing Dolpo and Mustang together with Tscharka Bhot (area: 3,211 km²) as one contiguous WHS, may bring both conservation and development together.

Conclusion

The proposal to link Dolpo of SPNP with Mustang of ACA with Tscharka Bhot as the biological corridor to conserve a contiguous landscape of the trans-Himalaya region as WHS, is of utmost importance. A conservation effort of such nature, is not only to maintain its biodiversity but also to usher a long-term benefit to mountain communities by safeguarding their cultural heritage and identity.

References

Shrestha, T. B. and Joshi, R. M. 1996. Rare, endemic and endangered plants of Nepal. WWF Nepal.
Addressing Invasive Plant Species As A Threat To The Natural Values Of The Australian Alps: English Broom As A Case Study

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Summary

English broom, Cytisus scoparius, is an upright woody legumeous shrub native to western and central Europe. Outside of its native range, English/Scotch broom (broom) is an aggressive invader of a broad range of ecological habitats and mountainous vegetation communities. Since its introduction into the high country in the early 1800s, broom has naturalised over 150,000 hectares from those first few planting’s, and has had a significant impact on invaded habitats through the formation of a chokingly dense understorey monoculture. Broom has reached management priority within the Australian Alps national parks (AANPs) due to its threat to and impact on biological diversity and its virtually unlimited potential to spread throughout the whole biogeographical region. This paper will outline the development of a strategic response to broom within the Australian Alps and will use Victoria as a case study to illustrate how effective that response has been in affecting change.

Introduction

English broom

Broom was introduced into Australia around 1800, after Governor King requested broom seeds from England, which were to be grown and used as a substitute for hops (Hoskings et al 1996). Since its introduction, broom has become an aggressive invader of a wide range of ecological habitats. Broom’s success as an aggressive invader rests with its ability to survive on low levels of resource availability. A wide tolerance of soil conditions, temperature and rainfall regimes, the ability to fix nitrogen in the soil, two flowering periods and the ability to set seed over a wide altitudinal range have contributed to its spread (Williams 1981). The absence of predators has also contributed to the spread of broom in south eastern Australia.

Broom is a prolific seeder with 2 flowering periods (spring and autumn). It is estimated that each mature plant produces on average 26,000 viable seeds per year, the majority of which are stored in a soil seed bank characteristic of broom infestations. There can be up to 50,000 seeds per square meter in the soil (CRC Weeds 2000). The latest viability figures for broom seeds stored dry stands at 80 years.
**Broom In The Australian Alps**

**Introduction of English broom to the Australian Alps**

Over 180 years ago an innocuous looking plant, English broom, was introduced into the Australian Alps. The early graziers, miners and timber getters who opened up the Alps nurtured in their settlements various plants that held either sentimental, aesthetic or more practical value. English broom, valued for its sentimental links to the ‘old country’ and prized for its showy yellow flowers, was among these plants. Evidence also exists that English broom, with other species like willows and poplars, were used as slope stabilisation and erosion mitigation techniques throughout the goldfields of the high country (Fallavollita and Norris 1992).

In more recent times the introduction of broom seeds into the AAlps has been attributed to park users, including, bushwalkers, horse riders and 4WD enthusiasts and the use of broom infested fill material. The movement of cattle has also been suggested as contributing to the introduction of broom into the Australian Alps.

**Distribution of broom within the Australian Alps**

The current distribution of broom within the Australian Alps reflects its symbiotic relationship with the vectors of introduction and spread. Consequently broom infestations are found at old townships; camp sites, along tracks, trails and watercourses

Broom occurs throughout the Alpine National Park in Victoria, Kosciuszko National Park in NSW and Namadgi National Park in the ACT. The distribution of broom is reflected in the following table:

<table>
<thead>
<tr>
<th>AREA</th>
<th>INFESTATION CHARACTERISTICS</th>
<th>TOTAL AREA INFESTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpine NP Victoria</td>
<td>Dense and Widespread.</td>
<td>Over 150 000 hectares</td>
</tr>
<tr>
<td>Kosciuszko NP NSW</td>
<td>Generally characterised by scattered, isolated infestations.</td>
<td>Over 20 000 hectares</td>
</tr>
<tr>
<td>Namadgi NP ACT</td>
<td>Generally characterised by scattered, isolated infestations.</td>
<td>Approximately 1000 hectares, 5000 hectares potential infestation</td>
</tr>
</tbody>
</table>

Table 1: Details of significant broom infestations in the Australian Alps.

**Impact of broom in the Australian Alps**

Broom has a significant impact on invaded habitats, primarily through the formation of dense understorey monocultures. Broom desciminates biological diversity, out-competing most native understorey species and restricting the regeneration of the forest trees endemic to the area. Several species of rare and endangered flora are under threat from broom.

Broom impacts on recreational pursuits in the Alps by restricting access to watercourses, tracks and trails, significantly increases fire hazard, and provides harbour for feral animals. Broom also has the potential to degrade the water quality and hence catchment values of the Australian Alps, through the displacement of indigenous flora.
The Strategic Response To Broom

The invasive potential of broom has long been known. English broom was considered naturalised by 1887, and was declared a noxious weed in 1901.

To date the strategic response to broom by public land management agencies can be characterised by three broad eras, ‘going it alone’, ‘agency support’ and the era of cooperation.

Going it alone

Over the many years of management of the high country prior to the establishment of park agencies and the AALC weeds such as English broom were controlled in an ad hoc, reactive poorly planned manner (Grenier and Good pp351). There was a lack of coordination in the control of weeds, both between neighbouring land managers and within the whole biogeographical region.

The control programs were most often based on the application of herbicides and the effectiveness of these programs reflected the application technologies available. Prior to 1970s, spray technology was antiquated and it wasn’t until the adoption of diaphragm pumps in the late 1970s early 1980s that the widespread control of weed species became practical (Sedgman pers. com.). The limited and toxic nature of chemicals available for use against woody weeds and the increasing awareness of their detrimental impacts, not only on the environment, but also the health of the operators, also hampered the effective widespread and comprehensive control of English broom prior to 1970s. Integrated weed management, while perhaps occurring on an informal ad hoc basis, certainly hadn’t reached the vernacular of the land managers of the day.

Agency support

The formal declaration of the high country as national parks in each respective state and territory brought with it a degree of strategy towards the control of exotic plant invaders such as broom. The New South Wales National Parks and Wildlife Service has given a strong commitment to pest plant management since the declaration of the Kosciuszko National Park in its current form in 1967, of which broom has been identified as one of the highest priority weeds to control. Both the ACT and Victorian governments developed management plans for their parks in the late eighties, early nineties that gave representation to the need to manage invasive weed species. However each park agency still operated ostensibly independently despite facing the same challenges across the same biogeographical region.

Australian alps liaison committee

The signing of the MOU and the birth of the Australian Alps Liaison Committee (AALC) in 1986 saw the start of a coordinated strategic approach to the management of English broom in the Australian Alps. The Broom workshop held in the same year at Barrington Tops in northern NSW highlighted the need for both strategic planning and integrated management when addressing broom.

Fallavollita and Norris

In 1992, the AALC commissioned the first comprehensive study into the occurrence of broom in the Australian Alps national parks. The report by Fallavollita and Norris represented a significant turning point in the strategic management of broom. For the 9 years before it was reviewed, the report gave direction and a best practice guide to park ranges in the Australian Alps national parks. The report also consolidated the significant achievements of broom control in Kosciuszko and Namadgi National Parks and gave hope to those areas of the Alpine National Park in which broom appeared to be winning.
Tumut workshop

The English broom workshop held at Tumut in 1997 represents another turning point in the strategic management of English broom in the Australian Alps. The workshop gave land managers an opportunity to take stock of their progress in controlling broom. Two significant outcomes resulted from the Tumut workshop which we define the new strategic direction of broom control. The first was the perceived need to update the 1992 Fallavolita and Norris report and the second was to identify the need to implement the widespread biological control of English broom in the Alps.

Biological control

Biological control involves using one living species (natural enemy) to control or suppress an unwanted species (target). Classical biological control, or the introduction of broom’s natural enemy from Europe, was identified as an important integrated control techniques to limit the growth and spread of broom in the Alps. CSIRO had completed comprehensive testing into the host specificity of these agents, secured permission to release a suite of (to date) four agents and had conducted field trials in both Kosciuszko and Namadgi National Parks. Trials in the Alpine National Park were conducted by the Victorian Keith Turnbull Research Institute.

Post Tumut, commitment was given by the AALC, and a strong partnership of stakeholders in Victoria to facilitate the widespread establishment of biological control agents as part of IWM at suitable broom infestations throughout the Alps. The English broom biocontrol program forms a cornerstone of the strategic response to broom within Victoria today.

Broom Management Strategy for the Australian Alps National Parks

In 1998/1999 the AALC commissioned a review of the occurrence of English broom in the Australian Alps and the development of an integrated broom management strategy for use by field staff. The goal of the strategy was to assist land managers minimise the impact of broom within the AAmps. The strategy built on the earlier Fallavolita and Norris report and incorporated information and ideas on the best practice management of broom, gleaned from outstanding work such as the 1997 Barrington Tops broom control strategy and current research findings. It was written through close consultation with past and present land managers and reflected the many lessons learnt the hard way in the Kosciuszko broom mopprogram over the past 30 years. The strategy represented a ‘new breed’ of management plan that endeavoured to set out the actions and resources required to implement the ‘best practice’ management of broom.

Protecting the natural treasures of the Alps

In 2000, the AALC, through the Natural Heritage Working Group, established a project to document the significant natural features of the Australian Alps and identify and rank the threats to them. Peter Coyne’s project “Protecting the natural treasures of the Australian Alps” identified the significant natural features, identified threatening processes, current and potential, and ranked the magnitude of threat. Out of a list of almost 100 threats encompassing pest plants and animals, land degradation and habitat destruction through to climate change, English broom was identified as the number one most significant threat to the natural treasures of the Australian Alps.

Has Strategic Planning Made A Difference?

Case study – broom control in the Alpine National Park, Victoria.

The Eastern Unit of the Alps has arguably the worst infestation of broom in SE Australia, certainly in the Alps. The broom infestation, originating in the abandoned gardens and goldfields of the Glen Wills area, has spread 130 km downstream (Fallavolita and Norris 1992). It is characterised by dense, thick mature stands and approximately 45 Kilometres of this infestation borders the Alpine National Park (ANP). While the control of broom has been addressed in the area with varying degrees of commitment and
capacity for decades, in the broom season of 2000, Parks Victoria used the Broom Management Strategy for the Australian Alps national parks (McArthur, 2000) to guide their control programs.

The availability of the strategic plan has enabled Parks Victoria’s Alpine District to secure more funds and to better direct available resources. Investment in the broom control program has increased 5 fold in the last 3 years since the strategy was developed, and a dedicated English broom project officer for the Eastern Unit of the Alps has been appointed.

The strategy has facilitated a more pro-active and forward thinking approach to broom control within the ANP. It has facilitated a large icon project, Protecting the Pathways to the Alps, concerned solely with the integrated control of broom within the ANP. The program has largely removed the control of broom from the pressures of the normal pest plant programs. Protecting the Pathways to the Alps strongly supports the use of biological control in strategic areas and reaffirms Parks Victoria’s commitment to long-term integrated broom management.

On the ground, the strategy has enabled a containment line to be maintained around the heart of the infestation, and a prevention and eradication program to operate outside this area, where mainly scattered and isolated broom plants occur.

The last 3 years also seen great advances in the cooperative and cross-land tenure management of broom in areas adjacent to the ANP advocated by the broom management strategy. Industry bodies such as Goulburn-Murray Water and private landholders, united in the landcare movement, have joined forces with Parks Victoria and the Department of Natural Resources and Environment to address English broom issues.

Discussion

History shows that the strategic and repeated control of broom is effective in securing the progressive eradication of broom, while the ad hoc nature of reactive management will have dire consequences. The success of the broom control program conducted in Kosciuszko National Park over the past 20 years indicates that the containment and eradication of broom is a manageable and achievable goal if resource allocation is well directed and committed for long term management. Strategic planning helps to facilitate this.

At the very least, the success of our strategic response to broom lies in affecting change, empowering natural resource managers and increasing the understanding and awareness of both the visitors to and communities of Australia’s magnificent mountain landscapes.

References


Ecology Of Disturbance: The Effect Of Tourism Infrastructure On Weeds In The Australian Alps

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Abstract

Tourism is a major form of land use in the Australian Alps national parks. A range of tourism infrastructure has been provided within the region by state and territory governments (through protected-area managers and traffic authorities), local governments, and tourism operators. The construction, maintenance and use of roads, tracks, picnic areas, buildings and other artificial structures often cause disturbance to natural vegetation. Such disturbances can favour the establishment and spread of weed species. The majority of the 175 alien plant taxa in the Australian Alps are found in disturbed areas: along roadsides/walking tracks (78% of taxa) and around resorts (58%). Around 20% of these taxa are naturalised; that is, able to reproduce and grow in the absence of further human activities.

The potential of different types of infrastructure to favour weeds over natives needs to be taken into consideration. This applies to the provision of walking tracks, which are long, linear disturbances through natural vegetation.

When upgrading or providing new tracks, the choice of track surface type may largely be influenced by initial construction cost. However, the ongoing cost of managing impacts (e.g. weeds) associated with various types of surface needs to be considered during the decision-making processes. Recent research by two of these authors has compared weed cover and loss of natural vegetation associated with four different walking track types: gravel tracks, concrete pavers, unformed tracks and raised steel metal walkways. Variation in the area of disturbance (weed cover and bare areas) associated with each track type was found. Gravel tracks were associated with the greatest area of disturbance (the Summit Road had 4292 sq. m of disturbance per km of track, and narrower gravel tracks had 2942 sq. m per km). For pavers there were 2682 sq. m of disturbance per km. Unformed tracks created much less disturbed area per km of track (266 sq. m per km), though the extensive network of unformed tracks in the alpine area (~106 km) meant that potentially 28,400 sq. m are disturbed. The raised steel metal walkway had the lowest impact on the vegetation, with only 62 sq. m of disturbance per km (47-fold less than the narrow gravel track), despite having the heaviest use of any of the track types. It is clear from this that the disturbance associated with some track types results in green weed verges and bare areas. These require costly ongoing management (e.g. spraying or rehabilitation). A more effective option would involve selecting tourism infrastructure that causes minimal disturbance during construction and use.

These results illustrate that more consideration needs to be given to ensuring environmental sustainability in the provision of tourism infrastructure in the Australian Alps national parks.
**Natural area tourism**

Tourism is the most rapidly growing industry in the world (Worboys et al. 2001; Newsome et al. 2002). It accounts for 12% of global gross national product, or around US$4.8 trillion dollars (Newsome et al. 2002). One of the fastest growing sectors of the tourism industry in Australia and overseas is tourism to natural areas, including national parks (Newsome et al. 2002). This incorporates nature-based tourism, where viewing nature is the primary objective; adventure tourism; wildlife viewing; ecotourism; and cultural tourism, where the cultural landscape or built environment occurs within a national park. In Australia, the primary objective of park agencies is to conserve the natural and cultural values of protected areas (Worboys 1997; Worboys et al. 2001; Eagles et al. 2002; Newsome et al. 2002; Worboys and Pickering 2002). However, they must also provide tourism and recreational opportunities where they foster the visitor's appreciation and understanding of the natural and cultural value of protected areas (Worboys 1997).

Tourism and recreation activities in national parks, along with the infrastructure provided, should be environmentally as well as socially and economically sustainable (Eagles et al. 2002; Newsome et al. 2002; Worboys and Pickering 2002). However, there is often inadequate knowledge and understanding of the negative impacts that tourism infrastructure can have on the natural environment (Worboys et al. 2001; Eagles et al. 2002; Newsome et al. 2002). Research into environmentally sustainable tourism has shown that there is a range of negative direct and indirect impacts of tourism (Buckley et al. 2000; Eagles et al. 2002; Buckley et al. In press). Research in the Australian Alps by the Cooperative Research Centre for Sustainable Tourism is examining impacts of a range of tourism activities and facilities, such as snow manipulation, camping, trampling, horse riding, resorts, track types, and the generation of human waste. In particular, the resilience of native vegetation to disturbance is being quantitatively assessed. In this paper, we report on the relationship between weeds and tourism infrastructure in the Australian Alps, and describe recent findings of research into the impacts on native vegetation of different track surface types.

**Tourism infrastructure and weeds in the Australian Alps**

Infrastructure associated with tourism in the Australian Alps provides habitat for a wide range of non-native plants. In a recent review of alien plants in the Australian Alps (Johnston and Pickering 2001a), 175 non-native plant taxa were recorded in the Australian Alps above 1500 m. Of these, 78% were found along roadsides and/or paths, and 58% in the resort areas. Some species, such as the clovers (Trifolium arvense, T. dubium, T. pratense, T. repens, T. ambiguum, T. glomeratum, and T. hybridum) and some grasses (Agrostis capillaris, A. stolonifera, Dactylis glomerata, Festuca rubra, Lolium perenne, Phleum pratenses, Poa annua, P. pratense and Avena sp.) were deliberately introduced for use in rehabilitation (Johnston and Pickering 2001a). Others, such as broom (Cytisus scoparius), lupins (Lupinus incanus) and attractive daisies (Chrysanthemum parthenium, Anthemis punctata, Leucanthemum spp.) have been deliberately planted in gardens in and around resorts and other buildings (McDougall and Appleby 2000; Johnston and Pickering 2001a; Pickering et al. In press). There are also large scale weed infestations around some parks facilities such as Waste Point in Kosciuszko National Park (Author obs.).

In the recent biodiversity survey, 35% of the total flora recorded were 146 non-indigenous taxa found in the 27 sq. km area from Thredbo Village to the top of Mt Kosciuszko (Pickering et al. In press). The vast majority were associated with tourism infrastructure. Within the garden areas of Thredbo Village 103 taxa that are not indigenous to the region were recorded, mostly deliberately planted. In the disturbed areas around the resort, again non-indigenous taxa predominated, with 49 out of the 51 taxa recorded not native to the area. On the ski slopes there was also a relatively high diversity of non-indigenous taxa, with 29 identified (30% of the species recorded on the slopes).

The presence of so many non-indigenous taxa within a national park is of concern. Among these taxa are species that could potentially spread from garden beds into adjacent disturbed areas, and even into the natural vegetation, becoming environmental weeds. A high diversity of non-indigenous flora has also been found for the ski resorts in Victoria, creating similar issues for the management of the adjacent national parks (McDougall and Appleby 2000).

**Why are weeds a problem?**
Weeds are one of the most serious threats to Australia's natural environment (COA 1999). They can have a range of negative impacts, including displacement of native species and modification of ecosystem functioning. Specific impacts include acceleration of soil erosion, alteration of fire regimes, limitation of the recruitment of native species, alteration in geomorphological process, acceleration of extinction rates of rare and threatened flora and fauna, alteration in the hydrology of a ecosystem, alteration in the nutrient content of soils, and effects on herbivory rates (Carr et al. 1992; Csurches and Edwards 1998; COA 1999; Low 1999).

Intact native vegetation is thought to be relatively resistant to weed invasions (Csurches and Edwards 1998; COA 1999). However, once vegetation is disturbed, weeds can become established (COA 1999). The disturbance may be natural, but if weed propagules are present then weeds can become established, altering natural cycles (Csurches and Edwards 1998). Alternatively, anthropomorphic disturbance, such as clearing of vegetation for the provision of tourism infrastructure, can alter ecological processes and favour weeds (Csurches and Edwards 1998; COA 1999; Johnston and Pickering 2001a). In some cases, weed propagules can be deliberately or accidentally introduced during the construction and use of the infrastructure. Problem weeds tend to have high reproductive rates, vegetative growth and tolerance to a wide range of growing conditions. These characteristics make them highly competitive in the bare ground created by disturbance (Csurches and Edwards 1998). Continued use of an area can promote weeds because of repeated disturbance that results in damage to vegetation, and in some cases, because of increased nutrification from human waste and other materials.

Examples of impacts of environmental weeds in the Australian Alps are: alteration of stream ecology (willows); displacement of native species (broom and yarrow); alteration of behaviour of native wildlife, such as feeding (willows and blackberries); alteration of the visual appearance of natural areas (ox-eyed daises, lupins, sorrel, dandelions and yarrow); and changes in soil chemistry (introduced clovers) (AALC undated; Sainty et al. 1998; Johnston and Pickering 2001a, 2001b).

**Walking tracks, native vegetation and weeds**

When providing infrastructure such as walking tracks it is important to take into account environment impacts, as well as direct financial costs and social issues (safety, visitor preferences etc.) (Worboys et al. 2001). For example, there is variation in the impact of different track types on the native vegetation, particularly in relation to the presence of weeds and bare areas. Recent research in the Kosciuszko alpine area compared the impacts of four track types on the native vegetation: (1) unformed trails (former bridle paths or paths formed by tourists walking off hardened tracks); (2) gravel tracks, including both sections of the Summit Road and Charlotte Pass to Blue Lake track; (3) concrete pavers; and (4) raised steel mesh walkway. We compared species richness, bare area and cover of weeds between quadrats located under/on the track, on the verge and in the adjacent native vegetation (Hill and Pickering Draft manuscript).

Seven species of weed were associated with paved and gravel tracks: sorrel (*Acetosella vulgaris*), dandelion (*Taraxacum officinale*), flatweed (*Hypochoeris radicata*), white clover (*Trifolium repens*), browntop bent (*Agrostis capillaris*), Muller’s bent (*Agrostis muelleriana*), and swamp bent (*Agrostis* sp.). These weeds formed extensive cover along the verge of the concrete pavers and gravel tracks (40% of verge of pavers were weeds, and 20% of verge of gravel track). Only one weed, the naturalised species sorrel, was found on the verge of the raised metal walkway, (just 0.29% of the verge). However, this is the same as in the adjacent native vegetation. No weeds were associated with the unhardened track.

The total area of disturbance associated with each track type also differed. This has important implications for management decisions about new tracks or the upgrading of existing tracks. For each kilometre of unhardened track there was 266 sq. m of disturbed area, mostly bare ground on the footpad itself. If the unhardened track were to be replaced by pavers, then the area of disturbance (weed cover and bare ground, including the track) would actually increase ten fold, to 2682 sq. m free of native vegetation per km of gravel track. If gravel were to be used to replace unhardened tracks, then the area of disturbance would be even more, 11 fold greater than the informal track (2942 sq. m free of native vegetation per km of gravel track). For the Summit Road, the area free of non-native vegetation is even greater, at 4292 sq. m. If, however, an unhardened track were to be replaced with a raised steel mesh walkway, then the area of disturbance would decrease by 400%, to only 62 sq. m of non-native vegetation.
(bare areas and weed cover) per km of this track type. Moreover, in the sample studied, this is similar to the amount of bare areas and sorrel cover in the adjacent native vegetation and hence does not appear to be a consequence of disturbance caused by the walking track.

If the New South Wales National Parks and Wildlife Service was to control the extensive weed cover associated with tracks in the alpine area by rehabilitating the verges of the tracks, the cost would be $50,827 per km of paved track, $41,246 per km of narrow gravel track, and $32,078 per km for the Summit Road (using an estimate of $119 per sq. m for rehabilitation, Johnston 1998). There is no need for rehabilitation to control weeds for the raised steel mesh walkway. Clearly, if the cost of weed control (estimated as cost of revegetation) during use of the tracks is incorporated into their total cost then, even though the cost of construction of the raised steel mesh walkway is initially greater than that of gravel (Harrigan 2001), the total cost of this option is cheaper than that of other track types. In addition, it has far fewer negative impacts on the environment. This cost effectiveness becomes even more apparent if estimates of future removal of any of the tracks are taken into consideration. The cost of just rehabilitating the area of disturbance associated with the surface of the gravel or concrete pavers tracks is substantial. For the Summit Road it would be around $510,600 per km, while for a narrower gravel track it would be around $153,900 per km. For the raised steel mesh walkway little or no rehabilitation would be required, because the vegetation cover under and adjacent to the track is equivalent to the native vegetation.

What to do?

