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Assessing the impacts of mountain biking and hiking on subalpine grassland in Australia using an experimental protocol

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ABSTRACT

Mountain biking is an increasingly popular, but sometimes controversial, activity in protected areas. Limited research on its impacts, including studies comparing biking with hiking, contributes to the challenges for mangers in assessing its appropriateness. The impacts of mountain bike riding off trail were compared to those of hiking on subalpine grassland in Australia using a modification of a common trampling experimental methodology. Vegetation and soil parameters were measured immediately and two weeks after different intensities of mountain biking (none, 25, 75, 200 and 500 passes across slope, 200 pass up and down slope) and hiking (200 and 500 passes across slope). There were reductions in vegetation height, cover and species richness, as well as changes in species composition and increases in litter and soil compaction with riding. Riding up and down a moderate slope had a greater impact than riding across the slope. Hiking also affected vegetation height, cover and composition. Mountain biking caused more damage than hiking but only at high use (500 passes). Further research including other ecosystems, topography, styles of riding, and weather conditions are required, but under the conditions tested here, hiking and mountain biking appear to be similar in their environmental impacts.

1. Introduction

Mountain biking is a popular activity in natural areas in North America (Schaefers, 2006; Cordell, 2008; Naber, 2008) and Europe (Heer et al., 2003; Arnberger, 2006), and is becoming increasingly popular in other developed countries such as Australia (Chiu and Kriwoken, 2003; Ryan, 2005; Hales and Kiewa, 2007; Newsome and Davis, 2009) and New Zealand (Mason and Leberman, 2000). In the USA, for example, around 43.3 million people rode a bike on back-country roads, trails, or cross country in 2000 (National Survey on Recreation and the Environment [NSRE], 2000). As a result there is increasing use of trails for mountain bike riding in many protected areas (Marion and Wimpey, 2007; Newsome and Davis, 2009). Also, as a result of diversification in equipment, there is increasing demand among riders for new experiences and destinations resulting in people riding mountain bikes well beyond formed trails within protected areas (Newsome and Davis, 2009).

There is considerable controversy regarding the appropriateness of mountain biking as an authorised activity in some protected areas, with much of the controversy involving the relative impacts of mountain biking compared to hiking (Cessford, 1995; Marion and Wimpey, 2007; Pickering et al., 2010a,b). This is in part exacerbated by the limited data available comparing the environmental impacts of hiking with those of mountain bike riding (Thurston and Reader, 2001; Marion and Wimpey, 2007; Newsome and Davis, 2009; Pickering et al., 2010a,b). This contrasts with the extensive recreation ecology research available documenting impacts from hiking on and off trails (Cole, 2004; Hill and Pickering, 2009 Pickering et al., 2010a).

One mountain biking specific impact that has been documented is the construction of unauthorised trail technical features (Newsome and Davis, 2009; Pickering et al., 2010b). These jumps, bridges, mounds and ditches are associated with reduced vegetation cover, introduction of foreign materials, soil compaction and erosion (Pickering et al., 2010b). They are a particularly important issue in parks close to urban centres where there is easy access to the area for a range of different riders (Newsome and Davis, 2009; Pickering et al., 2010b).

On existing trails, documented impacts of mountain biking include trail widening, vegetation damage on trail verges, soil compaction and erosion (Wilson and Seney, 1994; Chavez, 1996; Goeft and Alder, 2001; Chiu and Kriwoken, 2003; White et al., 2006; Pickering et al., 2010a). Where damage occurs on official trails, a common management response is not to ban or restrict use, but to further harden/modify the trail using some of the range of methods available for constructing mountain biking trails (Webber,

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2007). Where riding occurs off trail, documented impacts include vegetation damage and loss which can result in soil compaction and erosion and the formation of informal/social/illegal trails (Newsome and Davis, 2009; Thurston and Reader, 2001; Pickering et al., 2010a). The formation of new social trails either results in unplanned trail proliferation including in ecologically sensitive sites, or requires protected area managers to restrict further use of the social trails and undertake expensive rehabilitation of the existing damage.

Most of the research on impacts of mountain biking has assessed effects on existing trails, or compared the condition of hiking trails with those of mountain bike trails (Marion and Wimpey, 2007; Pickering et al., 2010a). There is limited research examining impacts of mountain bike riding off trails and the amount of use that is required to create social trails (Newsome and Davis, 2009; Pickering et al., 2010a). One experimental study compared the impacts of mountain biking and hiking on a susceptible forb dominated understory of a deciduous forest in Canada (Thurston and Reader, 2001). It used a modification of the Cole and Bayfield (1993) experimental methodology that has already been used to examine the impact of hiking on over 65 different vegetation communities around the world (Hill and Pickering, 2009). Treatment levels of 0, 25, 75, 300 and 500 passes down slope by hikers or by mountain bikers were applied to undisturbed vegetation (Thurston and Reader, 2001). Changes in vegetation and soils between treatments and controls were measured two weeks and one year after treatment. Mountain biking and hiking both resulted in vegetation loss, reduced species richness and increased soil exposure. The only significant difference in the impacts or vegetation recovery between the two activities was more exposed soil after 500 passes by a mountain bike compared to the same number of passes by a hiker, which could result in lasting damage.

