

IMPACTS OF CAMPING AND TRAMPLING ON AUSTRALIAN ALPINE AND SUBALPINE VEGETATION AND SOILS

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STATEMENT OF ORIGINALITY

This work has not previously been submitted for a degree or diploma in any university. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

Andrew Jason William Growcock

ABSTRACT

This thesis examines the impact of recreational activities, specifically camping and trampling, on alpine and subalpine vegetation communities in Kosciuszko National Park, Australia. A survey approach was first used to determine visitor use levels and types of recreation activities within the main alpine area. An experimental methodology was then used to quantify the relationship between use and damage from camping and trampling to vegetation and soils. Specific questions addressed were: (1) what are the visitor numbers, demographics, activities and patterns of visitation to the Kosciuszko alpine area and have they changed since previous estimates?; (2) what is the relationship between levels of use and damage for camping in undisturbed alpine and subalpine vegetation communities and does this vary between tent and activity areas?; (3) (a) what is the relationship between levels of use and damage for trampling in the undisturbed alpine and subalpine vegetation communities when trampled once and (b) are thresholds and/or the relationship altered when trampling is repeated in the following year?; (4) what is the relationship between use and damage from trampling to plant communities following a large-scale disturbance (bushfire) and do natural processes during the following year of recovery eclipse any recreation impacts?; and (5) what recommendations can be made to minimise impacts of trampling and camping in high altitude sites in the Australian Alps?

Research assessing the impact of recreation on the environment is important for conservation of protected areas. Recreation can affect a range of environmental components including vegetation and soils. These impacts can be measured using a range of parameters including vegetation cover, composition and height and soil compaction. When assessing the impact of recreation on vegetation and soils, four factors need to be considered: (1) amount of use; (2) type of use and behaviour; (3) timing of use; and (4) environmental characteristics. In this thesis it is proposed that low levels of recreation use may not cause significant damage to vegetation until a primary threshold point is reached where increasing use results in rapidly increasing amounts of damage. A second threshold may then be found above which increasing use does not result in significantly more damage. Type and intensity of impacts can vary among different activities so the effects of camping and trampling (which are popular activities in the area) were both examined at varying intensities of use. As vegetation types may also vary in their response, the impact of activities on different communities were compared. Finally, the effect of trampling after large scale fires was examined.

Kosciuszko National Park is a unique mountain area that has been used for a variety of activities since European settlement. Tourism is now one of the largest land uses of the Park with indications of continued growth from the mid 1950's through until the early 1990's. As the area has high conservation values, minimising the amount of disturbance to the environment caused by tourists is important for the long term management of the Park.

Based on an extensive analysis of visitor survey data collected prior to the thesis in the 1999/2000 non-winter period, it was possible to characterise recreational use of the largest alpine area in Australia. Like many protected areas around the world, recreational use in Kosciuszko National Park is increasing during the non-winter period. During this survey, 102 000 visitors were estimated as entering the Kosciuszko alpine area with approximately 47 000 visitors undertaking activities of a half a day or more. This is a 10% increase since the previous estimate from the 1990/91 non-winter period. A variety of activities are undertaken within the area including sightseeing, day walking, mountain biking and camping.

For camping, most trips were undertaken by small groups for short periods. Therefore the impacts to vegetation from one and three nights camping by groups of four people were assessed using an experimental approach. Camping for both one and three nights affected vegetation height, but to different extents. After three nights camping, there was a decrease in vegetation height in the tent and activity areas while after one night camping, a decrease in vegetation height only occurred in the tent area. Camping for three nights caused a short term increase in dead material, however six weeks after camping there was no difference in the cover of dead material among the control, tent or activities areas indicating that the effect was short lived. One night camping did not result in any significant increase in dead material.

Bushwalking is one of the most popular activities to be undertaken in the Australian Alps including the Kosciuszko alpine area. Many visitors undertaking walks during this time depart hardened tracks in order to reach destinations such as mountain peaks and glacial lakes. An obvious impact of this trampling is the creation of pads and trails as the vegetation cover is replaced by bare soil that then becomes compacted and/or erodes. The thresholds before signs of disturbance occur as a result of trampling vary among vegetation communities and among parameters measured. Generally, primary thresholds were exceeded after moderate use with damage still evident one year later. Reduced vegetation height occurred at lower levels of use, but recovered quickly. Vegetation cover showed limited recovery once damaged. This was particularly apparent for bog communities, which also had very low resistance to damage. Repeat trampling in the following year compounded the damage and lowered the primary thresholds.

Impacts and thresholds from trampling in subalpine areas within weeks of the landscape level bushfires in 2003 differed from those in the undisturbed community. Where areas had been burnt, low levels of trampling caused exposure and loss of underlying bare soils with secondary thresholds reached at low to moderate use. These thresholds occurred for both extensively burnt and partially burnt areas. The damage caused by trampling however, was rapidly eclipsed by natural processes with no significant effects after one year.

When examining the impacts of trampling in extensively burnt subalpine grasslands one year after the bushfires the thresholds for cover were again lower than undisturbed conditions even though there was substantial vegetation recovery from the fires. Low to moderate use was required to exceed the primary threshold for vegetation cover with a secondary threshold achieved after moderate use. Twelve months of recovery had however, allowed soils to become more cohesive with moderate to high trampling use now required to cause significant losses of soil.

This research has shown that the identification of two thresholds of disturbance will be beneficial for management decision making. A primary threshold will define the upper limit of use for dispersed recreational use while a secondary threshold will define when concentrated use should occur. This information is valuable, as while the resistance of the vegetation communities examined in this research was moderate in some communities, resilience was always low. As such, recovery from disturbance will be slow and damage should therefore be minimised as much as possible.

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GLOSSARY OF TERMS

Alpine area: the area between the climatic limit of tree vegetation (~1860 m in Kosciuszko National Park) and the zone of permanent snow and ice cover in other mountains.

Graminoids: sedges, rushes and grasses combined.

Impact: any undesirable visitor related biophysical change in the of the environmental resource (Leung & Marion 2000)

IUCN: World Conservation Union – International Union for the Conservation of Nature.

Non-winter period: in this thesis refers to the period between the middle of October and the end of May for Kosciuszko National Park in Australia.

NSW NPWS: New South Wales National Parks and Wildlife Service.

Primary threshold: maximum amount of use that can occur before there is significant damage to the pre-existing condition.

Recreation ecology: scientific research that examines the effect of recreation on the natural environment.

Resistance: the relative ability of individual plant species to withstand disturbance before being damaged.

Resilience: the capacity of a plant species to recover after disturbance.

Secondary threshold: level of use at which the proportion of damage associated with use begins to decrease.

Subalpine area: located between the upper limits of the montane zone and the climatic limit of tree vegetation (treeline) approximately 1500 and 1860 m in Kosciuszko National Park. The subalpine zone in the Park receives snow for an average of one month per year.

Subalpine grasslands: often found interspersed between the Snow Gum woodlands, in basin areas and within frost hollow areas in the Australian Alps. They are dominated by tussock forming grasses (*Poa* sp.) with inter-tussock areas dominated by a variety of herb species.

Tall alpine herbfields: widespread vegetation community found in the alpine zone of the Australian Alps with high species diversity. Prominently consists of species associated with the *Celmisia – Poa* alliance (sensu Costin *et al.* 2000).

Tolerance: the ability of vegetation to withstand a cycle of disturbance and recovery.

Valley bogs: wet vegetation communities dominated by *Sphagnum* species with underlying peat soils.