Currently, much of the control of weeds in the Australian Alps is by herbicide spraying, which is expensive, has limited success for some weeds, and may harm native vegetation (AALC undated; Forman and Alexander 1998; Sainty et al. 1998; Sanecki 1999). More recently, biological control programs have been introduced for weeds such as broom, St Johns Wort, Paterson’s Curse and blackberry (AALC undated). Also, parks agencies are encouraging resorts to use indigenous plantings rather than exotic plants, both on ski slopes and in the gardens (Pickering et al., In press). Active rehabilitation of previously disturbed areas is also critical for weed control (AALC undated; Parr-Smith and Polley 1998). While this tilts the ecological balance in favour of native vegetation, it can be expensive. In addition to these measures, we feel that careful selection of tourism infrastructure options is crucial. This should be based on a greater appreciation of the environmental and financial cost that can be incurred, in terms of disturbance to native vegetation and the introduction and establishment of weeds, when one form of infrastructure is chosen over another.

Acknowledgements

Much of this research has been supported by the Cooperative Research Centre for Sustainable Tourism. The support of the New South Wales National Parks and Wildlife Service for the research of Frances Johnston is also gratefully acknowledged.
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The Significance Of Mountain Catchments To Society
The Australian Alps Catchments

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Abstract

The Australian Alps and high mountain ranges yield relatively small total amounts of water to our streams and rivers but as the driest inhabited continent on earth this small yield contributes much to the quality of life of almost all Australians. As well as being the headwaters of the largest permanent flowing rivers in south-eastern Australia the catchments of the Alps and high mountains are also the catchment for thousands of tourists, bushwalkers and backpackers, and people seeking recreational, educational and inspirational pursuits.

As with other major continental mountain catchments around the world, the Alps and high mountain catchments of south-eastern Australia (and Tasmania) are also ‘catchments’ for biological diversity and centres of endemism, particularly that of the alpine plants. These mountains have also been the ‘catchment’ for thousands of years for the ceremonial activities of Aboriginal people, and for the past 180 years, European people, utilising the natural resources abundant in the high mountain and alpine environments. The mountain catchments play a very significant role in the social and economic well-being of Australian society.

Introduction

Mountain areas make up 24 percent of the earth’s land surface and support approximately 28 percent of the world’s closed forests. Some 550 million people live in high mountain areas around the world, being an integral part of mountain environments. A further two billion people have a close affinity with or attribute some form of deity to high mountain peaks, or have some reliance upon mountains, particularly the mountain catchments for drinking and irrigation water, hydro-electricity, recreation and education, and their physical well-being. Mountain areas around the world are usually considered in terms of being the headwaters of major rivers and the water yield they provide – the water towers of the world.

But mountain catchments are more than water catchments, as they are ‘catchments’ for biological diversity, plant and animal endemism, and significant ecosystem functions and environmental services. Mountains are also catchments for other cultural, recreational, spiritual, social and economic values. These values are a response to the very geographical features that define mountains – ruggedness, remoteness, extreme climates, soil and vegetation zonation and plant species diversity in both form and adaptation to the ecological extremes under which they have evolved.

Mountain areas around the world usually constitute a relatively small proportion of river basins, yet they provide the greater part of rivers flows downstream. Like other continents this is also the situation in Australia.
As the demand for fresh water increases, the potential for conflict over the source, yield and subsequent use of water from mountain catchments grows. While there is no potential international conflict over water resources in Australia, there is increasing conflict over the equitable sharing of water between environmental and commercial demands, and the sustainable use of water.

In the past the grazing of domestic stock in the Australian alpine catchments resulted in extensive disturbance and degradation of the native vegetation cover and over large areas, severe soil erosion. Grazing has now all but ceased in the alpine catchments, only occurring in several areas in the southern part of the Alps in the State of Victoria.

The grazing impacts have been replaced by the increasing development taking place within the mountain catchments, to provide for tourism and recreational activities. This is placing a renewed pressure on the soils, vegetation and water yields of the catchments. Management conflicts are increasing, hence careful management of mountain water resources must become a national (and global priority) in a world moving towards a water crisis in the next century.

**Alps catchments for water yield**

The world’s total freshwater reserves are in the order of 36 million Km\(^3\) but the rivers and lakes of Australia, hold and carry only about 0.007 percent of this total fresh water (34.5 billion m\(^3\)), or less than 9 percent of the annual flow of the Amazon.

The high mountain catchments of southeastern Australia cover a little over 25000sq km with 5200sq km being within alpine and subalpine elevations. (snow-covered for 1 to 3 months). These catchments are very efficient in capturing and delivering to rivers and streams, over several months, up to 1000mm of the annual total precipitation of 1800 to 2500mm. The catchments yield the greater part (approx 65% or 8000 to 10000 gigalitres) of the inflow to the Murray, Murrumbidgee and Snowy River systems. Of this water yield, 3780 GL of the Murray River flows are diverted to off-river uses and 2350 GL from the Murrumbidgee River. The bulk of the water is used for irrigation (approx 95%) with the remainder being used for stock and domestic requirements and for industrial use.

**The Murray River catchments**

The Murray River has its source about 45 Kms southeast of Mt Kosciuszko. The major NSW tributary rivers are the Swampy Plains River and the Tooma River which also arise in the Alps. The major Victorian mountain tributaries are the Mitta Mitta River and the Kiewa River. The Hume Dam on the Murray River and Dartmouth Dam on the Mitta Mitta River above Hume Dam store and regulate the downstream delivery of flows for irrigation, urban use and environmental purposes.

The mountain catchments above Hume Reservoir cover less than 1.5% of the total Murray-Darling Basin but yield about 38% of the total annual inflow to the Murray. About one third of the water yield is from the Mitta Mitta catchments in the Victoria alpine area and two thirds from the upper Murray catchments in the New South Wales alpine area. The total annual flow in the Murray is very low by world standards, for example the average annual flow is less than 3.5% of that of the Mississippi River and less than 0.25% of the Amazon. Approximately 66% of Murray River flows are diverted annually, providing water for irrigation over approximately 700000 ha. along the river downstream of Hume Dam.

**Murrumbidgee River Catchments**

The Murrumbidgee River rises in the Snowy Mountains north of Mt Kosciuszko where the headwaters are captured by Tantangara Dam and diverted to Eucumbene Dam from which is released for hydroelectric generation through the Murray and Tumut River systems.

The largest dam downstream of Tantangara Dam is Burrinjuck Dam, which stores, and regulates releases of approximately 1026GL annually to the Murrumbidgee and Coleambally Irrigation Areas and several smaller adjoining irrigation areas. The major tributaries to the river above Burrinjuck Dam are the Numeralla, Bredbo Goodradigbee, Cotter, Molonglo and Yass Rivers. Below Burrinjuck Dam the major
A tributary is the Tumut River which contributes natural flows and that diverted through the Snowy Mountains Hydroelectric Scheme from the upper Murrumbidgee and Snowy Rivers, into Blowering Dam. This Dam stores 1628GL of natural river flows, and additional waters released from the Snowy-Tumut section of the Snowy Mountains Hydroelectric Scheme.

The irrigation agriculture industry is the greatest user of water from the regulated Murrumbidgee River with the annual volume of water diverted for consumptive use being in the order of 2350 gigolitres or approximately 50% of natural flows. Approximately 2800 ‘irrigation’ farms, covering some 561000 hectares occur within these irrigation areas, with around 150000 hectares being irrigated each year.

At the lower end of the Murrumbidgee River the Lowbidgee Irrigation District covers an area of some 400000 ha, encompassing a floodplain area in excess of 160000 hectares, including large areas of significant riverine wetlands.

**Catchments for Hydro-electricity generation**

The Alps and high mountain catchments provide water to two hydroelectric schemes, the Snowy Mountains Hydroelectric Scheme in New South Wales and a smaller scheme, the Kiewa Hydroelectric Scheme in Victoria.

The much larger Snowy Scheme has an installed capacity of 3740000 kilowatts with an annual output of 5000 million kilowatt hours. It utilises almost 2500GL of water annually which is then stored and regulated for irrigation use.

**Social and Economic benefits of water diversion**

A very large and significant economic benefit accrues for the community from power generation and the agricultural production from the irrigation industries. The annual farm-gate returns from irrigation farming in the Murray and Murrumbidgee Valleys are in the order of $1.8 to $2.5 billion annually. The irrigation industries also contribute greatly to the quality of life and well-being of the rural and urban populations (almost 300000 people) along the rivers, as well as those of Sydney, Melbourne and Adelaide, through the provision of many everyday food products.

More than two million people depend directly on the Murray and Murrumbidgee Rivers for domestic water supplies with a further 250000 dependent on the major tributaries for water supplies. South Australia as the driest State is almost totally dependent on the Murray River for its further economic development.

Over 50% of South Australia’s water is diverted from the Murray, and piped to Adelaide, Port Pirie, Port Augusta, Whyalla, the Yorke Peninsula and towns as distant from the river as Woomera and Keith. In drought years up to 90% of South Australia’s water demands are met by diversion from the Murray River.

Hydro-electricity generated from waters captured in the Alps catchments contributes a small but very significant amount (approx 5000000 kilowatts) to the national electricity grid, this being valued at approximately $175 to $250 million annually. The significance of the hydroelectric schemes lies not in the dollar value of the electricity generated but the ready contribution the schemes make to peak load demands.

The mountain catchments as such contribute greatly to the economic well-being of society but the catchments are more than water catchments, being ‘catchments’ of significant biomes, native plant species diversity and endemism. They are also catchments of some unique plant and animal adaptations to extreme environmental conditions.
Mountain Catchment Biomes

As with mountain areas around the world the Australian Alps biomes are unique – the combined effect of rapid changes in altitude, climate, soil and vegetation over very short distances make them different from other biomes. An indication of the extreme climatic variation exhibited in all mountainous areas is that a rise in elevation of 100 metres is comparable to about 100 kilometres change in latitude. The rapid rise in elevation is sufficient to produce altitudinal zonation in the vegetation communities, particularly that evident in the zonation of the dominant Eucalypts, with different species occurring in defined elevation ranges and aspects.

Catchment biological diversity

Mountains are biologically diverse and of the 187 world centres of biological diversity more than half occur in mountain regions (Davis et al, 1995). The Australian Alps are identified as one of these centres with more than 500 plant species occurring within the Alps catchments of which 380 occur in the alpine and subalpine zones.

Plant endemicism is high in all mountain regions around the world, (about 5%), but plant endemicism in the Australian Alps at approximately 11% (Good 1992), is of particular note in comparison to other continental mountain regions. The Alps flora, particularly the alpine zone flora is unique on a world scale as it differs greatly in botanical composition, the level of differentiation, species richness and internal botanical zonation. Below the very diverse alpine zone the flora is dominated by a single genus (Eucalyptus), which has adapted to conditions from the highest elevations of the subalpine zone (the treeline) to the coast; this adaptation to the full elevation range and environmental conditions by a single genus is unique in the world floras.

The eucalypt woodlands, particularly at the higher elevations play a very significant role in the capture of precipitation and hence water yield, and in the stability of much of the mountain catchments.

While the number of native fauna species is low, which contrasts with other continental mountain areas, eight fauna species are endemic to the alpine and subalpine zones. Several of these species have restricted distribution ranges in the Alps catchments. eg Mountain Pygmy Possum Burramy parvus, Corroboree Frog Pseudophryne corroboree and Broad-toothed Rat Mastacomys fuscus. The Alps catchments as such capture, protect and maintain a unique genetic resource, but mountain catchments are more than water and biodiversity catchments; they are catchments for human enjoyment, recreational and educational use, and inspiration.

Educational and recreational – catchment opportunities

The diversity of the mountain landscapes provide for a wide range of recreational, educational, cultural and inspirational opportunities. The Alps attract and capture some 3 to 4 million visitors each year in pursuit of these opportunities.

The Alps have also been a catchment for much scientific research over the past 100 years and are now arguably, the most researched natural area in Australia. Over 2500 scientific and technical papers have been written on research undertaken within the Alps and this research has contributed greatly to ecological understanding and the establishment of principles for ecological sustainability in Australia.

Environmental resources and benefits

The natural systems of the Alps catchments are very significant and in many ways unique in the context of world mountain areas. A defining feature of the Alps catchments is the well developed soil cover which exists over almost all areas, to the highest peaks. This deep organic soil cover of the alpine and subalpine zones plays an important role in catchment hydrology.

The groundwater communities, the fen and bog areas where deep organic peatbeds have developed, are particularly significant in the storage and slow release of snowmelt waters to the streams and rivers and
ultimately to the hydroelectric schemes. The catchments are very stable under this complete soil and vegetative cover, but very minor impacts from external influences can lead to rapid deterioration of the ecosystem services that they provide. In the lower mountain catchment areas where eucalypt forests and woodlands dominate the landscape, the heavy ground litter layer provides a similar ecosystem service in terms of water yield and water quality. The water yield from the catchments provides for thousands of hectares of wetland watering and floodplain inundation downstream on the riverine plains. The environmental services / benefits provided by functional natural wetlands have been estimated to be valued at up to $1500 to $2000 per hectare or an estimated total economic benefit to society of up to $400 million.

**Catchment management**

Catchment stability and functionality are very sensitive to disturbance from factors, particularly where these are continuous or concentrated eg grazing, recreational activities, development sites, and changed fire regimes. Fire, due to the extensive nature of occurrence, poses the greatest threat to mountain catchment stability and the natural ecosystem services they provide.

Grazing has almost gone from the high mountain catchments but the increasing pressure of visitation and recreational activities has replaced grazing as a major detrimental impact influencing the long-term functionality of catchments and the ecosystem services they provide.

Several notable catchment rehabilitation and ecological restoration programs have been achieved over the past 40 years (Good 1992, 1999) and the rehabilitated catchments must not be allowed to degrade again under the pressure of human use. While the catchments are ‘catchments’, for water and human use the management of both without detriment to the natural catchment values is essential if society is to continue to benefit from the mountain catchments.

Many lessons have been learnt from past inappropriate management and the successful rehabilitation / management programs and these must continually be addressed in future mountain catchment management

**Summary - mountain catchment values**

Mountain catchments have many recognisable values and provide or contribute to many ecosystem services of economic and social benefit to society. The value of maintaining and protecting mountain catchments can therefore be recognised in a number of ways:

- through the natural physical features and biota, and the cultural history which provide for recreational, educational and inspirational opportunities. Mountain recreation and tourism is estimated to be valued at up to $750 million annually.
- in terms of the value of the water yield - water is now a tradeable commodity and at an average figure of between $40 and $120 per megalitre, the catchments can be valued at a minimum of $400 to $500 million annually, for water yield alone.
- in terms of the value of health and well-being of a large proportion of the community that utilise the mountains, which is estimated to be in the order of $100 to $200 million annually.
- in terms of the value of hydroelectricity generated (up to $250 million annually)
- in terms of agricultural production from irrigation farming, valued at up to $2.5 billion annually
- in terms of ecosystem services - functional wetlands provided for by discharges from mountain catchments alone are valued at about $400 million annually
- in terms of the total economic and social benefits estimated to be in the order of $4.5 to $5 billion dollars annually.
Reference


Snowy Mountains Hydro-Electric Scheme: Corporatisation and the Way Ahead

Nicole Shotter and Carol Bruce

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Carol Bruce – EMP Project Manager, Snowy Hydro Limited

Abstract

The Snowy Mountains Hydro-electric Authority (SMHEA) was established as a Commonwealth statutory authority in 1949 to construct, operate and maintain the Snowy Mountains Hydro-electric Scheme, much of which is located in the Kosciuszko National Park (KNP). From 1949 to 28th June 2002, the scheme remained under Commonwealth control and was not subject to NSW legislation.

As part of the national electricity market reform, in 1993 the Council of Australian Governments (COAG) agreed to corporatise the SMHEA. On 28th June 2002 corporatisation was achieved, creating the company Snowy Hydro Limited (SHL).

The activities of SHL have been subject to NSW legislation since 28th June 2002. With this in mind, a series of agreements between the NSW National Parks and Wildlife Service (NPWS) and SHL were developed through the corporatisation process of the past few years. These agreements, known as the KNP Package, are designed to provide a framework for the on-going management and operation of the scheme.

The ongoing and future relationship between NPWS and SHL is firmly focused on managing the iconic Australian resource that is the Scheme in the equally iconic fragile mountain environment of KNP.

Snowy Mountains Hydro-Electric Authority And Corporatisation

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KNP Package, are designed to provide a framework for the on-going management and operation of the scheme.

The KNP Package includes:

- Snowy Park Lease and Schedule of Existing Developments (administered by Planning NSW);
- Snowy Roads Maintenance Agreement;
- Snowy Management Plan;
- Minor Former Scheme Sites Deed; and
- Major Former Scheme Sites Management Deed

In addition to the KNP Package, approximately 35 documents were developed as part of the corporatisation process in various other packages:

- Corporate Package
- Water Package
- Debt Package
- Tax Package
- Transfer Orders
- Transmission Undertaking Package
- Blowering Package
- Miscellaneous Package

Of particular interest is the Water Package, which includes the Snowy Water Inquiry Outcomes. The Snowy Water Inquiry Outcomes include the return of environmental flows to the Snowy River below Jindabyne Dam and montane streams within KNP. The Department of Land and Water Conservation is the NSW agency responsible for administration of the water agreements.

Of the KNP Package, the Snowy Park Lease and Roads Maintenance Agreement are principally commercial documents.

The Snowy Park Lease provides tenure for SHL’s operations and in association with a Schedule of Existing Developments (SED) details all of the scheme’s current developments and activities. All activities listed within the SED are ‘deemed’ by the Snowy Hydro Corporatisation Act 1997 (NSW) to have complied with Part 5 of the Environmental Planning and Assessment Act 1979 (NSW). SHL therefore do not require approval from the NPWS to undertake the activities listed within the SED.

The Roads Maintenance Agreement provides for the maintenance arrangements of those roads used by SHL within the park, whether they may be public, park management or snowy exclusive roads. The agreement includes a set of road maintenance guidelines which detail how both organisations must undertake road maintenance works on roads listed in the agreement.

The remainder of the documents in the KNP Package, the Snowy Management Plan and two former scheme site deeds, are the focus of this paper and are presented in detail below.

Each of the day to day operational documents between NPWS and SHL (Lease, Roads Agreement and Snowy Management Plan) has an associated committee, comprised of NPWS and SHL personnel. The role of each of the committees is to guide the ongoing relationship between NPWS and SHL and manage any issues as they may arise. The committees aim to continue the cooperative working relationship that has been established between NPWS and SHL in past years.
Snowy Management Plan

The Snowy Management Plan (SMP) is a plan of management under Part 5 of the National Parks and Wildlife Act 1974 (NSW) and recognises that the current Kosciuszko National Park Plan Of Management (KNP PoM) did not adequately provide for the existence and operation of the scheme within the park. The SMP and KNP PoM are related documents and reviews of either must recognise the content of the other. The SMP however, deals exclusively with the operation of SHL in the park.

The SMP places general obligations (with respect to maintenance of developments and fire response) on SHL as well as the obligation to develop an environmental management plan (EMP). The purpose of the EMP is to address how SHL will environmentally undertake the activities listed within the SED ie those activities ‘deemed’ to comply with Part 5 of the EPandA Act, commensurate with the location of the activities within a national park.

The EMP must:

- contain clear accountability for its implementation;
- demonstrate that an environmental assessment identifying environmental risks has been undertaken and a subsequent programme for risk reduction has been implemented; and
- demonstrate that a performance monitoring programme is in place.

In addition, SHL must:

- base the EMP on sound and credible information;
- improve the EMP; and
- with NPWS, monitor the effectiveness of the EMP.

The EMP is to be a 15 chapter plan which will be developed by SHL and reviewed and approved by NPWS. Development is to be staggered over the next three years, with all chapters completed and implemented by June 2005. The EMP requires SHL to detail how it will meet environmental obligations and responsibilities for the 15 chapter issues. The NPWS will be able to enforce the approved EMP through an associated regulation. The existing National Parks Regulation 2002 (NSW) may also be applied to SHL activities within the park.

The 15 chapter headings of the EMP are:

- Aboriginal Heritage
- Aircraft Management
- Emergency Management (including fire management)
- Exotic Species (flora and fauna)
- Historic Heritage
- Public Health
- Water Quality
- Threatened Species and Significant Features
- Tourism, Recreation and Public Use
- Cabramurra
- Tunnel/aqueduct maintenance including desilting
- Road Maintenance
- Operational spoil dumps and quarries
- Landscape (including soil and vegetation management)
• General environmental management

For each EMP chapter, the SMP details the NPWS management objectives for the scheme and the minimum content required in the first draft of the chapter (refer to Figure 1). Where possible, the chapters focus on NPWS and SHL cooperative activities. These activities are generally aimed at implementing Park wide strategies for the various issues.

This approach is highlighted in the exotic species chapter with the requirements for SHL to develop:

• a strategy to manage noxious and environmental weeds in accordance with NPWS priorities and strategies;
• a statement of NPWS and SHL cooperation with respect to exotic species management; and
• notification procedures between NPWS and SHL.

To ensure the final content of the chapters provides the maximum benefit to both NPWS and SHL, development of the chapters is being undertaken in a cooperative manner. Both organisations have developed small dedicated teams for each individual chapter and these teams meet and communicate as required.

As adoption of the EMP is to be staggered over the first three years of corporatisation, the SMP also places interim obligations upon SHL with respect to ‘deemed’ activities. These obligations stipulate that from the date of corporatisation until approval of the relevant EMP chapter, SHL must comply with all laws and accepted current practices.

To ensure that the EMP remains relevant, the SMP stipulates a time frame and process for the subsequent reviews of each chapter. The timing of the review process varies based upon the subject matter of the individual chapter. For example, the chapters on emergency management, public health and water quality must be reviewed every second year. In comparison, the chapters on operational spoil dumps and quarries, and general environmental management need only be reviewed every ten years. Provision has also been made for chapters to be amended more frequently should both NPWS and SHL agree that such an action is required.

All new activities proposed by SHL, ie any activity that is not listed within the SED, must be the subject of an application for approval in accordance with the requirements of any applicable law.
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<td>2. To prevent the replacement of native species by exotic species within the Areas.</td>
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<td><strong>Fauna</strong></td>
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<td>3. To reduce the impact of pest animals on native animals and their habitat, and native flora in the Areas.</td>
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<td>4. To minimise disturbance, destruction and displacement of native fauna by exotic fauna in the Areas.</td>
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<td><strong>Flora</strong></td>
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<td>5. To contain and control the spread of weed species in the Areas.</td>
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<td>6. To minimise loss of habitat for fauna species within Areas.</td>
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<td>a) the Laws applicable to the containment and control of exotic species, pest animals and weeds species within the Areas; and</td>
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<td>b) the noxious and environmental weed species within the Areas.</td>
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<td>2. A strategy to control and manage noxious and environmental weed species in the Areas developed in accordance with NPWS weed management priorities and strategies within the relevant management units.</td>
</tr>
<tr>
<td>3. A strategy to minimise and control the planned and accidental introduction of exotic flora species into the KNP that:</td>
</tr>
<tr>
<td>a) Specifies procedures to minimise disturbance to the natural environment within the Areas when the Company carries out operations including road works, quarrying, construction and maintenance;</td>
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<tr>
<td>b) Includes an appropriate revegetation policy for the Areas; and</td>
</tr>
<tr>
<td>c) Includes procedures for minimising chance introductions of plant materials or pathogens, including procedures for machinery wash down and the use of seed free materials.</td>
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<tr>
<td>4. A plan for the control of exotic fauna within the Areas that specifies:</td>
</tr>
<tr>
<td>a) the procedures the Company will adopt to identify, minimise and control exotic fauna species including rabbits, starlings, goats, deer, non-native rats, house mice, foxes, cats and oriental weather loach; and</td>
</tr>
<tr>
<td>b) the Company’s participation in co-operative management of trout in any conservation streams specified by NPWS.</td>
</tr>
<tr>
<td>5. A statement as to how NPWS and the Company will cooperate in relation to the management of exotic species.</td>
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<tr>
<td>6. Notification procedures between NPWS and the Company with respect to all the matters above.</td>
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</tbody>
</table>
**Former Snowy Scheme Sites**

The corporatisation project identified numerous former scheme sites within the park. These sites have resulted from the construction period of the scheme and the majority still require some form of rehabilitation. Required rehabilitation ranges from the need to remove a snow pole to extensive geotechnical rehabilitation of large spoil dumps and quarries.