Reflecting the need for more experimental research to address the controversy around relative impacts of the hiking and mountain biking, we also used a modification of the Cole and Bayfield (1993) methodology to directly compare the impacts of mountain bike riding and hiking off trail on vegetation and soils. In our study the experiment was conducted on a more resistant plant community, subalpine grassland, in a popular protected area where there is increasing demand for mountain biking in Australia. Specific objectives of the research were to assesses: (1) the impact of mountain bike riding, (2) the effect of different levels of use, (3) the impacts of riding a bike up and down a slope compared to across a slope, and (4) directly comparing the effects of mountain bike riding and hiking for moderate (200 passes) and high usage (500 passes).

2. Methods

2.1. Study area

The experiments were conducted in Kosciuszko National Park (6900 km^2), in south-eastern Australia New South Wales (Fig. 1). The Park is an UNESCO biosphere reserve as it contains examples of glacial and periglacial features including block streams and erratics, while the largest of the four glacial lakes, Blue Lake, is a RAMSAR wetland (Costin et al., 2000). The Park receives around three million visits a year, mostly to ski resorts in winter. During the snow free period, mountain bike riding is permitted on some management tracks, on public roads and on selected trails in the Park. Although data on the number of riders for the whole Park or for the subalpine zone is not available, the number of mountain bike riders in the main alpine area of around 100 km^2 was estimated as 3280 people during the snow free period in 1999/2000 (3.2% all summer visitors) (Johnston and Growcock, 2005). Although required to stay on tracks or roads in the Park, mountain bike riders can, and do, on occasion, ride off trail damaging vegetation and forming social trails.

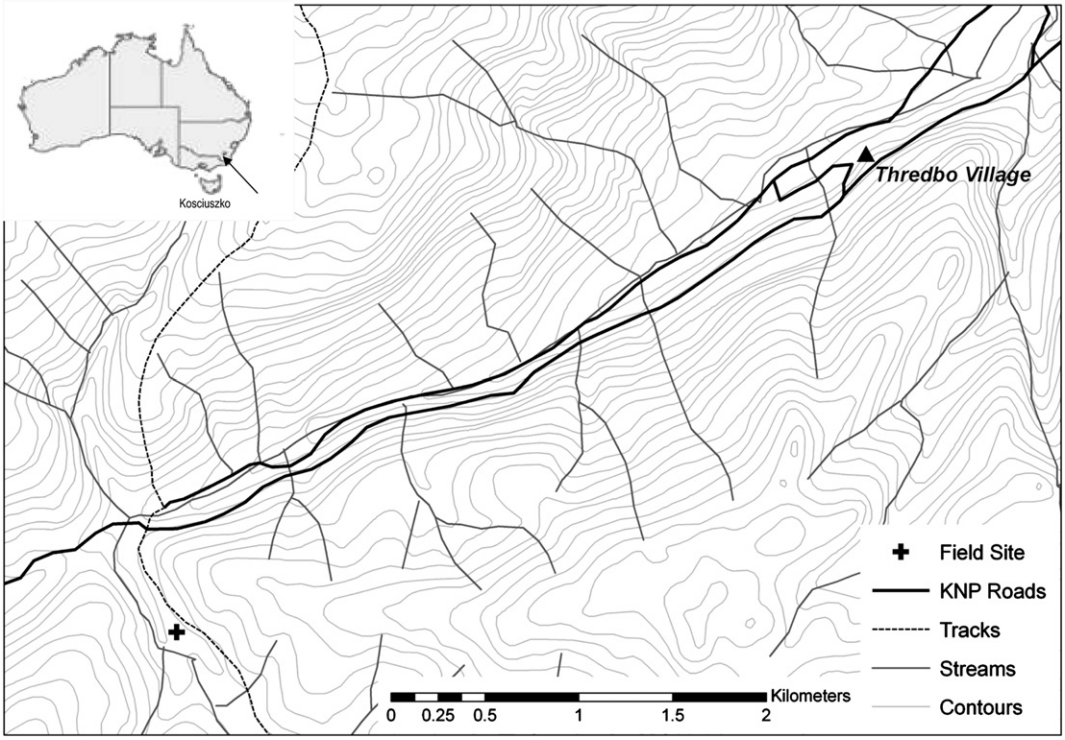

Fig. 1. Location of the site in subalpine grassland in Kosciuszko National Park, Australia.