Of the 400 or so former sites, 36 have been designated as ‘major’ sites requiring extensive rehabilitation. The remainder are designated ‘minor’ sites and require rehabilitation to a lesser degree. A major site is generally one that may potentially breach NSW legislation. Minor sites are not thought to breach NSW legislation.

During the corporatisation process, the three corporatisation governments (State of New South Wales, State of Victoria and the Commonwealth of Australia) agreed that NSW and more specifically NPWS were responsible for managing the land and any rehabilitation works required, and for any liability arising from either major or minor former sites. The exception is any liability arising under the *Contaminated Land Management Act 1997* (NSW) due to the scheme’s occupation of the site, for which SHL retains responsibility.

The minor sites category includes areas such as snow courses, weather stations, passive reflectors, radio stations, communication cables, roads, transmission lines, former works centres/depots, former townships/camps/construction sites, sandblasting areas, waste disposal areas, borrow pits, quarries and spoil dumps.

The predominant issue on minor sites is weed invasion, however other issues such as waste removal, erosion and native revegetation will need to be addressed on many sites. NPWS operational staff and contractors will undertake the rehabilitation of minor sites.

The major sites category includes areas such as spoil dumps, quarries, a former township and a waste disposal area. An independent investigation designated the major sites as potentially breaching NSW legislation. Issues identified include stability, erosion and sediment transport, hydrology, watercourse, water quality, flora and fauna, noxious and environmental weeds, solid waste, heritage, visual amenity, access during rehabilitation works, safety during rehabilitation and disposal/importation of material.

The investigation suggested an initial estimate of $78 million as the cost to rehabilitate the major sites to an agreed level based on what rehabilitation could potentially be undertaken in a practical sense. The NSW and Commonwealth agencies involved in the investigation acknowledged at the time that it would be extremely difficult and require an extensive financial input to rehabilitate the sites back to a standard commensurate with the surrounding national park.

As part of the corporatisation process, SHL is required to pay the NPWS $32 million towards the rehabilitation works for both major and minor sites; $25 million for major sites and $7 million for minor sites.

The difference between the potential original rehabilitation costs and the funding actually received poses a significant challenge for NPWS. The challenge will be to develop a program for the major sites that will achieve the best environmental outcome possible for the park within the funding available. It is proposed to meet this challenge by undertaking a risk assessment of the major sites as an overall project and basing any rehabilitation works on the results of that assessment.

Due to the size and complexity of the major sites, a dedicated project team will most likely be established to manage the project. In addition to NPWS, other relevant NSW agencies such as Department of Land and Water Conservation, Department of Fisheries, Environment Protection Authority will be involved as required.

Both the minor and major site rehabilitation projects will focus on long term rehabilitation, endeavouring to achieve the best environmental outcome possible across the full range of sites, on the funding provided.
A case study of both minor and major sites, and the range of issues and potential rehabilitation works required, is provided by the Happy Jacks group of sites. The Happy Jacks area is located approximately in the centre of KNP, approximately 2.5 km north of the Jagungal Wilderness area. Five major sites and four minor sites are located immediately adjacent to the Happy Jacks management trail.

The major sites include four spoil dumps and one quarry. Each of the spoil dumps contains material excavated during construction of the Happy Jacks Shaft and Eucumbene-Tumut Tunnel between 1954 and 1959. The spoil dumps range from a vertical height of approximately 30m to approximately 70m. The largest spoil dump has an estimated spoil volume of 300,000 m$^3$. The Happy Jacks Quarry, with an area of approximately 3 hectares, was used to manufacture aggregate for Tumut Ponds Dam, the Eucumbene-Tumut Tunnel, and the Tumut 1 Pressure Tunnel, also between 1954 and 1959.

Issues identified on the four major spoil dumps and single quarry include geotechnical stability, erosion and material transport, on-site hydrology, lack of native revegetation, lack of appropriate material to promote revegetation, weed invasion, watercourses obstruction, potential water quality issues, solid waste, heritage. In addition, associated issues such as access to sites, safety during rehabilitation, material requirements/disposal and data limitations will need to be addressed.

The minor sites include one spoil dump also formerly used as a crusher site by NPWS, a former township and two borrow pits. Issues identified include erosion and surface water run-off (spoil dump), lack of native vegetation growth (spoil dump and borrow pits) and weed invasion (all sites).

Rehabilitation of the major sites and any non-weed issues on the minor sites will likely be undertaken as a single project. The first stage in the planning of the major sites rehabilitation project will be for a risk assessment of all sites to be undertaken. The rehabilitation strategy that is ultimately implemented must be based on a risk assessment approach. Based on such a strategy, there is a potential that large geotechnical works will not be undertaken on the majority of the larger spoil dumps and quarries. Rehabilitation may instead be required to focus on ensuring long term stability of the site, weed management and encouragement of vegetation growth. A large component of the project will likely be long term monitoring of the sites.

**The Way Ahead**

The relationship between NPWS and SHL is two tiered with NPWS playing the role of both lessor and regulator. To ensure that this relationship works and produces the best environmental outcomes for the park at the same time as the best possible outcomes for the business of SHL, open communication between the two organisations is vitally important at all levels. Both organisations recognise the importance of ensuring the long term viability of the park and the scheme within the park.

The ongoing and future relationship between NPWS and SHL is firmly focused on managing the iconic Australian resource that is the Scheme in the equally iconic fragile mountain environment of Kosciuszko National Park.
Thatching The Roof Of Australia: Landscape Manipulation And History

Dr Michael Pearson

Heritage Management Consultants

Abstract

The conservation of the Main Range area in what is now the Kosciuszko National Park had its genesis, in the large part, in the movement to protect the catchments arising in the NSW Alps. The interests of the NSW Soil Conservation Commission, the nature conservation movement and the Snowy Mountains Authority converged to drive the moves towards grazing restrictions, erosion control and rehabilitation, and national park gazettal over a thirty year period.

The ways in which the history of this long process is recorded and interpreted to visitors to the park, and how the physical evidence of the process are conserved and interpreted, are issues of interest when considering the assessment and management of cultural heritage values of the Alps. The manipulation of the landscape to achieve stable catchments is a matter of fact—the manipulation of the history of that process to hide the role of the human hand in the creation of the current landscape is an ongoing threat.

Background

This paper, which concentrates on the Main Range within Kosciuszko National Park, is based on work undertaken for the Australian Heritage Commission to develop a nomination for the Snowy Mountains Scheme for the Register of the National Estate1. The generosity of Roger Good in sharing his great knowledge and memory is gratefully acknowledged.

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Map 1 - The Main Range showing the location of the treeline (roughly equating with area of soil conservation work)
Graziers were sending stock into the Snowy Mountains from at least the mid-1830s. Dr Gibson lost a stockman and cattle to a blizzard in the Kiandra area in 1834, and in 1839 T.A. Murray moved cattle from his Yarralumla property through the Brindabellas to the high plains around Coolamine². Summer grazing in the higher snow country became desirable from the mid-1860s, as stock numbers in the surrounding districts grew. By the mid-1880s the mountains could be described by one observer during a dry summer as ‘overcrowded with sheep’. Cattle were increasingly taken into the mountains, able to be run on steeper country than the sheep, and it was mainly cattle that were responsible for the degradation of the Main Range. The grazing was not officially regulated until the passing of the 1889 Crown Lands (Amendment) Act, in which snow leases were established. By 1893 some 81,000 acres of country adjacent to Mount Kosciuszko was divided into 22 snow leases³.

The Main Range land surface is commonly covered with loose soil and stones. The soil, thicker than in many other alpine environments, is derived from decomposed granitic rocks and is highly erodable. The elevated exposed location slows and limits plant growth, so that any disturbance of vegetation tends to take a very long time to recuperate. These factors, combined with the considerable slope of much of the land and the prevalence of summer rainfall delivered in heavy downpours, means that exposed soil is rapidly eroded. Once freed of its insulating blanket of vegetation, the soil is far more prone to frost-heave which in turn accelerates erosion.

Map 2 - Scale of cattle movements in 1954-55 season

³ Hancock 1972: 136
The freeze-thaw cycle also disturbs seedlings, making it very difficult for bare areas to revegetate naturally. The impact of grazing on the environment of the Main Range was enormous, with stock grazing the native vegetation, trampling and causing drying and erosion of the moss beds and bogs, introducing exotic weeds, and through all this enabling the substantial loss of topsoil through erosion. By the 1940s the high country had large areas of grazed land marked by sheet erosion, and with deep erosion gullies marking the habitual routes of stock movement and of tracks cut by the stockmen’s horses.

A number of converging interests combined to promote the conservation and landscape rehabilitation of the Main Range area. Myles Dunphy had been leading a campaign since the 1930s to have a ‘Snowy-Indi National Park’ created, based on the nature conservation and wilderness values of the area. Schemes to utilise the rivers of the regions for hydro-electric power generation and irrigation purposes went back to the nineteenth century, and were gathering strong support during the early 1940s. The creation of the Hume Weir and reservoir on the Murray River in 1936 led to the first direct moves to protect the upper catchments of the river through their reservation as state forests.

Utilisation of the upper Snowy River became a policy platform for the NSW Parliament opposition in 1941, and when William McKell became Premier later that year the protection of the Snowy Mountains catchments became a government priority. The head of the Soil Conservation Commission, E.S. (Sam) Clayton, was instrumental in formalising the direction of this policy. Clayton took McKell and the Minister of Lands, J. M. Tully, for a two-week ride through the Snowy Plain area on the Gungarlin River, to stress to them the damage that would be done if a closer settlement proposal then being promoted should go ahead. Clayton argued for the cessation of grazing leases and the transfer of the area to a Board under the Department of Lands administration.

McKell’s immediate response was to instruct Clayton to use the forthcoming review of leases (in June 1943) to achieve a two-thirds reduction in the stocking rate in the high country and to decide a safe carrying capacity for each lease and permissive occupancy. A Bill for the creation of a State Park followed shortly afterwards. The park idea has been credited in part to the influence of the Director of Physical Education, Gordon Young, who saw it as an opportunity to create a protected playground comparable with Jasper National Park in Canada, but the genesis of the idea leads back to Myles Dunphy’s campaign.

On introducing the Bill in 1944, Minister Tully emphasised three principles:

the permanent preservation of all water catchments in the Park;
the permanent reservation and development of the Park for recreation and the enjoyment of the people; and
the controlled use of the park for pastoral purposes, consistent with the first two principles.

From 1944 onwards the battle to remove grazing from the park was fought mainly from a catchment protection perspective, though strongly supported by the nature conservation objective. Ironically, the State Park Trust argued for the continuation of the high altitude snow leases in the face of mounting opposition, because lease fees was one of the few sources of revenue available to it through the Department of Lands.

A key factor reinforcing the need for catchment protection and rehabilitation was the advent of the Snowy Mountains Scheme, and of the Snowy Mountains Authority which had the political clout and financial resources to implement its objectives. The long history of plans for hydro-electricity and irrigation water
The Commonwealth Government in 1946 directed officers of the Departments of Works and Housing and Post-War Reconstruction to investigate the proposal put forward by O.T. Olsen of the State Electricity Commission of Victoria. The recommendations of that investigation led to the setting up in late 1947 of the Commonwealth / States Technical Committee to pursue the proposals for utilising the waters of the Snowy and Murrumbidgee for power generation and irrigation. The key aspects of post-war reconstruction, of which the Snowy Scheme was to be a major component, were to include:

- the maintenance of full employment by judicious use of public works, of which the Snowy Scheme was to be the prime example;
- the promotion of economically viable agriculture (while placing 9,000 ex-servicemen on the land), of which the Snowy-fed irrigation schemes were a part;
- bolstering manufacturing by tariff barriers, but also by facilitating the required infrastructure, such as a guaranteed power supply substantially augmented by the Snowy Scheme; and
- the use of immigration to stimulate overall development, targeting continental Europeans, many of whom went straight to the Snowy Scheme.8

After much debate and political posturing by the states about the various options for the extent of the scheme, a plan was finally adopted by the Committee in November 1948, and the recommendations of its report were approved by the relevant Governments in July 1949.9 The Commonwealth’s Snowy Mountains Hydro-Electric Power Act came into force on 7 July 1949, bringing into being the Snowy Mountains Hydro-Electric Authority (SMHEA) 10.

William (later Sir William) Hudson and the other Commissioners of the new Authority were keenly aware of the risk to the Scheme from siltation of its dams, and took action to reduce erosion from construction sites by cleaning them up after use.

Sam Clayton worked closely with the Authority, and Hudson, to broaden their understanding of the erosion issue, and it is this prompting that led to Hudson’s strong support for the cessation of grazing in the high country. The two men combined in the campaign to stop renewal of leases in the high altitude areas (above 1370 m) in 1958. The SMHEA overcame the State Park Trust’s reluctance to forgo the revenue from snow leases by making up the cash shortfall, though in a clever twist it was agreed that the Authority’s contribution would be transferred from the State Park to the Soil Conservation Commission to do erosion control and rehabilitation work in the Park.11

The success over the snow lease issue, however, was not the end of grazing—the State Park did not have the staff to patrol the park, and the ban was virtually ignored by many graziers. It was not until 1969 that grazing was finally made illegal within the Park, when the new National Parks and Wildlife Act, with stronger land management teeth, came into force,12 and the last leases were not terminated until 1972.

**Erosion Control and Revegetation**

The history of rehabilitation and revegetation of the high country has been one of trial and error13. Work by the Soil Conservation Commission (SCC) started in a small way in 1959, and increased considerably by 1962, funded by the SMHEA contribution to the State Park coffers, which were transferred to the SCC programs. Initial surveys found that some 5,560 hectares of minor to severe sheet erosion occurred along

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11 Hancock 1972: 164-161.
13 based on Good 1996 and personal communication 29/9/00.
the Main Range between Dead Horse Gap and the Schlink Pass Road, the worst areas being between Mt Kosciuszko and Mt Twynam.\textsuperscript{14} Initial attempts utilised standard soil conservation solutions developed for agricultural lands, involving contour banks and drains, rock-paved drains, and the sowing of European exotic grasses and clovers. The rehabilitated area was fertilised, and mulched with sterilised hay, which was held down with galvanised wire netting pegged into place. The first area worked on, and most effected by this technique, was around Carruthers Peak, where evidence of the approach can still be seen on many slopes. It was found that the high fertiliser rate inhibited the growth of native species adapted to low-nutrient levels, and actually caused native species to die back from the revegetation areas. The mulch, if applied too early in the season, insulated the soil and prevented its warming, inhibiting germination of seed, and the high humidity in the mulch contributed to fungal growth which attacked native seed. It was later found that another problem with the method was the release into the soil of zinc from the galvanised wire netting, causing zinc toxicity in soils with normally a very low level of the element\textsuperscript{15}. Early experiments on the slopes of Mt Carruthers also investigated the potential of tree propagation. A plot of \textit{Pinus mugo} was planted, stunted specimens of which survived for 30 years before their removal.

Figure 1 - Stone-lined contour bank and drain on Main Range walking track, Carruthers Peak, 2002

\textsuperscript{14} Irwin, F. 1991. \textit{Above the treeline: how the high country was rescued}, Soil Conservation Service of NSW, Sydney.
\textsuperscript{15} Good 1996
By the late 1960s it was recognised that the use of exotic species was not a viable long-term solution in the high country, neither practically nor philosophically. Native plant propagation trials started in 1967, and between 1969 and 1972 some 500,000 peat pots of montia \((Neopaxia spp)\) were over-planted on stabilised areas. It was then found that direct planting of small amounts of sod was just as successful as planting propagated stock, and later still that seeded mulch also worked.

Improved techniques were introduced as the soil conservation and revegetation work moved slowly north along the Main Range in the period between 1959 and 1973. The overall area needing such work extended from Mt Kosciuszko to the Bulls Peak area 35 km to the north, and 10 km east to the Ramshead and Perisher Ranges. New methods of holding down the mulch were tried, including black steel mesh, paper netting, plastic polymers, biodegradable nylon netting and water soluble anionic bitumen. The latter proved to be the best solution, consolidating the mulch long enough for the enclosed seed to germinate and become established, then breaking down over two or three years. The use of rock drains and dams in eroded water courses was replaced where feasible with jute mesh and sod laying\(^16\).

The Carruthers Peak area was revisited late in the program, and some areas of wire mesh were removed, and native species over-planted. Most exotics have now disappeared and been replaced by natives, though some white clover and exotic fescues survive, and Caucasian clover has become a pest species\(^17\).

The mark of successful soil conservation and revegetation work is that it is not noticed, and this is generally the case with the high country rehabilitation works. Apart from rock-work in erosion gullies (most of which is now buried by siltation), most rehabilitation work is invisible to the casual observer. However, the evidence is still there to be seen in the landscape if the right information is provided to the observer.

In a number of areas, but on Carruthers Peak in particular, can be found areas with decaying wire and later fabric netting, revegetated contour drainage banks, some stone lined, still visible on the slopes, and the many steel stakes used as monitoring reference points. These features are clearly seen, for example, from the Main Range track above Blue Lake and across Carruthers Peak.

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\(^{16}\) Roger Good, pers comm 29/9/00

\(^{17}\) Roger Good, pers comm 29/9/00
The landscape has been stabilised, but, as Roger Good points out:

‘...it will be many years before the full diversity of native species is to be found in each rehabilitated vegetation community. In a number of sites, such as the erosion feldmark areas, stable feldmark-like communities have replaced tall alpine herbfield communities. Thus these changes have led to the creation of a mosaic of vegetation communities somewhat different to the pre-grazing communities. While a stable native vegetation does exist in the restored fen and bog communities it will be decades before these bogs and fens recover their functional capacity in terms of groundwater storage and slow release of water to the streams and rivers.'

Good also points out that maintenance of the rehabilitation work, necessary for the long-term recovery of the alpine areas, has lapsed over the last five to ten years, leading to decline in the native vegetation cover, and the start of active erosion in a few locations.

Acknowledging the history of conservation on the Main Range

From the heritage assessment viewpoint, the substantial erosion control and revegetation work along the Main Range has considerable historical significance. It represents a major shift in soil conservation thinking in coming to grips with an Australian environment and conserving it rather than manipulating it with exotic species. The work is an important part of the overall Snowy Mountains Scheme, and indicates the degree of concern for catchment protection associated with the Scheme’s development. It also is indicative of shifting public and, more importantly, political attitudes to the protection and appropriate use of natural environment areas of high heritage value.

The soil conservation work has had a major impact on the alpine landscape, though most observers would not be aware of it without access to the historical information that makes the signs visible. The work has put a bandaid on the wounds inflicted by grazing, but the underlying scar will take much longer to heal. The simplistic interpretation of the program is that it has returned the Main Range to its natural state. However, this is clearly not the case. The area will never be in the state it was in before grazing, though it will eventually develop the species diversity and ecological and hydrological processes that replicate that state to varying degrees.

In a manner similar to the often blinkered interpretation of wilderness, there is a risk that the Main Range may be interpreted to the public as a ‘natural’ area, and the history of degradation and rehabilitation will be ignored or glossed over. The Main Range is not part of a gazetted wilderness area, but the parallels in thinking are worth considering. The identification of an area as ‘wilderness’ often results in a conceptual and management position that defines an area of land as being devoid of human history and having evolved in the absence human processes, regardless of the demonstrated facts about the human use of the area. Aboriginal landuse practices are simply regarded as part of the ‘natural’ state, regardless of the extent of ecological impact it may have had. Evidence of ‘modern’ human landuse is either ignored or actively removed. Tom Griffiths has argued that the definitions of ‘wilderness’ rely at their core on the look and feel of an area, and that ‘... “wilderness” need not be actually ancient, pristine and timeless; it just needs to seem so.’

In the case of the Main Range, the undoubted scenic beauty and high natural values of the high country dominate the conceptualisation and interpretation of the area. In that context the historical processes that have led to the present character of the Main Range could be overlooked as irrelevant distractions, or worse, could be actively suppressed in the interpretation of the area to visitors. This tension between natural history and cultural history, and natural conservation and cultural conservation, has been explored by others.

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In trying to see how NPWS is dealing with this tension, I looked at what information about the landuse history and rehabilitation of the Main Range was readily available to the visitor at the NPWS Jindabyne headquarters visitor display, at the Charlotte Pass car park, and on the Main Range Track. The interpretation panels at the Jindabyne Visitors Centre included information about the history and impacts of grazing, but nothing about the post-grazing soil conservation rehabilitation work. Similarly, the NPWS leaflets and brochures available there contained no information about the post-grazing rehabilitation work. Upon asking the very helpful counter staff if anything on the Main Range soil conservation work existed, I was given a very informative and well illustrated brochure put out by the Soil Conservation Service of NSW, but this came from the inside storeroom, and was not available to the passing visitor. At the information shelter at Charlotte Pass, where the track to the Main Range starts, one panel had some information and one photograph about the soil conservation work, but nothing to link this information with what the walker would see on the track. On the track itself there was no information that mentioned the thirty-year rehabilitation program, even where the evidence of that work was most visible and easily interpreted.

While NPWS is clearly not suppressing the history of degradation and rehabilitation, it equally does not appear to rank this part of the history of the area as a very important aspect to impart to visitors. I would argue that a fuller knowledge of the human history and impacts on the Main Range should enrich the understanding of the visitors to Kosciuszko. The history of the recent (150 year +) degradation caused by grazing can be used as a powerful educational message about the fragility of the environments of the Alps (and indeed elsewhere in Australia), and the history of the development of appropriate soil conservation responses can equally be used to demonstrate that good conservation-oriented and research-oriented management is essential if these fragile environments are to survive. The history of the Main Range, if fully told, would highlight for the visitor the need to be continuously alert to future environmental threats to Australia’s mountain heritage.

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Day Two – Mountains For Tourism
No Dogs in the Parks!

Anne-Marie Tenni

Falls Creek Alpine Resort

Abstract

Managing land in a Resort surrounded by the Alpine National Park has many social and environmental challenges for both Falls Creek Alpine Resort, the land manager, and Parks Victoria, managers of the National Park. The key to success is alignment of basic principles, philosophies and ideals both between the Resort and the Park and also within the leaseholders of the Resort. Dog sled rides, weeds, gardens, recreational pursuits, pets, a nature-based or eco-tourism experience, a hot spa, a gourmet meal, a cosy tent and an MSR meal – this paper explores it all with a view to creating good Karma all round.

The land management system in Victoria is principally governed by the Planning Scheme. Much of the recommendations for reserves and parks that we see today resulted from the work of the Land Conservation Council throughout the 1950s and 1980s. These detailed reports looked at attributes of different parcels of land and in particular the flora, fauna and geological values of an area.

This situation is different to NSW where the Resorts lie clearly within the National Park and thus are subject to the provisions of the National Parks Act. However, in Victoria, there are two other “resorts” that do lie within National Park i.e: Mt Buffalo and St Gwinear. In Victoria the Resorts have had various development histories, however this talk will focus on the Falls Creek experience.

The land comprising the Falls Creek Resort was originally managed through the Lands Department (now incorporated into the Department of Natural Resources and Environment) who provided the State Electricity Commission (SEC) with a permissive occupancy permit. In 1959 the Falls Creek Tourist Area Management Committee was established and the licensing function was transferred from the Lands Department to the SEC through provision of a Crown Grant to the SEC. In 1984 the Alpine Resorts Commission (ARC) was established. The ARC managed the six ski resorts that we have today. During this time the mandate was for developing the skiing industry and creating year round Resorts where appropriate. In 1998 the ARC was disbanded and replaced with six Alpine Resort Management Boards. This system is in place today where the Falls Creek Resort Management Board is the land manager for the Falls Creek Alpine Resort. Minister for Environment and Conservation appoints Board members directly and also signs off on all site leases. In 1989 the Alpine National Park was declared and this resulted in Falls Creek becoming entirely surrounded by National Park.

Under the Catchment and Land Protection Act, 1984 the Kiewa catchment area is designated as being for the purposes of hydro-electric power generation and water supply. This purpose statement has influenced the way in which the land in and around Falls Creek has been developed.

The SEC had a social conscience in its management of the land resource as evidenced by the guided bus tours of the dam (and hence a desire to maintain a certain water level). Inadvertently there was a triple
bottom line approach whereby social, financial and environmental aspects were all included in decision making; although the environmental decisions were a product of the times and not terribly environmental by today’s standards. A primary example of this was the way in which emigrant workers were encouraged to plant a wide range of exotic species that were reminiscent of their European homelands. The planting and subsequent proliferation of these exotic species has left a legacy of weed control for today’s land managers. The hubs of these exotic plantings lie around the power stations and villages created for workers ie: Bogong Village, Falls Creek Village and Clover Power Station.

Another major impact on the landscape of the Bogong High Plains has been that of the agricultural industry in the form cattle and sheep grazing. Sheep grazing ceased in Victoria during the 1940’s as reports of soil erosion problems were documented by the then Soil Conservation Authority and reported in Parliament. The increased disturbance due to grazing has created further niches for weed establishment.

Today there is an increasing emphasis on environmental management in Resorts. In recognition of this many Boards have created an environmental position. At Falls Creek, a Manager Environmental Services was employed and at Mt Buller an Environmental Officer. Other Resorts have incorporated environmental management into the role of the senior operations person. At Falls Creek the creation of a management position is an indication of the emphasis the Falls Creek Board has placed on environmental management.

Falls Creek has the greatest number of permanent residents of all Resorts – a legacy of the SEC. The Village is nestled in the sheltered valley of Rocky Valley Creek and provides a pleasant living environment. Many residents are long term and own lodges that have been operating for over 20 years. There are very divergent views within the community as to what constitutes good environmental management. The main issue challenging Falls Creek’s Resort Management Board is that of creating an alignment of views amongst the many stakeholders involved in the Resort.

Environmental change is being encouraged through the Board’s desire to attain Green Globe certification. Green Globe is an international certification program specifically designed for the travel and tourism sector. In Australia, Green Globe has focused on creating measurable environmental improvements within the travel and tourism sector. The science behind their activities is provided through the partnership with the Co-operative Research Centre for Sustainable Tourism associated with Griffith University.

Falls Creek is unique among the Alpine Resorts in that it is entirely surrounded by National Park. In the past this asset has not been recognized to the fullest extent for the tourism potential it attracts. Traditionally Resorts have targeted the downhill winter skiers and not really promoted the obvious connection with the Park and its natural assets nor made much of an attempt to smooth the transition between Park and Resort. As the Resort moves towards developing into a true all-year round tourism destination greater links between the Resort and the Park are being forged.

Falls Creek is working co-operatively with the Alpine National Park on a number of initiatives. I shall now elaborate on the co-operative programs undertaken so far.

a) Weed control
The history of European settlement in the Resort and the legacy of the hydro-scheme workers have created a landscape of bright, colourful exotic species. In 2000 the Resort engaged Ecology Australia, Geoff Carr and Andrew McMahon, to undertake a survey of the Resort and develop an exotic flora code. The survey revealed around 250 exotic species and divided these into three schedules: Environmental weeds with a known ability to invade (46 species), potential environmental weeds that may become invasive in the alpine environment (47 species) and non-invasive weed species (157).

The Resort has now begun a weed control program that concentrates on the control and possible eradication of the environmental and potential environmental weed species. The non-invasive species are a lower priority for control.

Over the last two years the Resort has been steadily building co-operative links with Parks Victoria as both agencies develop an integrated weed control program across their borders. There are instances now
where contractors employed by the Resort have been asked to undertake some of the control works in Parks eg: willows in Rocky Valley Creek below the dam wall.

The Resort’s approach has been to initiate weed control works along all boundaries and then to target some of the more obvious infestations on land that is not specifically leased. The program will then progress into the Village proper and work co-operatively with lodge site holders and the lift company. This year site holders with specific weeds have been approached for their consent to have the Board remove these weeds and then these people have been offered a plant voucher for replacement with indigenous plant species. To date around 15 site-holders have taken the Resort up on this offer with some of the sites being high profile.

b) Predator control
Two years ago Parks Victoria co-ordinated a predator control program across the Bogong High Plains incorporating both Falls Creek and Mt Hotham. Since then Falls Creek has drawn up a three-year contract with the contractor and this year will again work co-operatively with Parks in delivering a co-ordinated campaign. The challenge here is to develop a program with measurable results. The aim of the predator control program at Falls Creek is three-fold:

- to protect populations of threatened species such as the Mountain Pygmy Possum, Broad-toothed rat and Alpine Bog Skink;
- to protect vegetation and in particular revegetation sites from hare and rabbit damage and
- to improve amenity within the Resort by controlling feral cats and dogs.

The aim of course is to have no (feral) dogs in the Park or the Resort!

c) Development of tracks (walking and mountain biking) that link the Resort and the National Park and a Master Plan for Rocky Valley Dam.

Parks Victoria in the Alps has always appeared under-resourced for the task at hand. This has caused a narrowing and focusing of works to high profile areas where there is a definite need to manage the impacts of tourism in this fragile environment.

This year, Falls Creek Resort Management was able to secure $40,000 from the Minister for Environment and Conservation. These funds are for the development of walking tracks and trails that specifically link the Resort with the Park and also to develop a masterplan for Rocky Valley dam. The dam is an important asset to the Resort but lies completely within Parks land. The Resort is providing a further $40,000 for the project. All the background work to obtain this grant and the project administration is being undertaken by the Resort while the majority of the works will be within the Park.

d) Provision of Cross-Country skiing facilities
Parks Victoria and the Resort work closely together to provide a good cross-country skiing experience for our visitors. The groomed cross-country trail network extends into the Park, provided snow conditions are suitable. Grooming is undertaken by the Resort under guidance from Parks Victoria. Currently both Parks and the Resort are working on the development of a partnership agreement that clearly outlines the expectations of both land managers and provides some operational guidance.

e) Improved information forums
Along with cross-promotion of products is the need to better exchange information about particular visitor and land management approaches. Forums such as this are one opportunity but more regular involvement of Resorts with Parks is needed. The Department of Natural Resources and Environment (NRE) convenes a Biodiversity Network that has in more recent times split to form an alpine sub-set. It has been interesting to watch how the alps are leading to cross-regional co-operative programs. Not only within NRE, but also EPA and the waste management groups. It is better to manage land according to type rather than management boundary.

f) Marketing
Parks Victoria have a general “Healthy Parks Healthy People” marketing campaign. The efforts in the North East have not previously integrated well with the Resort marketing campaigns. Both organizations have focused on their own areas. This is a peculiarly Victorian (no pun intended) approach that is not evident in NSW where the Resorts are an integral part of the Park.

Recently however, the Resort is better recognizing, acknowledging and promoting the asset offered by the surrounding National Park (see Falls Creek Summer brochure 2002). There is no doubt that more co-operative marketing efforts will occur in the future as Parks Victoria has recently joined the Legends, Wine and High Country Campaign Committee that co-ordinates tourism marketing program in North East Victoria for Tourism Victoria. The marketing campaigns for the North East will have a strong focus on nature based and adventure tourism with particular emphasis on promoting the region’s tracks and trails.

One of the keys to achieving a high level of co-operation has been the development of close personal working relationships between Resort and Parks officers resulting in a greater understanding of what each land manager is trying to achieve. A good working relationship also means that mutually agreeable solutions are likely to be found rather than meeting an impenetrable barrier. Another key to successful co-operative programs is the sourcing of appropriate funds to undertake works. The Falls Creek Board has been successful in this area over the last 18 months.

**Future Co-operative Efforts**

There has often been two types of visitors to the Alps – those who want a national park experience – roughing it, at one with nature, wide open spaces and little evidence of human impact - and those who want a Resort experience – good food, restaurants, hot showers and comfy beds. These two types have often been treated as two completely separate markets. Falls Creek is developing strategies to break down the divisions between these groups of people. For example, it is not unheard of for a group of bushwalkers to want a hot shower and sauna after being out in the elements for a few days! The focus for future visitor marketing is to provide an experience that integrates the experience of the Park with the Resort.

**a) Development of adventure/nature based and eco-tourism opportunities**

Falls Creek is working hard to develop soft adventure tourism opportunities and further expand the nature-based tourism product. The aim is to provide a range of adventure products combined with a little luxury while seeking to appeal to the socially-aware and family-oriented market segments. Falls Creek has limited eco-tourism products available, however this is an area that we would also like to build. Some of the work in this area has involved running a weekend titled “Adventure in the High Country” where the different activities available were showcased to the public. The key issues are product density and product supply.

Many operators do not have an on mountain outlet and travel from Bright and Mt Beauty to provide their service. This circumstance is no different for Parks Victoria that has offices in Bright and Mt Beauty but no outlet on the mountain. Currently the Parks interpretations program is limited to summer ie: Christmas to the Australia Day weekend in January and then four days over Easter. The interpretations officer has no base on the mountain yet many of the clients for walks, slide nights and the like are mountain visitors. There is a need for Parks and the Resort to work more co-operatively in providing an interpretations service to visitors. There is much scope for cross-promotion of the different products offered by the Park and the Resort.

**b) Visitor management**

Visitor management within the Park and the Resort has a similar goal in that both organizations hope to provide their visitors with a good memorable experience. However there is some room for discussion as to what constitutes a memorable experience!

I would like to explore a couple of instances where conflict has the potential to arise due to the different management focus of the two organizations. Falls Creek is surrounded by National Park and has limited area on which to operate tours and the like hence there is a desire to extend services into the Park.

There is a need to improve the tourism experience on offer at the Resort by providing a greater range of activities and opportunities for connecting with nature. However, these activities should not be offered at...
the expense of the environment but rather in a manner that recognizes the values of the alpine environment and its ecological limitations.

In a National Park where a primary objective is to preserve the biodiversity of the area, the environmental impact of an activity is a key driver. In the Resort, where the provision of a recreational experience is a key driver, the environmental values of the area have been somewhat compromised in the past. The management challenge is to find a way to achieve a range of recreational experiences while minimising or eliminating any adverse environmental impacts.

The Resort is seeking to assess all recreational activities in this context. This is leading to management changes in many areas including the development of tracks and trails, downhill ski slope management and the offering of attractions such as skidoo and dog sled rides. A point of difference with National Parks is the governing legislation that mandates rules rather than an approach that uses ecological assessment criteria.

A tourism/recreational activity should be assessed within a framework that identifies its ecological impact. Those activities with adverse ecological impacts should be re-evaluated for their suitability in the alpine area while those activities with minimal or short-term impact can be continued with appropriate management practices.

Falls Creek is keen to improve its visitor numbers over both summer and winter periods. One way is to offer a wide-ranging customer experience that incorporates not only skiing but also other activities designed to cater for the non-skier or the skier who wants a day to relax in the sun. Falls Creek currently offers dog sled and skidoo rides to increase the opportunities available to the visitor. However, due to the limitations of the snow within the Resort there are times when the extension of these activities into the Park would create a more consistent and improved customer experience. The ecological impact of such activities within the Park would be transitory i.e.; noise and could be managed effectively to minimize disturbance to Park users.

It is interesting to note that dog sled rides cannot be extended into the Park however cattle grazing is allowed to continue and the use of dogs as a part of this business operation is acceptable. The allowance of a dog sled operation in the Park is not acceptable yet there would be no ongoing maintenance costs such as those associated with the need to rehabilitate areas that have been damaged by cattle – in particular walking trails. Resorts have always had a policy of excluding cattle because of the potential environmental damage and conflict with visitors.

There is a need to find some common ground for some of these seemingly intractable issues. The offering of an activity in these sensitive alpine areas should be guided in the main by its impact on the environment. The use of an ecological framework to assess the impact of an activity is one means of bringing together the different land use objectives of Parks and Resorts. It may well be possible for both land managers to achieve their objectives – do we remember the moral of the children and the orange? Both wanted the orange however upon closer investigation, one wanted the peel and the other the pith – both were satisfied with this different way of dividing the resource.

There is no doubt that summer tourism to the High Country must increase – just look at the success being experienced by Thredbo-Kosciusko in this endeavour. Resort and Park managers can either wait for increased tourists to arrive before taking action or else manage the tourism growth in a sustainable way. I always look to Uluru as a classic example of how good management can mitigate adverse visitor impacts. Uluru today takes over a million visitors annually and its surrounding environment is in a much better state now than it was in 1978 when I first visited and the concept of tourism management, within a framework of environmental sustainability, was not yet on the agenda.

The Alps too can potentially be the chosen destination for thousands of people in the years to come particularly if the impact of global warming is to take hold. It is up to us as land managers in the alps to work co-operatively bring our management philosophies into alignment to provide an overall better experience for the people who visit our region while enhancing the environmental sustainability of this most fragile part of Australia.
References


Falls Creek Resort Management (2002) *Draft Environment Improvement Plan*.

High Quality Wastewater Reclamation for Use in Snow-Making – Resource Rather than Waste

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Abstract

All alpine resorts in Australia face the constraints of climate variability and unpredictable snow fall. Often the timing and quantity of natural snow falls vary significantly creating unpredictability for the industry. Snow-making is a vital enterprise to the survival of the ski industry in Australia. Snow making at both Mt Buller and Mt Hotham Alpine Resorts has demonstrated an excellent adaptation to the shortage of natural snow.

The Victorian Resorts also have a requirement based on the State Environment Protection Policy - Waters of Victoria, to manage effluent discharge from the respective treatment plants in a manner that reduces impact on aquatic ecosystems and water quality.

The Resorts have recognised that these circumstances present a unique opportunity to utilise reclaimed water for increased snow making capacity. It is one of the unique opportunities where the wastewater is valued as a resource rather than merely viewed as a waste problem. The proposed water reclamation schemes at both the Resorts are considered to be the first application in the world in this direction.

Introduction

The Victorian Alps are a Victorian, national and international winter tourism destination. Over 1.3 million visitors are attracted to the Victorian Alps each year, adding $99.5 million to the Victorian economy and supporting 3181 full time equivalent jobs. Mt Buller, Mt Hotham and Falls Creek are the most popular Resorts, as they have been able to use snowmaking technologies in recent years to assure visitors of quality snow cover.

Mt Buller Alpine Resort is approximately 2300 hectares of natural bushland with approximately 400 hectares developed for snowfields, the Resort village and environs. It is adjacent to the Alpine National Park and State Forests and caters for year-round recreational activities. The Mt Hotham Alpine Resort is approximately 3,450 hectares in area, of which 245 hectares is developed for snowfields.

Scientists around the world acknowledge that global climate change is occurring and will produce varied local effects. Many aspects of climate change are agreed; there has been an increase in greenhouse gases...
over the past 200 years and a measurable increase in average global temperature has been observed. The implications of climate change are far reaching. Governments and organisations are beginning to develop adaptive strategies.

Snow-making is a vital enterprise to the survival of the ski industry in Australia. This situation has already been recognised by the State Government in the release of the recent Alpine Resorts 2020, Discussion Paper (DNRE, 2002). Snow making at both Mt Buller and Mt Hotham has demonstrated an excellent adaptation to the shortage of natural snow. Further enhancement to the infrastructure will allow additional areas to operate when natural snow is low. Plans to expand snow making capacity to increase the viability of skiing have been developed, but due to water constraints have not been implemented.

Concurrent with this water shortage, the Resorts have a requirement based on the State Environment Protection Policy (SEPP) – Waters of Victoria 1988, to manage effluent discharge from the treatment plant in a manner that reduces impact on aquatic ecosystems and water quality within the highland catchments.

The Resorts have recognised that these circumstances present a unique opportunity to utilise reclaimed water for increased snow making capacity. Reclaiming wastewater to supplement water supply for snow making is an initiative of both of the Resort Management Boards’ policies intended to enhance the environment. It demonstrates clear and measurable efforts to close the use and re-use loop; to achieve the purposes for which the Resort was established; while eliminating potential impacts to local waterways; and increasing the efficiency of use of water.

Wastewater Treatment In Alpine Environments

The Resort Managers at both resorts are responsible for the operation and maintenance of the water supply and sewage treatment facilities. Both resorts have invested significantly in the development of sewage treatment infrastructure, each which produces a very high quality secondary effluent, low in nutrients and pathogens, complying with EPA licence conditions.

The Mt Buller Resort generates approximately 195 ML of treated effluent per year with approximately 70% of effluent produced during winter. Presently, the treated effluent flows overland via a natural wetland, and eventually flows into the Howqua River. The river water quality is also closely monitored, with satisfactory results from testing agencies.

Approximately 90 ML per annum of treated effluent is generated from the Mt Hotham Resort. Presently, the treated effluent is discharged overland through a natural wetland, which then joins No-name Creek, before flowing into the Dargo River.

The Victorian state policy for wastewater management specifically promotes beneficial reuse of treated effluent, with an emphasis of land irrigation where environmentally sustainable. There is very limited scope for agricultural reuse in alpine resorts, particularly considering the fact that most of the wastewater load is generated during the winter. Effluent reuse in supplementing water supply for snowmaking is the only viable solution to maximising compliance with the State Environment Protection Policy.

Proposed Wastewater Reclamation Schemes

Mt Buller Resort

Since 1993 Buller Ski Lifts (BSL), Mt Buller’s chairlift operator, has been producing additional snow cover through snowmaking technology. This helps extend the duration of Mt Buller’s snow season by improving the natural skiing surface and maintaining safety conditions. Snowmaking technology, in tandem with nature, extends economic benefits to the Resort. The process requires a series of snowguns, a reliable water supply, power supply and suitable atmospheric conditions to manufacture artificial snow. Water is blasted into the air, to settle on the slopes as crystallised snowflakes.

The Resort is committed to minimise its impact on flows in the watercourses. The current pumping infrastructure makes insufficient water available to the snow-making reservoir to keep up with snow-making need after domestic water supply needs are met. While increasing the pump capacity is feasible, it is not an environmentally desirable option.
Given the limited number of days/hours suitable for snow-making – one night in four, or approximately 700 hours per season (compared to more than 2000 hours in the northern hemisphere) - pumping capacity and availability of water supply are critical. In an average season BSL will use 190 ML of potable water pumped up from Boggy Creek to the Sun Valley Dam, which has a storage capacity of 75 ML. BSL can pump 20 ML/d through its system, so Sun Valley Dam stores no more than 3 to 4 days supply. The dam can only be re-supplied at up to 4 ML/d. Thus it takes a week to pump one day’s snow-making supply. The full scale implementation of effluent re-use for snow-making will approximately double the available supply of water for snow-making without taking any more water from the environment.

![Diagram of Mt Buller Resort Water Reclamation Scheme](image)

**Mt Hotham Resort**

Snow making at the Mt Hotham Resort is currently managed by Mt Hotham Ski Lift Company (MHSC) Pty Ltd. The water supply for snowmaking is sourced from Swindlers Creek, via a 1 ML storage weir constructed downstream of the existing resort water supply weir. Goulburn Murray Water is responsible for the supply of water to MHSC, administered under a diversion licence, which allows MHSC to abstract a maximum of 1.6 ML per day.

MHSC obtain water supply from the 1 ML storage weir downstream of the water supply weir. The approximate quantity of water used for snowmaking can be as high as 1.6 ML overnight. The average snowmaking potential is dependent on the prevailing weather conditions. Based on the records over the last 5 years, the average snowmaking window of opportunity is 40 hours per week over an 18 week season, i.e. 720 hours available for snow making during the winter season.
During the 2000 ski season, approximately 100 ML of water was used for snowmaking. MHSC plans to increase snowmaking capacity within the next two years and therefore there will be a demand for more water, approximately doubling current requirements. The additional 0.55 ML/d of reclaimed water (averaged over the winter period) would provide a significant supply for snow making expansion and would reduce the additional demand for water supply from Swindler’s Creek. This would have the benefit of maintaining higher environmental flows in Swindler’s Creek. The total yearly wastewater generated (90 ML) could theoretically be used for snowmaking, thus significantly reducing the quantity of treated wastewater discharged directly to Swindler’s Creek.

The proposal to pipe the reclaimed water to the Swindler’s Creek catchment has the added advantage of taking effluent flows out of No-name Creek, which runs dry during the summer months, and ultimately out of the Dargo River catchment, which is a more sensitive water supply catchment.

Snow-Making Using Reclaimed Water

There are several examples of effluent disposal via snow making, particularly in North America. The primary objective of many of these schemes is to store wastewater as snow during the severe winter months. During the winter, biological treatment is not very effective and this can potentially result in the discharge of untreated wastewater or the need to store large quantities of wastewater, awaiting treatment in the warmer months. In some instances, the process is used as the primary method of sewage treatment. As the snow mounds melt in the spring nutrients are released and absorbed into the soil, while any residual nutrients are diluted by the overall snow-melt in the catchment. Examples also exist of reuse of treated effluent for snow-making, such as at Snowmass Resort in Colorado, USA, as an alternative disposal route.

Under the U.S. Environmental Protection Agency’s guidelines of water reuse (U.S. Environmental Protection Agency, 1992), reuse of treated effluent for snow making is permitted for unrestricted recreational use, provided the treated effluent quality meets the following standards:

Figure 2 – Schematic of Mt Hotham Alpine Resort Water Reclamation Scheme
- Treatment standard: secondary, filtration, disinfection;
- BOD$_5$ < 10 mg/L
- Turbidity < 2 NTU
- Faecal coliforms: not detected
- Chlorine residual: 1 mg/L
- pH: 6 to 9

To the best of the authors’ knowledge, there are currently no schemes around the world that use reclaimed effluent for snowmaking on areas with human contact. Therefore, the proposed water reclamation schemes at both the Mt Buller and Mt Hotham Resorts is considered to be the first application in the world in this direction.

**Water Quality Requirements For Snow-Making**

The conditions at both Resorts present a unique opportunity to utilise reclaimed wastewater to allow increased snow-making capacity. It is one of the unique opportunities where the wastewater is valued as a resource rather than merely viewed as a waste problem.

Wastewater reclamation for snow-making will require additional treatment for pathogen removal, due to the potential for exposure to humans (secondary contact). An investigation of alternative technologies was undertaken with the proposed recommendation that following the existing level of nutrient removal and UV disinfection treatment technology, the effluent will require further treatment with membrane ultrafiltration and ozonation and/or chlorination. The proposed treatment system will offer four to five barriers for pathogen removal.

Currently, the quality of the treated effluent is of a high standard, as would be expected from an advanced nutrient removal treatment system. The treated effluent quality complies with the U.S. Environmental Protection Agency’s standards for unrestricted recreational reuse, including snow making, except for the fact that the effluent is not treated by filtration.

Membrane systems including microfiltration (0.2 micron) and ultrafiltration (0.01 micron) are typically considered in effluent reuse applications (Jacangelo et al, 1995; Kamp, 1995; Panglisch et al, 1998). The major technical factor influencing the choice of membranes for effluent reuse is the need to establish a multilevel barrier against pathogens. As an indication of the likely effectiveness of microfiltration versus ultrafiltration in terms of pathogen removal, the various sizes of typical pathogens are listed in Table 1.

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Size (microns)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Giardia muris</td>
<td>7 to 14</td>
</tr>
<tr>
<td>Cryptosporidium parvum</td>
<td>4 to 6</td>
</tr>
<tr>
<td>E. coli</td>
<td>1</td>
</tr>
<tr>
<td>Pseudomonas dim.</td>
<td>0.3</td>
</tr>
<tr>
<td>MS2 virus</td>
<td>0.025</td>
</tr>
<tr>
<td>Membrane Filtration System</td>
<td></td>
</tr>
<tr>
<td>Microfiltration</td>
<td>0.2</td>
</tr>
<tr>
<td>Ultrafiltration</td>
<td>0.01</td>
</tr>
</tbody>
</table>
Several studies have been undertaken recently assessing the removal of pathogens with ultrafiltration and microfiltration in water and wastewater (Jacangelo et al, 1995; Kamp, 1995; Panglisch et al, 1998). It can be concluded that while, in general, all membrane systems gave very good removal of parasites, the removal of viruses was much higher with ultrafiltration membranes. This is understandable when the pore size of these materials is investigated.

Due to the individual nature of each treated effluent, it was considered prudent to undertake piloting of an ultrafiltration system at both Mt Buller and Mt Hotham so as to demonstrate filtration and recovery rates as well as pathogen removal. At Mt Buller, the pilot trials commenced in June 2000 and continued until October 2001. The pilot plant has continued to operate at Mt Buller until the present time. At Mt Hotham, pilot trials were conducted between June and October 2002.

**Pilot Plant Wastewater Reclamation Trials**

**Mt Buller Resort**

The pilot plant at Mt Buller consisted of a fully skid-mounted, PLC controlled filtration system, with a capacity to treat up to 1 L/s, i.e. about one-tenth of the full-scale plant. The system consisted of 2 No. 127mm diameter X 1220mm long polysulphone hollow fibre cartridges, supplied by Koch Membrane Systems. Bundles of hollow fibres are contained within cartridges as shown in Figure 3. A typical cross section of a hollow fibre is shown in Figure 4.

The filtration cycle has been 30 minutes between backwashes, with chlorine backwashing on every third cycle. The rejection rate during filtration has been between 5% and 15%. The temperature of the effluent being filtered has been as low as 7°C during the winter months. This low temperature operation has not significantly affected the operating regime of the filtration system. Figure 5 shows the arrangement of the membrane ultrafiltration pilot plant at Mt Buller, housed within a container.
The pilot plant commenced operation in June 2000 and has been operating intermittently over the last year. The filtration trials were completed in October 2001, although the pilot plant has continued to operate during 2002. Independent water quality analysis was undertaken to test the effectiveness of the ultrafiltration system at Mt Buller. A summary of the filtration results are shown in Table 2.

The pilot plant included a 20 m$^3$ treated water storage tank and snow gun to demonstrate snow-making potential and assess the quality of the manufactured snow from treated effluent. Mt Buller Alpine Resort’s core business in winter is providing high quality snow for hundreds of thousands of visitors taking to our slopes for skiing and snowplay. Figure 6 shows the snow gun in operation making artificial snow using ultrafiltered reclaimed water. The snow-making trial was considered a success by the Mt Buller community and paves the way for full implementation.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Raw Water (Secondary Effluent)</th>
<th>UF Treated Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Organic Carbon (mg/L)</td>
<td>8.5</td>
<td>6.5</td>
</tr>
<tr>
<td>Total Nitrogen (mg/L)</td>
<td>4.5</td>
<td>3.2</td>
</tr>
<tr>
<td>Total Phosphorus (mg/L)</td>
<td>0.5</td>
<td>0.03</td>
</tr>
<tr>
<td>Apparent Colour (PCU)</td>
<td>100</td>
<td>&lt; 10</td>
</tr>
<tr>
<td>Turbidity (NTU)</td>
<td>30</td>
<td>0.1</td>
</tr>
<tr>
<td>Cryptosporidium (ocysts/50 L)</td>
<td>265</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Giardia (ocysts/50 L)</td>
<td>320</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Reovirus (orgs/50 L)</td>
<td>130</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Adenovirus (orgs/50 L)</td>
<td>310</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Enterovirus (orgs/50 L)</td>
<td>1600</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Clostridium perfringens (orgs/100 mL)</td>
<td>1500</td>
<td>N.D.</td>
</tr>
<tr>
<td>Campylobacter spp (orgs/1000 mL)</td>
<td>N.D.</td>
<td>N.D.</td>
</tr>
<tr>
<td>Salmonella spp (orgs/1000 mL)</td>
<td>N.D.</td>
<td>N.D.</td>
</tr>
<tr>
<td>E. coli (orgs/100 mL)</td>
<td>9000</td>
<td>&lt; 2</td>
</tr>
<tr>
<td>Total coliforms (orgs/100 mL)</td>
<td>61000</td>
<td>&lt; 2</td>
</tr>
</tbody>
</table>

Notes: UF = Ultrafiltered; orgs = organisms; N.D. = Not Detected
Mt Hotham Resort

A pilot ultrafiltration plant has been operating at the Mt Hotham wastewater treatment plant site since June 2002 and will continue to operate until early 2003. The pilot plant consisted of a fully skid-mounted, PLC controlled filtration system, with a capacity to treat up to 1 L/s, i.e. about one-tenth of the full-scale plant. The system consisted of a 50 micron pre-filter, and 1 No. 200mm diameter x 1800mm long polysulphone hollow fibre cartridges, supplied by Koch Membrane Systems. Figures 7 (a) and (b) show the arrangement of the membrane ultrafiltration pilot plant at Mt Hotham, housed within a container.

![Figures 7 (a) and (b) - Mt Hotham Ultrafiltration Pilot Plant, June 2002](image)

The filtration cycle has been 30 minutes between backwashes, with chlorine backwashing on every third cycle. The rejection rate during filtration has been between 5% and 15%. The existing wastewater treatment plant does not have facilities for chemical dosing for phosphorus removal. Alum dosing was undertaken as part of the pilot plant trials. Alum was dosed into the pilot plant raw effluent feed tank to simulate alum dosing in the ultimate upgraded plant.

Independent water quality analysis was undertaken to test the effectiveness of the ultrafiltration system at Mt Hotham. A summary of the filtration results are shown in Table 3.

The pilot plant also included a 20 m³ treated water storage tank and snow gun to demonstrate snow-making potential and assess the quality of the manufactured snow from treated effluent. The snow-making trial was considered a success by Mt Hotham RMB and paves the way for full implementation.
Table 3 – Summary of Effluent Ultrafiltration Pilot Plant Trials

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Raw Water (Secondary Effluent) Range</th>
<th>UF Treated Water Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Organic Carbon (mg/L)</td>
<td>5.5 – 10</td>
<td>4.6 – 7.7</td>
</tr>
<tr>
<td>Total Phosphorus (mg/L)</td>
<td>1.0 – 4.9</td>
<td>0.04 – 3.0</td>
</tr>
<tr>
<td>True Colour (Pt/Co units)</td>
<td>35 – 75</td>
<td>18 – 60</td>
</tr>
<tr>
<td>Turbidity (NTU)</td>
<td>2.2 – 3.6</td>
<td>&lt; 0.1</td>
</tr>
<tr>
<td>Cryptosporidium (ocysts/50 L)</td>
<td>&lt;1 – 3</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Giardia (ocysts/50 L)</td>
<td>1.5 – 2</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Reovirus (orgs/50 L)</td>
<td>&lt;1 – 6</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Adenovirus (orgs/50 L)</td>
<td>7.5 – 16</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Enterovirus (orgs/50 L)</td>
<td>4.5 – 8</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>MS2 phage (orgs/50 L)</td>
<td>19 – 62</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Clostridium perfringens (orgs/500 mL)</td>
<td>170 – 7000</td>
<td>N.D.</td>
</tr>
<tr>
<td>Campylobacter spp (orgs/500 mL)</td>
<td>N.D.</td>
<td>N.D.</td>
</tr>
<tr>
<td>Salmonella spp (orgs/500 mL)</td>
<td>N.D.</td>
<td>N.D.</td>
</tr>
<tr>
<td>Enterococci (orgs/500 mL)</td>
<td>120 – 22000</td>
<td>N.D.</td>
</tr>
<tr>
<td>E. coli (orgs/250 mL)</td>
<td>73 – 110000</td>
<td>N.D.</td>
</tr>
<tr>
<td>Faecal coliforms (orgs/250 mL)</td>
<td>&lt;250 – 130000</td>
<td>N.D. – 1</td>
</tr>
<tr>
<td>Coliforms (orgs/250 mL)</td>
<td>&lt;250 – 120000</td>
<td>N.D. – 19</td>
</tr>
<tr>
<td>SPC (orgs/mL)</td>
<td>110 – 41000</td>
<td>&lt; 1</td>
</tr>
</tbody>
</table>

Notes: UF = Ultrafiltered; orgs = organisms; N.D. = Not Detected

Conclusion

Every alpine resort in Australia faces the constraints of a limited ski season, generally from June to September, due to relatively low altitudes and seasonal climatic conditions, and the high costs of providing expensive infrastructure to service small communities. Snow-making is a vital enterprise to the survival of the ski industry in Australia.

Analysis of the quality of treated water used in the pilot trials at both Resorts allows the Resort Management Boards to confidently state that the ultrafiltered reclaimed water will be “safe to ski on”. The results showed that the ultrafiltration system completely removed pathogens, including E. coli, coliforms, Cryptosporidium spp., Giardia spp., Clostridium perfringens, enteroviruses, adenoviruses and reoviruses, thus complying with Australian drinking water guidelines.

The installation of a full-scale ultrafiltration plant at both Mt Buller and Mt Hotham, with associated snow-making activity will enable the Resorts to guarantee pure, white and environmentally friendly snowfields for the sustainable benefit of recreational users, the district economy and wider community.
REFERENCES


Perisher Range Resorts Environmental Management System

Alistair Henchman and Cathlin Collins

Alistair Henchman, Project Director, NSW National Parks and Wildlife Service
Cathlin Collins, Project Environmental Engineer, URS Australia Pty Limited

Summary

During 2001, NSW National Parks and Wildlife Service, with the assistance of URS Australia Pty Limited, developed an improved framework for environmental management in the Perisher Range Resorts in Kosciuszko National Park: a place-based environmental management system known as the ‘Perisher Range Resorts EMS’. The Perisher Range Resorts EMS is based on the international standard for environmental management (ISO 14001), and represents a systematic approach to managing the environmental impacts and risks associated with the operation of a ski resort in one of Australia’s most sensitive environments.

This place-based EMS applies to NPWS and all tourism operators within the Perisher Range. The EMS defines the mechanisms through which environmental impacts and enhancements due to future development and operations will be managed in a sustainable manner. Through the development of the EMS, resort managers, commercial operators, ski lodges and NPWS share the vision of becoming a recognised leader in ecologically sustainable mountain tourism.

This paper summarises the purpose and benefits of an EMS, the triggers for developing an EMS as a tool to help manage the Perisher Range Resorts, and the involvement of stakeholders in the development and on-going implementation of the EMS. It also discusses the tools developed to help ski lodges improve their environmental performance.

Background

The need for the Perisher Range Resorts EMS

The Perisher Range Resorts is an area of 1250 hectares within Kosciuszko National Park in New South Wales. The Perisher Range Resorts are made up of the ski areas and villages of Perisher Valley, Smiggin Holes and Guthega, as well as the Blue Cow ski area.

The NSW National Parks and Wildlife Service is the state government authority responsible for the management of the resorts in their national park context. All businesses which operate in the Perisher Range lease their land from NPWS. As well as the major ski field operator, Perisher Blue Pty Limited, there are 87 club lodges and 34 commercial lodges and accommodation facilities.

Combined, the resorts have 52 lifts and over 100 km of cross-country ski trails, making the Perisher region a major winter snow sports destination. In summer the area is also popular; its proximity to Mt Kosciuszko being a major attraction.
Kosciuszko National Park attracts around 3 million visitors per year, with a 60/40 percent split between winter and summer. In total, an estimated 600,000 visits are made to the Perisher Range Resorts each year. In the peak periods of the winter ski season, as many as 20,000 people visit the resorts in a day, with around 3,600 people being accommodated overnight.

In May 1999, approval was granted by the NSW Government to extend the Perisher Range Resorts by 1,320 beds, improve infrastructure and access, and to create a village centre in Perisher Valley. In addition, the ski area operator, Perisher Blue Pty Limited, has proposed a major expansion of ski slope capacity.

These developments will certainly attract more visitors to Perisher each year, increasing the potential risk to the environment. Some of these environmental risks include:

- Vegetation loss and habitat degradation resulting from clearing for ski run and resort facilities;
- Introduction and spread of feral weed and pest species;
- Water quality and aquatic ecology health degradation from pollution;
- Soil erosion and instability resulting from vegetation removal and alterations to hydrological regimes;
- Local air pollution resulting from particulate and gaseous emissions, transportation and fuel use;
- Noise pollution from day and night recreational activities and the operation of heavy equipment;
- Use of non-renewable resources;
- Impacts resulting from poor waste management practices, including littering by park visitors, and poor collection, storage and disposal of domestic and building wastes; and
- Impacts on visual amenity and sense of place.

One of the recognised approaches to mitigating environmental impacts and risks posed by development is to adopt an environmental management system or plan. The development of an EMS was therefore made a key condition of consent for the expansion of the resorts. The development of an EMS is also part of the long-term strategic vision of NPWS to facilitate the holistic management of Kosciuszko National Park.

**What is an EMS?**

An EMS is essentially a framework to help organisation reduce their impact on the environment through targeted, continuous improvement in environmental management. EMS are defined by ISO14001 – the international standard for environmental management – as “that part of the overall management system which includes an organisation structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy”.

Environmental management systems are usually developed for a single corporate entity, operating at one or multiple sites, and ISO 14001 is commonly applied to manufacturing and processing industries. However the Perisher Range Resorts are operated by over 120 organisations, varying from large, corporate entities, to government agencies and utility providers, to small, volunteer organisations.

Due to the high number and variability of operators involved in the Perisher Range Resorts, a place-based EMS was developed to provide a framework for these organisations to work together to improve environmental performance throughout the resort.

To ensure that the EMS would be a practical and equitable tool for all parties, it was developed in close consultation with all key stakeholders in the Perisher Range. Stakeholder involvement in the EMS development process is discussed further below.
Stakeholder Involvement

Reference Committee
A ‘Reference Committee’ of stakeholders was established to oversee the EMS development process. The Reference Committee comprised representatives from the following organisations:

- National Parks and Wildlife Service Resorts Division
- Perisher Blue Pty Limited
- Kosciusko Chamber of Commerce (representing commercial operators)
- SLOPES (representing Club Lodges)
- Elgas
- Telstra
- Nature Conservation Council
- National Parks Association
- PlanningNSW

The Reference Committee worked together for more than 12 months, contributing extensively to the development of the EMS. The establishment and operation of the Reference Committee helped to ensure the system was practical and was accepted by all stakeholder groups.

Some of the key outcomes and achievements of the committee include:

- Development of a shared Environmental Vision and an Environmental Policy statement in which each organisation has agreed to work cooperatively to achieve better environmental outcomes;
- Identification of the environmental risks, and development of strategies to mitigate these risks under the EMS;
- Establishment of a series of common environmental objectives coupled with targets and key performance indicators that all resort stakeholders are required to work towards. The environmental objectives are presented in Section 4.1 below; and
- Agreement on the EMS Framework – this being an overarching structure and set of requirements which gives stakeholders the flexibility to develop their own systems or use the tools and procedures provided for them. The structure of the EMS is discussed further in Section 4.2.

The establishment, operation and agreed outcomes of the Reference Committee are a positive example of community, business and government working together to ensure a sustainable future.

Gap analysis

NPWS also undertook a gap analysis of the current systems which it and other stakeholders were using to manage the environmental impacts of their operations to make sure that the Perisher EMS could be consistent with these existing systems. This included a review of existing manuals, policies and procedures.

This analysis showed that various stakeholders had quite different understanding of and progress in the implementation of environmental management. This reinforced the need for the EMS to provide for the wide range of organisations operating in the Perisher Range.

The Perisher Range Resorts EMS

The key components of the Perisher Range EMS are the agreed Policy and environmental objectives, the overarching structure – made up of procedures, registers and forms – that direct the requirements of all parties, and the reporting requirements that provide essential feedback to ensure environmental
improvements are ongoing. An EMS Operational Committee has been established to oversee the system in the long term.

The Lodge Workbook – a tool to assist smaller operators meet their obligations under the system – is an important component of the system.

**Common Environmental Objectives**
The Perisher Range EMS establishes a process for setting and achieving targeted environmental performance goals, not only for NPWS, but for each of the operators in the resort.

The EMS requires all stakeholders to measure and report on their progress towards achieving the common environmental objectives which were agreed to by the Reference Committee.

The common environmental objectives comprise:

- To achieve a high quality environment for indigenous flora and fauna in the Perisher region and to preserve the biodiversity of the area.
- To improve the quality of aquatic ecosystems through improvement of water quality, maintenance of environmental flows and control of sedimentation and erosion.
- To identify and remediate all soil and groundwater contamination and to prevent future contamination of soils or groundwater.
- To improve local air quality, reduce greenhouse gas emissions, and reduce the use of ozone depleting substances.
- To reduce the consumption of renewable and non-renewable resources through water, waste, energy and materials management.
- To conserve the cultural heritage values of the Perisher region and archaeological sites in the National Park through increased site assessment and visitor education.
- To ensure that existing and future development and activities do not compromise the visual amenity and sense of place of the surrounding National Park.
- To ensure that the ski, summer and other recreational facilities are provided sustainably and to a world-class standard within the ecological carrying capacity of the region.
- To ensure that all persons working within, and visitors to, the National Park are well educated about the region’s natural and cultural environment.
- To increase the proportion of staff and Park visitors who use sustainable transport systems to and within the region.
- To have effective environmental management in the Perisher Range Resorts.
- To ensure ongoing communication and cooperation amongst stakeholders on the environmental management of the Perisher Range Resorts.

All stakeholders are required to work towards the achievement of these objectives, and must report their progress towards the objectives to NPWS periodically. This is discussed further below.

**Perisher Range Resorts EMS Procedures**
The Reference Committee helped to define the final structure of the EMS framework for the Resorts. This framework is based on the principles of ISO 14001, and follows the ‘Plan, Do, Check, Improve’ management cycle.

NPWS has developed a series of procedures which direct the requirements of all stakeholders under the Perisher Range Resorts EMS. These procedures are listed in Table 1.

NPWS will use these procedures as tools to manage their own activities on a daily basis, and to manage stakeholders and assets. Other stakeholders can adopt these tools directly, or can develop their own system as long as it is in compliance with the overarching framework.
The ‘Lodge Workbook’ was developed for small scale accommodation operators, to help them meet the requirements of the Perisher Range EMS without the need to follow each of the procedures. The Lodge Workbook is discussed further in Section 5, below).

Regardless of whether stakeholders choose to directly adopt the overarching procedures to develop their own systems, all stakeholders are required to report their progress towards the set of common environmental objectives and targets.

The Perisher Range EMS is a structured and coordinated way for each organisation to demonstrate its environmental performance and to meet, and continue to meet, its legal and policy requirements.

Table 1 – Perisher Range Resorts EMS Procedures

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Aspects</td>
<td>To identify, assess and prioritise the impacts and aspects of every existing or new activity which occurs within the resorts area.</td>
</tr>
<tr>
<td>Legal and Other Requirements</td>
<td>To identify all legal obligations that apply to the activities of each stakeholder, and ensure ongoing compliance with these obligations</td>
</tr>
<tr>
<td>Objectives and Targets</td>
<td>To establish goals which will ensure continual environmental improvement</td>
</tr>
<tr>
<td>Training</td>
<td>To ensure that all personnel whose work in the resorts area may create an impact on the environment receive appropriate training.</td>
</tr>
<tr>
<td>Communication</td>
<td>To ensure efficient and effective communication within and between NPWS and stakeholder organisations on environmental matters</td>
</tr>
<tr>
<td>Document Control and Records</td>
<td>To ensure that only correct and current versions of relevant documents are being used in the management of the EMS, decision making, and to manage environmental records.</td>
</tr>
<tr>
<td>Operational Control</td>
<td>To ensure that all significant environmental issues that relate to a particular operation or activity are being appropriately managed by each operator.</td>
</tr>
<tr>
<td>Emergency Preparedness and Response</td>
<td>To establish appropriate processes for preparing for and responding to environmental incidents and emergencies in the resorts.</td>
</tr>
<tr>
<td>Monitoring</td>
<td>To prescribe the monitoring, measuring and reporting of the environmental impact of activities within the Perisher Range area, in order to demonstrate compliance with regulatory requirements and operational control procedures, and to measure and record performance so that this can influence future decision making.</td>
</tr>
<tr>
<td>Nonconformance and Action</td>
<td>To prescribe how actual and potential non-conformances will be managed, and for taking corrective and preventive action for responding to these non-conformances.</td>
</tr>
<tr>
<td>EMS Audit</td>
<td>To conduct a systematic and defendable assessment of the implementation of the EMS by NPWS and stakeholders.</td>
</tr>
<tr>
<td>Management Review</td>
<td>To describe the methodology to be employed by NPWS and the EMS Operational Committee for the periodic review by management of the EMS.</td>
</tr>
</tbody>
</table>

**Reporting Requirements**

To capture data relating to each of the common objectives, and allow performance to be tracked, a series of common key performance indicators have been developed. These include:

- The amount of energy consumed by facilities in the resort (including electricity, heating oil, gas and wood fires), and the amount of greenhouse gas generated;
- The proportion of energy used from renewable sources;
- The number of woodburning appliances and fireplaces in compliance with AS 4013;
- The amount of water consumed at facilities in the resort, covering human consumption, hygiene, landscaping, maintenance and snow making;
- The amount of waste produced from facilities in the Resort that is disposed to landfill;
- The amount of non-biodegradable cleaning chemicals used;
- The amount of ozone depleting substances used;
- The number of releases of chemicals (eg spills) to land and/or water;
- The proportion of positive feedback from visitor surveys;
- The proportion of visitors using environmental interpretation / education services; and
- The proportion of staff trained with respect to environmental management.
All stakeholders are responsible for collecting environmental data for each of these performance indicators to track their performance against the objectives and targets. While small operators can use the workbook, NPWS and larger commercial operators are required to develop and follow procedures for collecting relevant environmental data specific to their operations, in addition to the common requirements.

In addition to the common key performance indicators, NPWS has identified the need to measure a wider set of parameters to monitor the condition of the Perisher Range environment. These include the diversity of fauna habitat, status of threatened species and their supporting ecosystems, visual amenity, protection of cultural heritage sites, and abundance of weeds and pests.

Perisher Blue Pty Limited are currently identifying the environmental aspects relevant to their own activities, especially on-mountain activities such as slope and snow grooming.

NPWS will compile data and provide statistics on environmental performance and achievements of the Resorts as a whole. Improvements made by individual organisations can also be tracked from year to year.

The EMS will ensure that the data collected is meaningful, transparent and targeted, and provides a real indication of environmental performance. Compilation of the data twice per year (summer and winter) will allow NPWS and other stakeholders to set research priorities, develop education packages, invest in infrastructure or personnel, and make informed decisions for future planning.

EMS Operational Committee

An environmental sustainable future in Kosciuszko National Park’s delicately balanced environment needs a strong level of commitment from all stakeholders beyond the EMS development stage. The Perisher Range EMS therefore includes processes for ensuring ongoing consultation and cooperation into the future.

The EMS includes an ongoing “EMS Operational Committee” made up of representatives from each stakeholder organisation. The role of the Committee is to review and advise on the ongoing implementation and cooperative operation of the EMS. The Committee will also review the environmental performance of the Resort against the environmental objectives and targets, and will help define new environmental goals into the future.

The Perisher Range EMS also establishes a defined process for stakeholder and NPWS communication on environmental matters, ensuring that it is regular, transparent and proactive.

Tools Developed for Ski Lodges - the ‘Lodge Workbook’

While the Perisher Range EMS is based on the International Standard for Environmental Management (ISO 14001), certain changes were made so that the EMS could adapt to the differing organisational structures operating in the resort.

One such adaptation was the development of the ‘Lodge Workbook’ to help ski lodges manage their environmental impacts and report against the common objectives and targets.

While individual ski lodges may not have a major impact on the environment, the cumulative impact from lodges is potentially a significant risk to the environment. Because of this the operations of individual lodges needs to be captured under the system.

It was not realistic to expect ski lodges to invest time and resources into developing unique environmental management systems and procedures given the voluntary and small scale nature of their organisations, or to expect them to follow the overarching Perisher Range EMS procedures.

The Lodge Workbook was developed to combine environmental education with information about environmental obligations and EMS reporting requirements. The Lodge Workbook allows clubs and
small commercial lodges to work towards environmental improvements without needing to invest resources in the development of individual systems or procedures.

The Lodge Workbook is a creative way of helping lodges recognise areas where they may be causing environmental impacts, and has been designed to change the behaviour of stakeholders in the resort so that the way they do business presents less risk to the environment.

The Lodge Workbook includes a separate chapter for each of the 12 environmental objectives. It has spaces for lodges to identify how they control environmental issues, and provides useful prompts and ideas for lodges that do not have a good understanding of the environmental risks posed by their operations. In this way, lodges can either use the workbook to demonstrate to NPWS that they are taking responsibility for the environment, and they can use it as a tool to help them become more sustainable.

By filling out the workbook and undertaking the activities as directed, lodges will be able to plan, document, measure and evaluate their environmental performance. In future years, lodges will be able to compare their performance to the environmental performance of the resort as a whole.

The workbook will also help lodges identify and manage some of the environmental risks associated with their business, and achieve and maintain compliance with relevant environmental requirements.

The Lodge Workbook is an innovative and practical solution for managing the cumulative environmental impacts of small businesses and organisations in the Resort.

**Conclusion**

The Perisher Range Resorts place-based EMS is an example of how all stakeholders at a single tourism destination have worked together to produce an innovative and comprehensive system for managing their environmental impacts. NPWS and URS are confident that the EMS will greatly benefit both the health of the tourism industry in the area as well as Kosciuszko National Park.

The Perisher Range EMS will help NPWS and stakeholder meet the following goals:

- Reduced environmental impacts, and protection of the resources upon which the long-term viability of the tourism industry depends;
- Increased efficiency and reduced operating costs through conservation of resources;
- Clear setting of priorities and allocation of resources;
- Identification and prioritisation of environmental issues, based on a risk assessment approach.
- Competitive advantage through the ability to market products as sustainable. For instance the Perisher Range EMS is consistent with certification systems such as Green Globe;
- Achievement of a significant development consent condition; and
- Improved relationship between government and stakeholders.

We believe the development of place-based management systems for tourism destinations is potentially an excellent way forward for the tourism industry. Many tourism destinations may profit both financially and environmentally from the implementation of comprehensive and tailored environmental management systems.

The commitment made by the tourism industry and government to move forward sustainably is embodied in the Perisher Range Resorts common environmental Vision Statement, which concludes this paper:

*The Perisher Range Resorts will be widely recognised for the exemplary environmental management of the area’s natural, cultural, aesthetic and social values in the national park setting, and for sustainable, recreation-related development that respects, conserves, enhances and restores those values.*
The small communities of remote and rural centres in south-eastern Australia share a common affinity with the mountains. Their brief history and cultural heritage is built on the pioneering spirit and legendary stories of hardships endured as European settlers sought grazing land, mineral wealth and timber resources as they pushed out from the coast into the mountains. In contemporary times these communities are again facing hardships as world economies and conservation values impact on traditional lifestyles and their ability to sustain economic viability. These changes are forcing communities to embrace new challenges and re-evaluate the potential of their common asset, the mountains, to provide economic stability and growth in lieu of decline and decay.

This project has engaged communities in practical demonstrations through participation, to explore the potential for economic sustainability through co-operative asset utilisation and partnership building. These partnerships include stakeholders from all sectors including managers of public and private assets in the region. A key feature of this project is the application of information technology to engage a wide range of people across traditional boundaries, encompassing four local government areas and two tourism regions. All discussion and exercise planning has been done with minimal need for meetings, using email and web publishing as the key information distribution mediums.

Through email discussion, the backpacker market was identified as providing great potential for economic growth with relative low levels of new investment and manageable impacts on the total environment. This market segment matches the available asset very well, recent survey (August 2001 TNT Magazine and USIT World) identifies the top four activities sought as:

- 73% camping
- 72% scuba diving
- 68% bush walking
- 62% 4X4 safaris

The mountain region of south-eastern Australia is well place to provide visitors with unique experiences in three of these top four activities.

The key stakeholders needed awareness of this potential market, and an understanding of what this market is seeking and how best to position the region to cater for the market. The project engaged the local communities to collectively invite a group of backpackers from around the world to experience a free tour of the region. The prime objective being to expose the local communities to the needs of the
market and invite feedback from the visitors on the suitability of the region, the quality of the products provided and the perceived value for money.

With financial support from local government and in-kind contributions from operators ten backpackers were treated to a 2-day tour through the high country between Licola and Dargo. Following the success of this exercise a second was arrange for eleven backpackers on a three day tour beginning at Bairnsdale, travelling via Ensay, Swifts Creek, Cassilis, Omeo and Anglers Rest to Glen Wills at the foot of the Bogong High Plains. In each case the visitors were taken to the attractions which locals considered to be their main drawcards.

The emphasis was to identify and utilise existing infrastructure to provide unique experiences for the visitors, and ensure that the market potential was exposed to as wide a cross section of the communities as possible. Examples of the range of experiences offered to the visitors were:

- Camp oven cooking and interaction with locals at Wallaby Rise
- Purebred dingo’s at Licola Lions Village
- Visit to thunder egg geological site
- Visit to mountain cattleman’s hut
- Fire lookout station on the Pinnacles
- 4X4 drive on the Billy Goat Bluff Track
- Social evening in the Dargo Hotel
- Visit to Grant Historical area
- Wonongatta River barbecue
- Town barbecue at the Omeo Historic Precinct
- Australian Stockman whip-cracking demonstration
- Visit to Glen Wills gold mining ruins
- Bush walk to Wombat Falls
- Lunch at the Blue Duck Inn, Anglers Rest
- Visit the Omeo Historic Precinct and Courthouse
- Visit Mt Markey Winery Cassilis
- Clay Target shooting at the Tambo Valley Gun Club
- Mountain Bike ride from Swifts Creek to Ensay with students from the Alpine School, Dinner Plain
- Country Pub lunch at the Little River Inn, Ensay

For each activity/product encountered the visitors were surveyed with three basic questions, a) product suitability to the backpacker market, b) hospitality experienced, c) value for money. The visitor response to the surveys were comprehensive, a total of 670 individual questions answered providing excellent feedback to the product providers. The overall responses to the three questions for each exercise are recorded in Table 1.

Table 1.

<table>
<thead>
<tr>
<th>Suitable Product</th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Bad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Licola - Dargo</td>
<td>49%</td>
<td>35%</td>
<td>12%</td>
<td>4%</td>
</tr>
<tr>
<td>Ensay- Omeo region</td>
<td>28%</td>
<td>48%</td>
<td>24%</td>
<td>0%</td>
</tr>
<tr>
<td>Hospitality</td>
<td>Excellent</td>
<td>Good</td>
<td>Fair</td>
<td>Bad</td>
</tr>
<tr>
<td>Licola - Dargo</td>
<td>55%</td>
<td>33%</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>Ensay- Omeo region</td>
<td>62%</td>
<td>32%</td>
<td>6%</td>
<td>0%</td>
</tr>
<tr>
<td>Value for Money</td>
<td>Excellent</td>
<td>Good</td>
<td>Fair</td>
<td>Bad</td>
</tr>
<tr>
<td>Licola - Dargo</td>
<td>15%</td>
<td>65%</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Ensay- Omeo region</td>
<td>27%</td>
<td>48%</td>
<td>22%</td>
<td>3%</td>
</tr>
</tbody>
</table>
The exercises confirmed the belief that the region has much to offer the backpacker market, but also emphasised the need for communities to work together to become “product ready” for the market. The market requires the “total package” of the three critical components to be successful:

- Accommodation
- Transport
- Activities

Accommodation needs to be under $20/day, be in a secure homely environment with other backpackers, provide cooking and laundry services and be close to socialising opportunities.

Transport is a real issue for regional areas, 80% of backpacker rely on public transport, and often these links are not available to remote communities. The Alpine project is currently working with local and state governments to develop “passengers on mail-runs” as a possible solution to public transport infrastructure.

Activities need to be easily accessed, priced to meet the market expectations and be unique to the region in order to become a “must see/do” experience for the backpacker market. Often communities can provide these activities with minimal infrastructure investment requirements, as demonstrated by the Swifts Creek community. Backpackers were treated to a unique experience, clay target shooting at the local gun club which proved to be very popular, allowing the visitors to interact with the local community in an activity which is a part of everyday life here, but unique to the visitors.

These exercises involving partnerships between remote communities have demonstrated a potential to utilise the mountain region in attracting visitors aware of environmental issues, interested in heritage and desiring interaction with locals in the region.

Full details of this project are published on the Maffra Community Resource Centre web site at, www.maffra.net.au/alpine.
Tourism in Protected Areas: Continuing Challenges and Emerging Issues for Sustaining Visitor Experiences

Stephen F McCool

School of Forestry, The University of Montana USA

Mountains and Visitor Experiences

The high levels of growth in nature-based tourism in mountain landscapes continue to challenge land managers to sustain the experiences that parks and other protected areas were established to provide. Mountain protected areas provide valuable opportunities for tourists to be tested, to learn about and appreciate nature, to strengthen family togetherness and build lifetime friendships, to find solitude, to attain escape from the pressures of an increasingly chaotic and frenzied urban culture, to seek spiritual insight, to become physically fit, and to develop and reinforce outdoor recreation skills.

The ability of mountains to provide such opportunities is no accident. Their topography, climate and vegetation have often made extensive development difficult, so that they have remained as remote vestiges of a more primitive and earlier landscape. The absence of continuous development and agriculture leaves their meanings and opportunities to the human imagination. While we can argue whether these benefits of mountains are solely dependent on their largely undeveloped status, these benefits are often sought in mountain landscapes.

The emergence of mountains in the 20th century as havens for recreational opportunities has lead to important questions for managers of the protected areas that lie within them, the small communities that were once established to exploit mineral and timber resources found in mountains, the tourists themselves, and the private sector entrepreneurs that seek to capitalize on a growing market for these opportunities. What experiences do visitors seek? What do they find acceptable and what is preferred? Which of these experiences is appropriate in mountain landscapes? How do we manage landscapes to provide for these appropriate experiences? How do we decide on what is appropriate? Who gets to decide? How do we listen to those visitors who are excluded from study? What types of areas provide for what kinds of opportunities? How do we, as managers, both think and act regionally? How do we reconcile competing objectives and conflicting experiences? How do we transition from one economy to another? What capacities do communities have for a tourism economy? What role does the private sector have in providing experience opportunities in publicly administered areas? The challenge to sustain visitor experiences in protected areas encompasses these questions and many others.

In addition, the developing expectations that parks provide a variety of ecosystem goods and services, serve as refuges for endangered species of fish, wildlife and vegetation, and function as centers for learning about the effects of development and other human endeavors act as a complex overlay upon the traditional roles of parks in providing opportunities for nature and culture based recreation. These newer expectations in combination with growing desires that parks and protected areas also provide the
foundation for a variety of income producing recreation activities serve to test even the most perceptive and competent manager.

Mingled with an ever more conservative political agenda that increasingly replaces a publicly funded model of management with a market driven one, it would be easy to abandon a principled, conceptually sound and socially acceptable method of management for one that relies solely on market tendencies and fancies. This is the natural propensity when adopting a private sector model for managing publicly administered resources. Yet, such resources are driven by mandates that go well beyond the market responsive desires of private sector business.

Managers, visitors, communities and business leaders have somewhat different interests in sustaining visitor experiences, and as a result these interests may at times collide, at others reinforce each other. The challenges and issues emerging from the intersections of these interests with protected area mandates are usually complex, frequently contentious, and filled with uncertainty. Within a social and political environment that is increasingly turbulent and volatile, sustaining visitor experiences has become, if nothing else, a messy job. In this paper, I review the significant challenges and emergent issues that confront the four interests as they seek to sustain visitor experiences.

**Continuing Challenges**

Sustaining visitor experiences over the time scales necessary to build a business, to protect a park, to make available quality tourist opportunities or to assist a community requires vigorous engagement of business leaders, community activists, visitors and park managers. The ability to provide high quality opportunities over long time frames is fundamental to being competitive in the global arena that characterizes 21st century tourism.

There are three significant challenges that confront those for whom providing high quality recreation and tourism opportunities is important. First, mapping and measuring the experiences visitors desire persists as a major challenge, not only for researchers, but also for the park managers mandated to provide opportunities and businesses seeking to find a profitable market. Second, linking these desired experiences to the attributes that are needed to provide for them remains problematic. And, third, the relationship between the natural environment, which serves as the foundation for these desired experiences and the tourism industry that often exploits them is often poorly understood, yet is fundamental to sustainability.

**Mapping and Measuring Visitor Experiences**

At the heart of sustaining visitor experiences is a significant research task that involves understanding what outcomes tourists seek when visiting mountain landscapes. In one sense, the technology for mapping and measuring visitor experiences is well advanced, but evolving, broadening the repertoire of methodologies available. In the US, a strong research tradition built upon the work of Driver, Brown, Knopf and associates (e.g., Driver, Tinsley and Manfredo 1991; Driver, Brown and Peterson 1991) has informed many a park and protected area manager of the experiences, outcomes and benefits that tourists seek during a visit. This approach to identifying visitor experiences is based on the proposition that a satisfying experience is determined by the extent to which the actual outcomes sought compare to those experienced. This approach largely attempts to identify the specific social-psychological outcomes sought by visitors, thus being specific about what it is that visitors seek.

I offer up two examples of this approach in which I was involved. In the first study (McCool and Reilly 1994), we examined visitors to three state parks in Montana. The purpose of the study was to provide information about what outcomes visitors seek when they visit a state park and how those may be used in determining how managers might deal with specific attributes of the park. In this study, we assessed the importance of a number of expected outcomes by asking sampled visitors to complete a mail return questionnaire: nature appreciation, solitude, activity participation, escape and family togetherness1. Among these motivations, we found that nature appreciation was the most important as shown in Table 1, a significant finding in itself. However, we know that visitors often bring with them expectations

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1 Complete details about the methodology are found in McCool and Reilly (1994).
for a variety of outcomes: it is this package or cluster of outcomes that more appropriately describes the experience people seek in a recreational engagement.

However, visitors to a recreation site or protected area are not all the same: there are likely to be a variety of visitors seeking somewhat different outcomes (Shafer 1969): what benefits or outcomes that are important for one subgroup of visitors may be unimportant for another. To identify the potential subgroups visiting these parks, cluster analysis was used to group visitors together based on the similarities in their pattern of scoring on the outcome domains identified, as shown in Figure 1. Four types of visitors, based on how they viewed the importance of various outcomes or benefits of visiting these parks were developed in this cluster analysis. This analysis developed essentially four market segments.

The second example deals with visitors on a day hiking trip in several areas in Glacier National Park (Miller, McCool and Freimund 1997) in Montana. This study used a similar approach as the state park one: we asked visitors to complete a questionnaire that included their ratings of the importance of several outcomes, including solitude, security, appreciating wildlife, introspection, and personal control. The results of clustering visitors on these different dimensions of the experience are shown in Figure 2.

Both studies identified the experiences people seek, and indicated that visitors to these parks are composed of a series of minorities (each cluster in the two studies is around 25% of the population sampled) based on the cluster of outcomes they seek. Each of the experience minorities shares with the others some similarities, but is differentiated from the others by the importance to which certain outcomes are held. The presence of several minorities thus advances the notion that there is diversity in the types of experiences people seek. One particular mountain landscape may thus provide the setting for different opportunities. In a sense, a setting is several settings, as it evokes different meanings for different visitors.

Borrie and Birzell (2001) discuss several other approaches to identifying the experiences visitors seek when entering a protected area. These include meaning-based approaches (where scientists attempt to understand the role of wilderness or other protected areas within the larger context of the visitor’s life), experience-sampling methods (where researchers, through the use of a beeper or other means ask study respondents to describe moods and other feelings about wilderness at specific points in time) and importance performance analysis (which calls upon visitors to rate the importance of certain setting attributes to their experience and how well those attributes functioned during their visit). Each of these approaches has certain advantages and has varying utility for how a specific mountain setting would be managed.

**Linking Site Attributes to Desired Experiences**

Mapping the outcomes that visitors expect to attain from a recreational engagement is important, but understanding how to manage settings so that they may achieve these outcomes is critical to sensitive stewardship. In terms of visitor experiences, all managers can do is provide the opportunity for visitors to achieve the experiences they seek; visitors create experiences by interacting with the attributes or conditions they encounter at a recreation site. Recreation sites contain many attributes, biophysical, social and managerial (Clark and Stankey 1979). Only some of which may be relevant to particular experiences, others may be salient to all experiences. When recreationists visit a site they essentially “pick and choose” the salient attributes and from those “produce” a recreational experience.

Recreationists may have norms or standards by which they judge the acceptability of the salient attributes or conditions they encounter, thus leading to a favorable or unfavorable evaluation of those attributes. However, these norms will be related to the importance of the outcomes sought. Thus, for example, a backcountry hiker for whom solitude is an important dimension of the experience would likely have stronger and more well-defined norms for encountering others on a trail than another recreationist who is not expecting solitude. The former would evaluate encounters with others more negatively than the latter.

Yet, there is a subtle issue here. Managers can only provide opportunities for people to achieve certain desired outcomes. The visitors themselves produce the experience. Managers manipulate setting attributes and conditions in order to increase the probability that a certain set of experiences can be produced, but as
noted above, often visitors will realize experiences not necessarily intended by managers. Thus, in order for managers to increase the probability of certain experiences, objectives for a protected area must be stated in order to clearly define the intended experience.

If our objective is to sustain experiences, then we need to understand how setting attributes are related to these experiences. Figure 3 shows how this may occur using some of the data from the study of Glacier National Park visitors. We asked visitors to what extent the conditions and attributes they encountered during their hike “threatened” the reasons for visiting the park. The figure shows that different types of visitors had, in some cases, different reactions to conditions, and in other cases, their reactions were similar.

The data suggest that how a park or other protected area is managed will affect the ability of a visitor to achieve the outcomes sought. For example, if management decides that too many people are visiting the park, and implement a use limit policy, people who are sensitive to high use levels and encounters will be favored. If managers provide lots of development, those visitors seeking experiences related to appreciating nature or scenery would be negatively impacted.

Linking Experiences Dependent on Natural Environments to the Tourism and Recreation Industry

The third challenge concerns how the tourism and recreation industry views stewardship of mountain landscapes. Much of the tourism and recreation industry in mountain landscapes is directly linked to the quality of the natural environment that exists there. In the State of Montana, one study reported that about 50% of the state’s tourism industry, measured as gross retail expenditures of non-resident visitors, was directly linked to activities occurring on wildlands (Yuan and Moisey 1992). A marketing study by the Angus-Reid Group of California travelers observed that “a place that takes care of its environment” is a very important consideration in selecting out of state destinations. Further, “a chance to see wildlife and undisturbed nature” was ranked as very important by 44% of the respondents. Menning and McCool (1993) reported that where there was congruence in visitor attitudes between an environmental motivation and an image of a destination as “natural”, respondents were more likely to visit an area than other tourists.

This data suggests that good stewardship of the natural environment lies at the foundation of a successful tourism and recreation industry, particularly in mountain landscapes that are sensitive to impacts. Good stewardship requires active, competent managers, a socially acceptable plan to identify a future and how to get there, and the funding resources (and in some cases policy) to ensure that the actions designed to secure a desired future indeed are implemented as scheduled. Fundamental to these requirements themselves is the political activism needed to draw attention to management challenges and to allocate the money required to deal with them. Here the interests of managers, visitors, communities and businesses converge, for without good stewardship, the recreational and tourism values underlying and important to each interest may be threatened or even lost.

Of all these groups, the tourism industry generally wields the most influential political power. Its comments and input into the political process are important in determining policy, allocating funds, and in implementing management actions. Yet, I have detected reluctance, particularly in the US, to engage in lobbying for stewardship of mountain protected areas. Often we see industry lobbying against certain proposed actions, but rarely do I see tourism organizations lobbying for increased park budgets, pressuring for new management plans, and advocating for protection over utilization.

There may be systemic reasons for this. It may be difficult for a motel owner, a restaurant proprietor, a service station manager, or even a transportation vendor to see the connections between a business and the quality of a nearby park. It may be that the management of the park is viewed with disdain or not trusted. The tourism industry may not possess much ownership in the park or a management plan. Regardless, of the reason, visitor experiences are destined to decline in quality or become more exclusive without the active political engagement of all interests, but particularly tourism dependent business and trade organizations.
Emerging Issues

The above challenges have confronted the managers of mountain protected areas for a long time. Against this backdrop of continuing challenges, three issues are emerging that will confront stakeholders interested in these areas. What experiences are to be provided has become a major developing issue as recreational interests have diversified. Second, we are increasingly confronted with the challenge of managing within the context of a region. And, third, how do we manage to be adaptable in a world of change, uncertainty and competitiveness?

For Whom do We Manage?

Looking back on the two examples of park visitors, we observed that each of the studies demonstrated that there were several clusters of visitor types. And, we observed that each type had somewhat different perceptions of preferred setting attributes. A major implication of these findings is the question of who (in terms of clusters of visitor types) should the park be managed for.

Not all visitor types may be expecting outcomes that are consistent with park objectives. It would be inappropriate to manage setting attributes and conditions consistent with these expected outcomes. There may be several visitor types that can be accommodated within park objectives, but their preferences for setting conditions may be substantially different. Attempting to satisfy all visitor types may lead to a situation where none are really satisfied, and where each conflicts with the other. Thus, the recreational benefits flowing from the park will not be maximized.

By choosing one group to manage for, planners can increase the flow of benefits for that group, but, by managing setting attributes for one group managers may meet the needs of other groups. Careful examination of outcomes expected and how those are related to setting attributes can help managers better understand the consequences to visitor experiences, and thus ultimately the flow of benefits arising from satisfactory recreational engagements.

Making decisions about for which group to manage may be an uncomfortable one. Parks are for everybody, after all. Yet, quality is best assured through diversity of settings. Over a variety of jurisdictions, managing for different groups will actually maximize this flow of benefits (Wagar 1966). To do this will require regional level venues for discussion and allocation.

Managing Within a Regional Context

One of the fundamental tasks of protected area managers is to make tradeoffs between environmental protection and recreational access. Managers do this to ensure that the biophysical attributes serving as the foundation for recreation are not unacceptably impacted and reasonable, unrestricted access is provided for recreationists. But in making these decisions, managers often deal only with the area under their specific jurisdiction, attempting to reduce impacts and optimize recreation opportunities. Yet a single protected area exists within a regional system of areas, that is parks and other reserves that, while potentially managed by different agencies, are linked together in an informal system, such that management actions in one area affect management and recreation opportunities in another.

Sustaining high quality visitor experiences requires that we provide diversity of opportunity, generally within a region. Yet, there are few mechanisms and venues for managers to consider how to think and act at a regional level with respect to visitor experiences. Lessons from conservation biology, where corridors and reserves are being designed at large scales to provide habitats may be useful here.

The one area at a time approach has the potential negative impact of homogenization of recreation opportunities as each manager listens to the visitors currently entering the area. Visitors who are dissatisfied with current site attributes and conditions no longer visit and thus will not be consulted in determining visitor experiences. But since only those visitors entering the park are consulted, it is their opinions for which managers may be attempting to respond. Over a series of areas, we can end up in a situation where each area caters to approximately the same type of visitor, and thus the range of
experiences that are provided are reduced, ultimately to a point of homogenization (McCool and Cole 2001).

**Becoming Adaptable**

For 98 years, ending in 1969, a large bonfire would be lit every evening on the edge of Glacier Point in Yosemite National Park. At 9 PM, down on the valley floor, someone would call out “Let the Fire Fall”, and someone else 3,000 feet above would slowly push the burning coals and embers over the cliff with the words “The Fire is Falling”. For these 98 years, the Firefall was a component of a preeminent national park experience. But things change. What once was acceptable is no longer. The last Firefall occurred in 1969 because this activity, this experience was no longer acceptable.

While most of us would probably agree that being adaptable in the face of global change is a desirable characteristic, we face threats to experiences first, by being too adaptable and second, by having institutional designs that restrict adaptation in the face of overwhelming evidence that change needs to happen. The first threat is that of fads. Preferences shift; values and beliefs fluctuate, change occurs; but will the institutions respond?

Thus an emerging challenge to sustaining visitor experiences is adapting to changing visitor needs, but doing so consistently with the social mandate that established the protected area.

**Conclusion**

Sustaining visitor experiences remains one of the most challenging tasks of protected area managers for they must integrate sociology, psychology, political science and biology into a set of decisions that can only provide opportunity, not determine quality. Visitor experience decisions remain challenging because they also require integration of science and planning to develop opportunities that are difficult to tangibly describe. In addition, because managers of protected areas are generally rewarded for the stewardship they provide their area, there are distinct possibilities that gaps in the spectrum of opportunities may occur, opportunities may be homogenized, and duplication may occur.

The science of managing visitor opportunities within a systems context is not particularly well developed (McCool and Cole 2001). The science of identifying the experiences visitors seek has a strong conceptual foundation and is evolving to be more inclusive of different approaches and paradigms. We understand how to differentiate different types of experiences, we understand somewhat less how to manage to provide opportunities for people to experience these opportunities, we understand least, and are uncomfortable most with, how to make decisions about for whom—in the sense of experiences—a park should be managed.

Table 1. Mean scores and ANOVA significance levels on scales for respondents visiting each of the parks included in the Montana State Park study (source: McCool and Reilly, 1994)

<table>
<thead>
<tr>
<th>Park</th>
<th>Nature Appreciation</th>
<th>Solitude</th>
<th>Escape</th>
<th>Affiliation</th>
<th>Activity Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flathead Lake</td>
<td>4.2</td>
<td>4.6</td>
<td>4.7</td>
<td>3.7</td>
<td>2.6</td>
</tr>
<tr>
<td>Lewis and Clark</td>
<td>4.6</td>
<td>3.2</td>
<td>3.8</td>
<td>3.5</td>
<td>2.3</td>
</tr>
<tr>
<td>Makoshika</td>
<td>4.5</td>
<td>4.4</td>
<td>3.7</td>
<td>3.2</td>
<td>2.4</td>
</tr>
<tr>
<td>AVERAGE</td>
<td>4.4</td>
<td>4.1</td>
<td>4.1</td>
<td>3.5</td>
<td>2.4</td>
</tr>
<tr>
<td>F Significance</td>
<td>.002</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>.027</td>
<td>.137</td>
</tr>
</tbody>
</table>
Figure 1. Results of cluster analysis that shows importance of various expected experience benefits by segment.
Figure 2. This figure shows the benefit segmentation of Glacier National Park day hikers (source: Miller and others 1997).
Figure 3. Figure showing how different experience or benefit segments felt that the conditions they encountered during their visit to Glacier National Park "threatened" the reasons (vertical access) for visiting the Park (source: Miller and others 1997).
Literature Cited


Communicating Minimal Impact Messages
In The Australian Alps National Parks

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Abstract

Millions of visitor-days are spent in the Australian Alps national parks (AAnp) each year, so the potential for environmental impact is great. By making visitors aware of why and how they can modify their behaviour to lessen that impact, interpretation provides cost-effective resource and visitor management. In the 1990s, the AAnp developed ‘Minimal Impact Code’ leaflets for different recreational pursuits. Evaluation in 1998/99—through extensive stakeholder consultation—showed the leaflets were reasonably effective at communicating, but had design deficiencies and were poorly distributed. To meet the identified need for a generic code of minimal impact (MI) behaviour across audiences, new MI messages were developed in 2001. Using an innovative research-based and consultative approach, a four-tier hierarchy of texts was created under the overarching slogan ‘Care for the Alps—Leave No Trace’. This paper summarises the processes and outcomes of that redevelopment.

Minimal Impact Education In The Australian Alps

With large numbers of people bushwalking, camping, canoeing, horse-riding, skiing, mountain biking or climbing—often in fragile habitats—there is significant potential for environmental impact in the Australian Alps national parks (AAnp). To minimise this, managers apply the three ‘Es’—engineering (site hardening at ‘honey-pot’ areas), enforcement (regulation of group sizes, ‘fuel-stove only’ zones) and education, showing visitors how and why to modify their behaviour to lessen their impact while still enjoying their recreational activities. Spurred on by Tasmanian successes (O’Loughlin, 1989, 1996), in the 1990s the AAnp introduced a leaflet series of ‘Minimal Impact Codes’ (Bushwalking, Car-based Camping, Mountain Bike, Horse-Riding, River Users, Snow-camping and Huts Codes).

Evaluating The Minimal Impact Codes

In 1998/99, these Codes were evaluated through extensive stakeholder consultation (interviews with visitors in Kosciuszko, Namadgi and Mt Buffalo National Parks; surveys and interviews with special-interest user groups; interviews with rangers and tourist/visitor centre staff—Beckmann, 1999a, 1999b). While the Codes did communicate MI information, specific deficiencies in content, design, amount of text and graphics decreased their effectiveness. Stakeholder feedback was comprehensive, including the identification of subtle and unintended messages, such as the bushwalker ‘looking miserable’ on the Bushwalking Code, or the illustration of young riders, but older bushwalkers, in the Mountain Bike Code. Overall, distribution was the main weakness: many Alps backcountry visitors and user groups were
simply not receiving the leaflets. User groups received moderate to high levels of MI messages through their own material, but these messages sometimes conflicted with management policy. There was widespread support for additional MI media, especially signage, face-to-face ranger contact, leaflets and feature articles in user-group/specialist magazines (Beckmann 1999a, b).

**Redeveloping The Minimal Impact Messages—The Task**

On the basis of the evaluation’s findings and recommendations, it was decided to redevelop the Alps MI messages to apply to all Alps visitors across a variety of settings and media using extensive formative evaluation (the developmental testing of material for its suitability for its intended purpose with its intended audience). The process involved literature research; development and testing of messages through stakeholder consultation; consideration of delivery media; and development of a medium-term monitoring framework.

**Minimal Impact Education—The Theory**

**Modifying Behaviour Through Persuasive Communication**

Minimal impact education aims to encourage visitors to adopt types of behaviour that reduce the level, or risk, of environmental impact. When the desired behaviour is already practised, MI messages act as reinforcement. When the desired behaviour is relatively novel (e.g. as with MI toileting), the objective is behaviour modification, and effectiveness depends on how well the visitor is persuaded to behave in the desired manner. Effectiveness of ‘persuasive communication’ is influenced by many factors—how the audience receives messages and relates them to underlying beliefs and attitudes; the relevancy and detail of information provided; the format and channel of presentation; and the timing of message delivery (Finn, 1985; Ajzen, 1992; Petty and Wegener, 1998; Beckmann, 1999c; S. Ham, pers. comm., 2002). Developing effective persuasive communication thus requires an understanding of how verbal and non-verbal messages influence human attitudes and behaviour, as suggested, for example, by the Theory of Planned Behaviour (Ajzen, 1991), the Elaboration Likelihood Model (Petty, McMichael and Brannon, 1992) and the Activation Theory of Information Exposure (Donohew, Palmgreen, and Duncan, 1980). Principles of behaviour psychology—the relevance of audience beliefs and attitudes—have long been applied by health communication professionals (Hochbaum, Sorenson and Lorig, 1992), and are now being addressed in road safety (Parker and Stradling, 2001) and wildlife-related visitor safety (Beckmann, 2001; S. Ham, pers. comm., 2002).

**Research Findings From The Literature**

Relatively little empirical research specifically relates to the communication of MI messages, but five key findings emerged.

1. Information conveyed through simple brochures disperses wilderness users, enhances opportunities for solitude, and reduces site impacts, with personalised information contacts more successful (Roggenbuck and Watson, 1986).

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1 Without formative evaluation, unexpected communication problems may arise. For example, one river safety poster was less effective than expected largely because the slogan ‘Don’t Croak in the River’ and its accompanying graphic of a frog clinging to a reed simply did not convey the intended message ‘Don’t die in the river’. Audience feedback showed that many people associated frogs with conservation rather than safety, and did not know the colloquial phrase: this lack of immediate understanding made it more likely that the whole interpretation would be dismissed, despite the safety messages elsewhere on the poster (Beckmann, 1994). Where resources permit, formative evaluation is becoming more common (Mascot, 1998).
These principles (each with several sub-headings) were chosen to reflect the most important visitor impacts and to communicate broadly.

2. In the mid-1970s, US Forest Service wilderness managers introduced face-to-face ‘no trace’ education (Marion and Reid, 2001). By the 1980s, a more formal program emphasised wilderness ethics and more sustainable travel/camping practices. In 1987, a ‘Leave No Trace Land Ethics’ leaflet (developed by the US Forest Service, National Parks Service and Bureau of Land Management) complemented the national ‘Tread Lightly’ program geared to motorised visitors (Marion and Reid, 2001). By 1990 the ‘Leave No Trace’ message was adopted nationally, with the principles revised in 2000 (Figure 1; Watts, 2000).

3. The Tasmanian MI Bushwalking campaign (O’Loughlin, 1996) showed the importance of:
   - knowing the audience (e.g. origin, motivations, MI attitudes);
   - using eye-catching messages, preferably humorous, sharp and short;
   - aiming and disseminating the messages to stakeholders; and
   - monitoring effectiveness (especially biophysical impacts and attitude changes).

4. Phrases used to focus MI education are reasonably familiar to visitors in Australian national parks—54% of 204 visitors to Bunya Mountains National Park (Queensland) knew the phrase ‘minimal impact bushwalking’ or ‘no trace camping’ (Parkin, 1997), while many Alps backcountry visitors knew all common MI phrases (Beckmann, 1999a; Table 1).

<table>
<thead>
<tr>
<th>Phrase used in minimal impact education in Australia</th>
<th>Proportion of all interviewees who knew this phrase (n=109)</th>
<th>Proportion of all interviewees who thought this the most meaningful phrase (n=109)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimal impact bushwalking</td>
<td>76%</td>
<td>20%</td>
</tr>
<tr>
<td>Take nothing but photographs, leave nothing but footprints</td>
<td>74%</td>
<td>49%</td>
</tr>
<tr>
<td>Minimal impact camping</td>
<td>61%</td>
<td>10%</td>
</tr>
<tr>
<td>Tread lightly</td>
<td>61%</td>
<td>4%</td>
</tr>
<tr>
<td>Walk softly</td>
<td>51%</td>
<td>0%</td>
</tr>
<tr>
<td>No trace camping</td>
<td>32%</td>
<td>9%</td>
</tr>
</tbody>
</table>

Table 1 Awareness and Perceptions of Common MI Phrases Among Visitors to Australian Alps national parks (adapted from Beckmann, 1999a)
5. American researchers had examined the effectiveness of presenting up to eight MI messages on trail-side bulletin boards in wilderness areas (Cole, Hammond and McCool, 1997; Cole, 1998). Reading the messages did increase visitors’ knowledge about appropriate practices, but very few actually read them, with ‘the attention devoted to each message and the ability to retain the message content’ declining as the number of messages increased, although using a simple ‘appeal’ increased attention time significantly. Hikers exposed to eight messages could not identify more of the recommended practices than those exposed to only two messages. Attention per message was greatest with just four messages, with the most retention of message content occurring with only two messages present.

**Planning The New Messages**

Trying to apply these empirical findings where possible, the project sought to define target audiences, identify content to be addressed in key messages, and develop a message structure.

Intended target audiences included independent visitors; special-interest recreation groups; commercial guides leading recreational/educational groups; young people participating in outdoor learning; and Alps residents, especially those involved commercially (e.g. tour operators, information centres, gear suppliers). Relevant experiences, beliefs, attitudes and behavioural norms vary across these audiences, so the new messages could make few assumptions.

Stakeholder consultation—with AAmp staff, special-interest groups and other visitors—was crucial. Consultation aimed to canvass ideas on proposed messages, to collect detailed feedback on draft wording (e.g. Did it patronise experienced visitors, or deter inexperienced ones?), to suggest supporting graphics, and to consider distribution.

An overarching and consistent slogan was essential. The messages themselves—limited to just six—needed to focus on communicating specific behaviours, not just concepts. Wording had to convey complex information clearly but with some language ‘play’ to enhance memorability, with each message supported by a visual element for sight learning and recognition.

At a February 2001 workshop, AAmp staff discussed slogans, branding, content, wording preferences, message structures and dissemination. The most important MI messages—i.e. relating to behaviours that cover the widest range of AAmp audiences and impacts—were identified as trip planning, use of tracks, use of fires, toileting, waste (litter) management and multiple-user recreation. Additional content areas—such as washing, health issues, interaction with wildlife and group size—were to be addressed within the detail of the six key areas.

The new messages were constructed in a four-tier hierarchy (Figure 2).

- **Level 1**—Slogan—a single phrase to communicate the overall MI message through a simple directive (i.e. telling people what to do), and to provide continuity and cohesion across all MI materials;
- **Level 2**—Key Message (KM)—short, memorable phrase to summarise the specific behavioural directive in each of the six key areas of MI impacts/practices; suitable for use on almost all media, and supported by easily recognisable graphics (Message Icons) to provide a visual reminder/reinforcement;
- **Level 3**—Key Message Support (KMS)—additional phrase to extend and interpret each Key Message, useable across most media;
- **Level 4**—Extended Sub-Text (EST)—more extensive (though concise and readable) text to expand on specific behaviours and their rationale, to be used in media/circumstances where visitors are receptive in terms of time/interest, or in situations when managers/interpreters want to target one or two messages in depth.
Figure 2  Hierarchical Message Structure for New Alps Minimal Impact Messages

This hierarchical structure was designed to facilitate the overall communication process. Each level has different characteristics and content, with each successive level providing more information on the recommended behaviour and its rationale. Each level thus has different relevance to potential media and dissemination—a leaflet may use all four levels while an accessory could carry just Slogan and Message Icons. Not all KMs need be used in every situation, nor in the same order; where the main issues are behaviour on tracks and toileting, for example, these two KMs may be given priority. Conversely, on a well-used track three small signs at spaced intervals, each with two KMs, may be more effective than just one trackhead sign with all six messages.
Formative Evaluation

Between February and May 2001, the message structure and draft texts were developed in close collaboration with AAnp staff, then formative evaluation occurred from May to August 2001. First, students from the University of Canberra’s Cultural Heritage Management stream—representing inexperienced but supportive visitors—provided feedback on proposed group-work processes and draft text. Next, some 50 ACT- or NSW-based special-interest user groups (e.g. bushwalking/camping, vehicle-based touring, skiing, climbing, canoeing, cycling, outdoor education, Scouts, tour operators, gear suppliers) and independent recreationists—including contributors to the earlier evaluation—were invited to a workshop in Canberra. About 25 people attended, overall widely representative of target audiences.

Discussions were focused but wide-ranging. Consideration of the proposed slogan centred on the pros and cons of known MI ‘umbrella’ phrases. ‘Take nothing but photographs, leave nothing but footprints’ was popular in terms of awareness and memorability, but was considered inappropriate for fragile environments (where even footprints constitute an impact) and too strongly directed at walkers. Participants discussed three alternatives of the first three levels of each message. Having alternatives stimulated debate and identified audience perspectives (although individual written feedback ensured that verbal consensus was not dominated by a few). For example, participants felt that many campers are convinced they make safe campfires, so that it was better to emphasise fuel stoves being quicker and easier rather than safer.

After AAnp staff had checked revised wording/content for relevance across jurisdictions, 50 additional groups based in Victoria, NSW and ACT were invited to provide on-line (web-based) feedback. About 20 people responded (representative of Alps users both in activities and locations). Wording of all levels of text was then finalised and Message Icons commissioned by the AALC (Figure 3).

Message Structure—The Practice

While the final text at each message level appears simple, careful semantic analysis has been involved. For example, the Slogan Care for the Alps—Leave No Trace is to be used on all media both as a stand-alone summary/reinforcement element and as an introduction/summary of the key messages.
Care For The Alps—Leave No Trace

Plan ahead. Think before your trip—about weather, equipment and safety.

Use a fuel stove—quicker and cleaner for you, better for the bush.

Carry it in, carry it out. Don't burn, bury or leave anything.

Got to ‘go’? Use a toilet or take a walk—at least 100 paces from water and campsites. Dig 15 cm deep and cover well.

Stay on track—even if it’s muddy or dusty. Don’t widen tracks or take shortcuts.

Leave no trace. Walking, driving, camping, skiing, riding, climbing, paddling—whatever you do, aim to leave no trace.
The two-part directive is short, all-encompassing and acceptable across age/interest groups, and reinforces/expands the ‘no trace’ phrase used in the Alps Codes. ‘Care’ is a positive directive, well associated with environmental protection (e.g. LandCare). Direct mention of the Alps provides a clear ‘branding’ element. Linking the word ‘care’ to Leave No Trace identifies the nature of the care required while still retaining the wider interpretation of environmental protection in its broadest sense. Each of the six KMs addresses behaviours relevant to important impacts, with the final KM having both summary and appeal elements. The ESTs communicate the ‘official’ view of AAnp managers simply and concisely, but can be shortened, expanded or rewritten as needed. All wording is positive, simple and straightforward—only the toileting message has a potentially culturally- or linguistically-restrictive element (i.e. an understanding of the colloquialism ‘got to go’), but this adds a humorous element, explained by the KMS and Message Icon.

Relating the Message Structure to Media Selection and Dissemination

Each level has different relevance to potential media and dissemination (Figure 4). Thus a water bottle may convey just the Slogan, Key Messages and Icons, while all four levels are appropriate in media expected to be read in full. Individual KMs and associated KMS can stand alone where just one impact needs highlighting. Visitors pay more attention to information in smaller ‘chunks’ and prefer information that is stimulating as well as informative (Donohew et al., 1980; Finn 1985), so changing the number and combination of messages on different media at different sites may encourage greater attention. The broader design context is important too: the effectiveness of written media, for example, is influenced by typeface, colour and graphic design (Moscardo, 1999). Though outside the scope of this project, these design aspects will be crucial to the success of the strategy and each individual product. The aim is to present the Slogan and KMs sufficiently often to promote familiarity and reinforcement, but maintaining interest through different presentations. Formal monitoring (developed as part of the project) will depend on funding availability, but community awareness of the new Slogan and KMs could be assessed as part of the broader-focus Alps Benchmark Awareness Surveys.

Figure 4 Sample Media-Selection Matrix—Interpretive Media for Alps MI Messages

<table>
<thead>
<tr>
<th>Interpretive Medium</th>
<th>Level 1 Slogan</th>
<th>Level 2 KM</th>
<th>Level 3 KMS</th>
<th>Level 4 EST</th>
<th>Appropriate Placement/Distribution</th>
</tr>
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<tbody>
<tr>
<td>Flier, mini-poster (DL/A5)</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>—</td>
<td>Major distribution sites (visitor centres etc.)</td>
</tr>
<tr>
<td>Leaflet (tri-fold A4)</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>Major distribution sites; as insert into group magazines; commercial tour operators</td>
</tr>
<tr>
<td>Sign / display shelter</td>
<td>+</td>
<td>+</td>
<td>(++)</td>
<td></td>
<td>‘Honey-pot’ visitor congregation sites e.g. trackheads, chair-lifts</td>
</tr>
<tr>
<td>Accessory e.g. water bottle</td>
<td>+</td>
<td>(++)</td>
<td>(++)</td>
<td>—</td>
<td>Gear suppliers, visitor centres</td>
</tr>
</tbody>
</table>

Widespread US use of ‘Leave No Trace’ for branded MI education (Marion and Reid, 2001) provides potential for external reinforcement. Not unexpectedly, similarities occurred between the principles/wording of Leave No Trace Inc. and the AAnp (Figures 1 and 3 respectively), but there are distinguishing cultural, linguistic and management perspectives.
Conclusions

Ever-increasing visitation in the AAnp make awareness, knowledge and implementation of MI practices essential. Using formative evaluation to develop the new messages provided relevant and cost-effective feedback, with consultation also providing positive promotional outcomes. Dissemination of MI messages is as important as wording or media (Beckmann, 1999a, b), so consistent effort and funding will be needed. The new messages are already being used—in an International Year of Mountains feature (280,000 copies distributed via information centres and regional newspapers, January 2002); in an educational insert (The Canberra Times, 45,000 copies provided to readers and in class sets to schools, February 2002); and towards the end of 2002 in a new AAnp icon brochure, a revised Huts Code, a water bottle, an avant card, a new Alps Walking Track brochure, and the website (C. Renwick, pers. comm., 2002; AAnp 2002). Informal staff and audience feedback is very positive. The research-based perspective has given Alps managers confidence in the likely effectiveness of the new messages, as well as continuing the process of engaging AAnp users and managers in co-operative MI education.

Acknowledgements

This work was commissioned by the Australian Alps Liaison Committee. Very special thanks to the Project Team—Cath Renwick, Simon Allender, Karen Civil and Virginia Logan—for enthusiastic support and feedback; to Dr Linda Young, University of Canberra; and to the many people participating in the consultation.
References


Finn, S., 1985, Information-Theoretic Measures of Reader Enjoyment, Written Communication, 2, 358-376.


The Cooperative Research Centre for Sustainable Tourism, Mountain Tourism Subprogram

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Senior Lecture in Environmental Sciences, School of Environmental and Applied Sciences, Griffith University, Australia
Director, Mountain Tourism Subprogram, Cooperative Research Centre for Sustainable Tourism.

Abstract

The Mountain Tourism Subprogram of the Cooperative Research Centre (CRC) for Sustainable Tourism was established in 1999, to enhance the economic, social and environmental sustainability of tourism in Australia’s high country. In its first four years, the subprogram has been involved in research into visitor monitoring in the Kosciuszko alpine area and at Mt Buffalo; environmental education and interpretation; the economic benefits of the Australian Alps National Parks; impacts of human waste on alpine ecosystems; impacts of snow manipulation on vegetation; the role of tourism in the spread of weeds in the Australian Alps; national parks staff perceptions of the environmental impacts of tourism; environmental issues associated with the provision of walking tracks; climate change and tourism; and environmental management of mountain tourism and resorts. Within the program, at the School of Environment and Applied Sciences at Griffith University alone, we have produced four scientific papers, with a further five under review; four refereed book chapters; three CRC research reports, with another two under review by refereed publications; and 34-plus conference presentations. We have also provided support for three honours theses and three PhD projects.

What are Cooperative Research Centres?

The Cooperative Research Centres and Development Initiative was set up by the Commonwealth Government in 1990. The program was established to strengthen collaborative links between industry, research organisations, educational institutions and relevant government agencies. It aims to bring research providers and industry together to focus on outcomes for business and the community.

What is the Cooperative Research Centre for Sustainable Tourism?

The Cooperative Research Centre for Sustainable Tourism (CRC ST) was established under the Australian Government’s Cooperative Research Centre (CRC) program, to underpin the development of a dynamic, internationally competitive and sustainable tourism industry. Its goal is to deliver innovations to business, community and government, in order to enhance the environmental, economic and social sustainability of tourism. Partners in the CRC ST include 14 universities; the peak government tourism bodies in each state and territory; and 20 industry partners, including Qantas, KPMG, American Express Travel Related Services, and the Bureau of Tourism Research.
Within the CRC ST there are seven programs: 1) Tourism, conservation and environmental management research, 2) Tourism engineering design and eco-technology research, 3) Tourism policy, events and business management research, 4) Tourism information technology and infomatics research, 5) Post graduate education, 6) the Centre for tourism and risk management and 7) the Centre for regional tourism research. Within 1), the Tourism, conservation and environmental management research program, there are four subprograms: 1) Adventure tourism, 2) Wildlife Tourism, 3) Nature tourism and 4) Mountain Tourism.

What is the Mountain Tourism Subprogram?

The Mountain Tourism Subprogram is a research partnership established between ski resorts, universities, national parks, and local tourism organisations, in the Snowy Mountains, the Victorian High Country, Tasmania and the Australian Capital Territory. Our goal is to enhance the environmental, economic and social sustainability of mountain tourism in Australia.

Why do we need research into mountain tourism?

Mountain tourism is a large, important and distinctive area for tourism in Australia (Hill and Pickering 2002; Worboys and Pickering 2002). As with other sectors of the tourism industry, there is a vital need for research to ensure sustainability. Key aspects of mountain tourism in Australia include ski resorts, summer tourism, backcountry tourism, the potential impact of climate change, economics and visitor monitoring.

Ski resorts are one of the most intensive forms of tourism development in mountain areas (Buckley et al. 2000). They have large capital and operating costs, significant reserves and potential profitability, and often operate in very sensitive natural environments. As industry members compete for clients, they are increasingly seeking to expand visitation by broadening their range of activities. They are evolving from "ski resorts" into "winter resorts" and, by lengthening their operating season, from "winter resorts" into "mountain resorts" (Konig 1998; Buckley et al. 2000).

Mountain tourism is not all resort based. In winter it also includes wilderness touring on cross-country or telemark skis, or snowboards and snowshoes; guided commercial backcountry tours; visits to huts; and the use of rope tows, small club skifields, larger commercial skifields without accommodation, and skifields with lodge accommodation only (Buckley et al. 2000; Pickering and Hill In press).

Summer mountain tourism includes car touring, guided walks, horse riding, paragliding, mountain biking, camping in organised camp sites, backcountry camping, hiking on trails, hiking off trails, sightseeing, wildflower viewing, rock climbing, hang gliding, fishing, and golf (Good 1992; Hill and Pickering 2002; Worboys and Pickering 2002). Some of these activities make use of resorts and associated facilities. Others use facilities such as roads, trails, and organised campsites away from resorts (Arkle 2000; Hill and Pickering 2002). A growing number of these activities occur in remote wilderness areas with high conservation requirements (Worboys and Pickering 2002).

Dramatic changes in the climate of alpine areas in Australia have been predicted to occur within the next 70 years (Whetton 1998). These changes involve a reduction in snow cover, increased temperatures and possible lower precipitation. The models indicate fairly substantial changes in the total area covered by snow, and a substantial change in the duration of snow cover for specific locations.

Such alterations to snow cover are likely to have significant effects on ski resorts and mountain tourism in Australia (Buckley et al. 2000). Poor snow seasons in the past have resulted in dramatic declines in income for resorts and their associated commercial activities. Surveys of people currently visiting resorts to ski or snowboard indicate that the majority would either give up skiing, ski overseas, or ski in Australia less often, if snow cover declines (König 1998). Non snow based tourism could act as a buffer for any such changes, as well as enhancing the economic viability of the industry in the current environment. Resorts and local regional centers need to start focusing more on year round tourism, including conference, educational and health tourism, as well as increasing educational and activity holidays and adventure sports (König 1998; Worboys and Pickering 2002).
These types of changes in tourism activities and in their timing and intensity result in changes in the economics, demography and environmental sustainability of the industry (Worboys and Pickering 2002; Mules 2002). Therefore a better understanding and monitoring of visitors to resorts and national parks, both in summer and winter, will assist with effective planning for all those involved in mountain tourism (AALC 1999; Triandos 2000; McMasters 2000). Effective use of visitor data can enhance the economic sustainability of the industry. It can also assist with effective planning for maintaining the environmental values that are a vital component of the attractiveness of the region to tourists.

The sustainability of mountain tourism in Australia requires effective management, based on accurate research, of all aspects of mountain tourism at the national, regional and local levels. This research is being provided by an innovative and interdisciplinary team that addresses the needs of: the tourism industry; regional economies that are dependent on mountain tourism; specific resorts and tour operators; the public; and national parks. That’s what the CRC ST Mountain Tourism Subprogram is here to do.

The Mountain Tourism Subprogram at a glance

Objectives

- Summarise patterns and trends in Australian mountain tourism.
- Review environmental management issues for mountain tourism in National Parks.
- Assess likely effects of climate change on mountain tourism.
- Establish economic importance of mountain tourism.
- Facilitate management of ski resorts in mountain tourism.
- Facilitate the development of sustainable backcountry and summer tourism in the mountains.

Outcomes

- Assistance to stakeholders in strategic planning for sustainable mountain tourism, in the light of tourism trends, climate change and environmental management issues.
- Diversification of mountain tourism, including environmentally sustainable summer tourism.
- Improved market and financial viability for mountain resorts and tour operators.
- Improved environmental sustainability of mountain tourism in protected areas.
- Integration of mountain tourism into regional tourism development.
- Implementation of policies, strategies, legislation and other institutional instruments to facilitate sustainable development of mountain tourism.
- Enhanced co-operation between natural resource managers and resorts and other tourism operators in the management of mountain tourism.

Deliverables

- CRC Research Reports in Mountain Tourism (four published, two under review).
- Papers in refereed international scientific journals (nine published or under review).
- Chapters in academic books (four published, two more in draft).
- Academic books (two published).
- Factsheets (four produced so far).
- Conference presentations (34-plus at international and national conferences).
- Workshops (four jointly with the Australian Institute of Alpine Studies, two with the Australian Alps Liaison Committee).
- Research theses (three current PhD students and three completed honours students).
- Sponsor of the International Year of the Mountains conference “Celebrating Mountains”.
- Contribution to new Kosciuszko National Park Plan of Management.
Figure 1 - Scope of subprogram research projects
# Research projects

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<th>Title</th>
<th>Principle university researchers</th>
<th>Stakeholders involved</th>
</tr>
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<td>Mountain Tourism Subprogram</td>
<td>Dr C. Pickering, School of Environmental and Applied Sciences Griffith University</td>
<td>consultation with industry and government.</td>
</tr>
<tr>
<td>Tourism in Kosciuszko National Park: planning for change</td>
<td>Dr C. Pickering, P. Scherrer School of Environmental and Applied Sciences Griffith University</td>
<td>Griffith University, New South Wales National Parks and Wildlife Service (NSW NPWS)</td>
</tr>
<tr>
<td>Visitor monitoring in mountain parks and resorts</td>
<td>Dr R. Russell, Formally Faculty of Law and Management School of Tourism and Hospitality La Trobe University</td>
<td>Parks Victoria, Mt Buffalo Chalet, Mt Hotham Resort Management, Mt Buller Resort, La Trobe University</td>
</tr>
<tr>
<td>Sustainability of mountain tourism</td>
<td>Dr C. Pickering, W. Hill, F. Johnston, and A. Growcock School of Environmental and Applied Sciences Griffith University</td>
<td>Australian Alps Liaison Committee, NSW NPWS, Griffith University</td>
</tr>
<tr>
<td>Events and festivals: ensuring economic sustainability in mountain areas</td>
<td>Prof. T. Mules, Tourism Program, University of Canberra</td>
<td>Thredbo Chamber of Commerce, University of Canberra</td>
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<tr>
<td>Visitor monitoring for regional areas: a case study of tourism in the Snowy Mountains region</td>
<td>Prof. T. Mules, Tourism Program, University of Canberra</td>
<td>Tourism Snowy Mountains, University of Canberra</td>
</tr>
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<td>Characteristics and expectations of alpine backcountry bushwalkers in Tasmania</td>
<td>Lorne Kriwoken, Centre for Environmental Studies, University of Tasmania</td>
<td>University of Tasmania, Parks and Wildlife Service of Tasmania</td>
</tr>
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<td>The economic value of tourism to the Australian Alps protected areas</td>
<td>Prof. T. Mules, Tourism Program, University of Canberra</td>
<td>University of Canberra, Australian Alps Liaison Committee, NSW NPWS, Environment ACT, Parks Victoria</td>
</tr>
<tr>
<td>International Year of the Mountains in 2002: promoting sustainable mountain tourism in Australia</td>
<td>Dr C. Pickering, W. Hill, School of Environmental and Applied Sciences Griffith University</td>
<td>Australian Alps Liaison Committee, Australian Institute of Alpine Studies, Griffith University, University of Tasmania, Parks and Wildlife Service of Tasmania</td>
</tr>
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</table>
References

AALC See Australian Alps Liaison Committee.


Improving Planning For Sustainable Mountain Tourism – Consideration Of Cumulative Impacts

Lisa Testoni

Department of Environment and Heritage, lisa.testoni@ea.gov.au

Abstract

The acknowledgment of the relationship between tourism and cumulative impacts is not new, and is increasingly important considering the global concept of sustainability. This is further emphasized by the fact that tourism often occurs in environmentally sensitive environments, including many of the world’s mountainous regions. The question of how effectively cumulative impacts are considered in mountain tourism in Australia and Canada forms the broad research context for this paper. Key literature identifies links between cumulative impacts and tourism (Wight 1994) with the view that it is in the interest of the tourism industry that cumulative environmental impacts be managed, since these impacts can destroy the industry’s commercial viability very rapidly (Butler and Waldbrook 1991).

Research has involved investigation of a completed study process, incorporating cumulative impact assessment, in Banff National Park, Canada and application of a approach to cumulative impact assessment in consultation with Resort Management and Government Regulators in the Victorian Alps, Australia. This paper will consider some of the opportunities and limitations involved in translating cumulative impact assessment into improved planning for tourism in mountain regions.

Introduction

The primary thesis of this dissertation is that “planning for sustainable tourism regions can be improved through consideration of cumulative impacts”. Applying a theoretical model (incorporating research and planning) demonstrates how cumulative impacts could be considered and managed within current planning frameworks. This is explored with reference to the Banff Bow-Valley in Canada and the Victorian Alps, Australia.

According to the literature review, planning for tourism has principally been development based and hence has not been integrated with broader planning processes. Combined with the lack of consideration of cumulative impacts (as a result of limited research and planning) the achievement of sustainable tourism is limited. While tourism is an important activity it does operate within a system of other land uses, human needs and desires, ecological capacity etc. Various activities are inextricably linked, and ignoring the integrated nature of activities and impacts and their combined, synergistic and cumulative effects can result in negative consequences.
Literature

Cumulative impacts (CI) are the effects on valued environmental component(s) that are additive in time, space and/or interact together (Cameron 2000 and Hegmann et al. 1998). Cumulative impact assessment aims to take the longer and broader view to identify the possible total effect of decisions about a number of seemingly isolated projects (Thomas 1998).

A holistic or systems view of all elements (human and natural) is increasingly recognised as necessary for a sustainable approach to development generally (Odum 1982; Suzuki 1999), and in relation to tourism development (Carlson 1998; Getz 1983; Gunn 1979). Systems theory was adapted to urban and regional planning (Chadwick 1971), and has been used to inform various models in relation to tourism planning (Getz 1983).

Cumulative impacts have been recognised as an important issue in planning for sustainable tourism (Butler 2000; Buckley 1994; Court et al. 1994; Dowling 1993; Pearce et al. 1993; Wight 1994). Review of current practice reveals that there is considerable room for improvement in planning for tourism, the industry with perhaps the most to lose from inadequate consideration of sustainability issues (Butler and Waldbrook 1991; Dredge 1997; Ecologically Sustainable Working Groups 1991; Hall, Jenkins and Kearsley 1997; Hall and Lew 1998; Prosser 1991). The cumulative impacts of individual tourism developments frequently threaten the ecological, economic and social “carrying capacity” of tourism areas and undermine the natural and social values that attract tourists. In many cases the planning and impact assessment methods and processes currently in use are not effective in managing the cumulative impacts of all tourism enterprises to ensure the sustainability of the tourism resource (Buckley 1991; Butler 2000; Harvey 1998; Hunter and Green 1995; McDonald 1999; Orians 1995; Rees 1988; Theobald 1994). Many tourism/recreation impacts take place in uncontrolled settings, posing problems for the traditional scientific approach (of control population or site). Cause and effects can often only be surmised rather than proven. It is difficult or impossible to separate effects of tourism from those of other activities and processes of change (Butler 2000: 343).

Impacts research needs to be more frequently incorporated into the management of tourism and recreation areas to minimise adverse consequences (Butler, in Pearce and Butler (eds.) 1993 and Butler 2000). Literature indicated that there is limited acknowledgement of cumulative impacts as being particularly critical in tourism as well as very little research or method application in this area (Dredge 1998; Sun and Walsh 1998). Cumulative impact assessment (CIA) can play a role in management of current projects, allowing for future development, while also considering regional carrying capacity (Glasson, Therivel and Chadwick 1999; Rees 1988; Tollefson and Wipond 1999).

Research

Research aimed to consider the relationship between tourism regions and cumulative impacts, as well as how this knowledge can be included in planning so as to improve the sustainability of tourism development. Consideration of how cumulative impacts can be considered to achieve sustainable tourism was investigated, through review of international cases, the Banff-Bow Valley Study, Canada (Green et.al.1996) and application of a network approach to CIA in Mt Hotham Alpine Resort/Alpine National Park, Victoria, Australia. This involved information collation and investigation of research questions using a theoretical model framework (Getz 1986) and a combination of document analysis, case study, interviews, observations, and a questionnaire. This variety of methods was used to achieve reliability and validity of research results, in using qualitative methods (Leedy 1993; Minichiello et al. 1995).

Getz (1986) proposed the “Integrative systems model of tourism theory and planning” applied to the assessment of an areas capacity to absorb tourism. Central to the model is that the planner or decision-maker should integrate understanding of the tourism system with control of the system. The incorporation of cumulative impacts in improving system understanding and planning is investigated through application and adaption of the model.
The Banff-Bow Valley Study (1996) was selected as a case study due to their being a substantial amount of research and writing on cumulative effects assessment in Canada, and the study was an application of CIA to a regional tourism situation, with sufficient time elapsed to enable analysis of whether this has informed planning. In Banff National Park (and region), it became clear that various projects over time were in combination detrimentally affecting the Banff Bow Valley ecosystem. The Task Force agreed that complete and naturally functioning ecosystems, a healthy environment upon which a viable, regional tourism industry depends, and a clean and abundant water supply for the large population centres along the Bow River were too valuable to risk (Page et al. 1996). The objective of the Cumulative Effects Assessment (CEA) was "to quantitatively assess the cumulative effects of land use, development, human presence and activities on aquatic and terrestrial ecosystems, the physical environment and socio-economic systems by evaluating the changes to key representative species or indicators in the past, present and the reasonably foreseeable future" (Page, et. al. 1996:367). This case demonstrates that the cumulative impacts of tourism and associated development became recognised as a threat to the values of the region and to future sustainable tourism development in the National Park.

The Australian Case Study research applied a network approach for cumulative impact assessment developed by Lane et al. (1988) from Canadian research (largely supported by CEARC), used conceptually in an Australian Commonwealth Review of CIA (Court et al. (1994)). This network represents causes, actions, primary impacts, secondary impacts and tertiary impacts. Networks have value as a means of identifying cumulative impacts and can be used to pinpoint cause and effect relationships and identify priority impact issues, tracing their base causes to enable effective management (Dixon and Montz 1995). Further, networks can be developed using expert judgement (Lane et al. 1988 and MacDonald 1998), in the absence of other data. The nature of cumulative impacts study, and the relative unavailability of quantitative data means that "…qualitative methods are used to a greater extent " (Cooper and Canter 1997: 26).

Document review was collated in combination with interviews to identify valued resource components, activities and impact issues. This information was used to construct the network diagrams in relation to tourism use of the Victorian Alps and more specifically in relation to the Horsehair Plain Airport development for Mt Hotham Alpine Resort. A questionnaire was distributed to consolidate the network, prioritise issues as well as to assess the usefulness of the network diagram in communicating cumulative impacts in a given area to decision makers. This presented one samples’ view and would require greater input and iterative workshopping to make the results more robust.

**Opportunities and Challenges in managing cumulative impacts for sustainable tourism**

Obstacles or challenges in this context can be identified for (a) cumulative impact assessment generally, (b) the Banff case, (c) the Australian Case Study CIA, and (d) the network analysis approach. This section will consider opportunities and obstacles with particular reference to the lessons from Banff and Victorian case studies.

**Opportunities**

The Banff study focused on the research component, with an ecological bias but did not adequately include the management component to successfully consider cumulative impacts. Planning has since been implemented (with varying success) and would appear to at least have increased knowledge of the affects of tourism in the natural ecosystems.

The Banff-Bow Valley Study and associated activity did create a reaction and increased awareness of cumulative impacts in a region of high visitor use (Ross pers.comm. 1999, Creasey 1999, Page pers.comm.1999, McDonald and Aumonier 1998). It has also prompted the development of formalised approaches to cumulative impact assessment in Parks Canada management. Cumulative effects/impacts are now explicitly considered in Parks planning, tourism operations have been changed (and in some cases limited) and a tourism strategy (appropriate to the nature of the setting and knowledge of cumulative impacts over time) has been developed and is being implemented.
There are still conflicts in relation to legislation requirements and the setting of limits in tourism development (although this provides some certainty in development planning). It has provided an important step in the application of cumulative impact assessment, but also points to the constraints in terms of resources.

Incremental growth in the Victorian alpine areas, was recognised. Combined with the fact that the environment is very sensitive to damage and there is a push for year round utilisation of resorts, better understanding of capacities and a longer-term view could allow Victorian Alpine resorts to remain competitive in changing circumstances over the longer term. Environmentally sensitive approaches to resort development, such as that used by Mount Hotham Resort Management in the Mary’s Slide/ The Orchard lift development (Arup 2000 and Keenan 2000) has the potential to reduce the individual impacts of various development projects while also making a contribution to reduction of future cumulative impacts.

Experts, in the Victorian case study indicated that the most important issues relating to development of alpine tourism infrastructure was topographic and environmental changes and their secondary and tertiary impacts. Identifying cumulative impacts can provide the policy maker with a clear indication of the area that may have to be more closely monitored in the future to manage impacts. This could also indicate which impacts should be subject to scientific quantitative analysis and evaluation (Hunter and Green 1995).

Priority issues can be identified from the network method allowing strategic planning and management efforts to focus on these. This also allows achievement targets to be set. There is the potential to apply significance weightings to issues and branches of the network to potentially address some of the acknowledged limitations of the network method. Hence, the results of the CIA exercise in the Victorian Alps could be used to inform the current strategic planning process, highlighting issues for management and flagging impacts on particular valued ecosystem components that may require monitoring.

It was found through the Victorian Case Study that the tourism industry and resource managers have a wealth of knowledge that can be used to define a qualitative regional context for assessment of cumulative impacts (without the need for complicated methods or quantitative analysis). The biases involved with using expert opinion should be kept in mind and minimized where possible. Where quantified data is available this can be used to inform decision-making.

Challenges

Some of the challenges inherent in cumulative impact management also apply to impact assessment and planning generally. These include limited jurisdictional authority, the role of public perceptions, multi-stakeholder requirements, issues of scale (spatial and temporal), availability of information, political will, ability to undertake assessment, uncertainty in prediction, a reluctance in tourism development to undertake impact assessment and the dilemma of financing additional analysis and management activities. There is limited administrative authority between jurisdictions, responsibility for different activities and lack of coordination between different levels and types of resource management (Ross and Duinker 2001). Jurisdiction is often unclear, and linked to the number of stakeholders involved. This is a challenge in the Victorian Alps, with various authorities involved in regional planning and management.

Public perceptions of a problem may or may not warrant funds for mitigation and management. The Banff process highlighted that the general public had little understanding of the seriousness of ecological degradation in the Banff-Bow Valley. Studies and research has demonstrated to policy makers and resource managers that there is a problem (Ritchie 1999a: 109). Similarly, "The problem is that while cumulative impacts are an issue, if they can't be seen then it is hard to justify resources to address these issues. Incremental damage and impacts is all about perceptions as much as it is anything else" (Rose pers. comm.1999). With environmental change taking some time to become evident, visitors will generally not notice the impacts they are causing, or that these require remedial management. It may be difficult to justify additional research and assessment required for CIA as well as management activities when the public do not see that there is a problem (or potential for adverse cumulative impacts). This was evident in both Case Studies, with incremental damage to alpine environments subject to public perceptions.
CIA and planning are multi-disciplinary tasks. Coordinating all interests in management of impacts will be challenging. Even when the impacts and interactions are identified and appropriate management outlined, there is still the problem of who will finance these measures. The Banff study clearly identified the fact that the financing of environmental protection in the National Parks System is going to be a major challenge. “Everyone said the right thing when it came to protecting the environment, but when it came to putting their money on the line, everyone (including the environmental movement) scurried for cover” (Ritchie 1999a). Parks Victoria and other government authorities in Victorian are limited by budgets, and have many issues to deal with. This is a major obstacle, however considering cumulative impacts in planning can result in a more holistic view of the situation, potentially avoiding cumulative impacts and hence the need for rehabilitation or management works.

The uncertainty of future activities is also one of the major challenges in CIA. Environmental change can take some time to emerge in some environments and many tourism impacts take place in uncontrolled settings, making it difficult to separate effects of tourism from those of other activities and processes of change. This poses problems for the traditional scientific approach. Cause and effects can often only be surmised rather than proven (Butler 2000).

The scale of a CIA is often a barrier to them being carried out. Some studies (particularly on a regional scale) have required teams of experts, financial support and lots of time. “The Banff-Bow Valley Study was one of the most comprehensive and most expensive studies of its type ever carried out in Canada” (Ritchie 1999a: 33).

The administrative situation can make access to best available information difficult, or information may simply not be in existence. Existing information may be biased (Stone pers.comm. 2001). Methodologies for CIA are available but not applied due to limited resources for comprehensive studies and data availability (Court et al. 1994).

The continuing fear of master planning and commitment to actions (Creasey 2001) makes CIA integration into planning processes more difficult as there is resistance to even the basic planning that occurs in many situations currently. Planning in the Australian Case Study has been limited and some stakeholders are reluctant to encourage the current planning process. There is some awareness of regional capacity and cumulative impacts in relation to tourism development but this needs to be applied in strategic planning.

The ecological focus taken in the Banff Bow Valley study, appears to have pleased some interests, but many others are not in agreement with the recommended actions as a result of this process. The Banff case could be seen as a step forwards in terms of recognition of cumulative impacts on the natural environment. While an improved understanding of cumulative impacts contributes to a theoretical model for sustainable tourism, there are many other factors that will require far more improvement for tourism to be sustainable in the Banff-Bow Valley, including greater integration of socio-economic interests and recognition of political/managerial realities. There has been some court action in relation to the limits on tourism activity as a result of the study and CIA (Christie pers. comm.1999). This may reflect a lack of socio-economic consideration in the process.

Conclusions

This paper has discussed some of the opportunities and challenges to including cumulative impact consideration in planning for sustainable tourism. There is nothing new, and many of these are characteristic of current planning and impact assessment. CIA can prompt investigation into understanding the system in which tourism operates beyond a project or strategic plan. The resultant information would improve and complement strategic planning. The difficulty or inability to predict in modelling systems (Jafari in Getz 1986: 32) should not prevent research and planning that attempts to improve our knowledge of the inputs and outputs of tourism. Systems are complex, and degrees of simplification are necessary for analysis and decision making, but the detail is integral to our understanding. Improved understanding of the system with continual evaluation and reassessment of goals will assist the planning process in being more adaptable as well as an improved ability (over time) to predict changes or consequences. Therefore, improving not only planning, but also the sustainability of tourism development.
Some of the challenges inherent in cumulative impact management have been presented, including issues of limited jurisdictional authority, the role of public perceptions, the multidisciplinary, multistakeholder requirements and the dilemma of financing additional analysis and management activities. Whether incorporation of cumulative impacts into planning of tourism regions results in improved sustainability outcomes, is difficult to determine, despite being possible theoretically.

Theoretically, it has been shown that CIs have relevance to tourism and can be included in planning. Controlling the tourism system through planning requires an understanding of the system. The region has been proposed as the best scale for this to occur. The in-depth examination of International examples, the Banff Case and Australian Case Study illustrated that cumulative impacts are an issue in tourism destinations and can be considered (with varying degrees of success). However, incorporating this knowledge in planning and implementation is the real challenge. Analysis and planning are subject to politics and the value-laden sphere of decision-making.

Analysis of the research using the theoretical model has shown that there is a general lack of understanding of the integrated tourism system (environmental, social and economic), including cumulative impacts. Cumulative impacts are often not considered in planning for tourism, despite being characteristic of much tourism activity and development. The ability of planning to successfully achieve sustainable tourism is complicated by the nature of sustainability, natural ecosystems, communities and political influence. Understanding of the nature of tourism and its impacts could improve planning and decision making for long term sustainable development.

References


Celebrating Mountains – An International Year of Mountains Conference
Jindabyne, New South Wales, Australia

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Mount Hotham Skiing Company Pty Ltd 2000 Take Off 2000 Mt Hotham, CD of photos.


