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A longitudinal multi-method study of recreational impacts in the Arthur Range, Tasmania, Australia

Grant Dixon *, Martin Hawes [1]

Parks and Wildlife Service, Department of Primary Industries, Parks, Water and Environment, GPO Box 1751, Hobart, Tasmania 7001, Australia

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ABSTRACT

Longitudinal studies of recreational impacts can be valuable for identifying long-term trends and for assessing the long-term effectiveness of management measures designed to mitigate impacts. Several types of impact relating to recreational walking were monitored periodically in the remote and rugged Arthur Range, Tasmania, utilising a variety of techniques over a 20-year period starting in 1994. The first twelve years of the study coincided with the implementation of several management measures in the range including extensive 'hardening' of some tracks (trails) and campsites, local track realignments and closures, and the installation of signs encouraging walkers to 'fan out' on some track-free sections of the range. The monitoring programme provided information on the effectiveness of these measures and on trends in the condition of unimproved tracks, routes and campsites. The installation of camping platforms and associated infrastructure halted deterioration and facilitated recovery at several major campsites, although the recovery of devegetated sites was slow. 'Fanning out' forestalled track development in some parts of the range but proved ineffective even as a short-term measure on steep, confined terrain. Active deterioration continued on many unimproved track sections and campsites. Further management inputs are required if recreational impacts in the range are to be sustainable.

MANAGEMENT IMPLICATIONS

This study demonstrates the value of longitudinal monitoring programs for describing both the severity and extent of recreational impacts and the effectiveness of management measures. However, the situation in the Arthur Range exemplifies much of the 'real world' where, despite an abundance of data, changing policies and limited management resources have stalled efforts to achieve sustainable recreation management.

Findings of the study include:

- On unimproved track sections, absolute impacts are lower but rates of change proportionally greater in many lower-use areas (consistent with the widely-reported finding that the impact-use relationship is curvilinear).
- The installation of camping platforms, hardened tracks, toilets and other infrastructure at major campsites arrested and in some cases actually reversed campsite impacts, broad-scale trampling impacts and ad hoc track development at several of those campsites.
- Some recovery of closed or disused impacted campsites occurred, but recovery was minimal or extremely slow on alpine sites that had lost most of their original vegetation cover.
- The implementation of a 'fan out' (dispersal) policy in selected areas met with varying success, failing to halt track development even in the short term on steep, confined sites, but proving successful on open sites with low vegetation.

1. Introduction

Many of the world's natural areas are managed primarily to preserve their natural condition while providing opportunities for nature-based recreational activities such as hiking and camping

* Corresponding author: Tel.: +61 3 6165 4228; fax: +61 3 6223 8308.
E-mail addresses: Grant.Dixon@parks.tas.gov.au (G. Dixon), martin@twelveprinciples.net (M. Hawes).
[1] Permanent address: 469 Abels Bay Rd, Abels Bay, Tasmania, 7112, Australia.

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(Dudley, 2008). These objectives can conflict since recreational activities are often associated with impacts such as vegetation loss and soil erosion that degrade natural values (Cole, 1993). Consequently, managers often need to implement measures such as educating visitors and stabilising walking tracks to limit recreational impacts (Park, Manning, Marion, Lawson & Jacobi, 2008). For such measures to be effective and to optimise their effectiveness, monitoring is required so that managers can be informed about usage patterns, determine the location, severity and extent of biophysical and other impacts (Eagles, McCool & Haynes, 2002; Hadwen, Hill & Pickering, 2007; Tanner and Nickas, 2007), and assess the effectiveness of management measures (Leverington, Costa, Pavese & Hockings, 2010; Newsome, Moore & Dowling, 2013). Ideally, monitoring should be ongoing continuously, so managers stay informed about current conditions, be aware of long-term trends and adjust management measures to take account of changing conditions (Boyers, Fincher & van Wagtendonk, 2000; Hockings, Stolton, Leverington, Dudley & Courrau, 2006). Long term recreation impact monitoring programs are rare internationally; this is one of the reasons there are so few rigorous assessments of management effectiveness worldwide (Cole, Foti & Brown, 2008).

The past half-century has seen a dramatic increase in the extent of protected areas around the world, a development that reflects increasing awareness of environmental issues including anthropogenic threats to the natural environment (Dudley, 2008). The same period has witnessed a huge increase in the popularity of nature-based recreation activities (Balmford, Beresford, Green, Naidoo & Walpole, 2009). Since the early 1970s a substantial body of the literature has emerged in the field of recreational-impact research (Leung & Marion, 2000; Cole, 2004; Manning, 2011; Newsome et al., 2013), exploring topics such as the mechanisms of track deterioration and the effectiveness of educational programs in modifying walker behaviour. A range of techniques has been developed to monitor usage patterns and recreational impacts (e.g. Leung & Marion, 2000), and studies have been undertaken into the effectiveness of management measures such as signage (Park et al., 2008).

1.1. Nature and mechanics of recreational impacts

Numerous researchers have studied the biophysical effects of recreational trampling and camping in natural settings (Pescott & Stewart, 2014; Cole, 2004). Impacts typically include damage to and loss of vegetation, changes in species composition, soil compaction, erosion, and the development and deterioration of defined walking corridors (i.e. tracks or trails) and campsites (Cole, 2004). Post-impact recovery is often slow, particularly in alpine environments (Leung & Marion, 2000). The relationship between recreation use and impact has often been described as curvilinear, with low usage causing disproportionately high impacts (Hammit & Cole, 1998). For example, in some Tasmanian environments prolonged and sustained damage can result from as few as 100 walker passes (Whinam & Chilcott, 2003). However, the use-impact relationship can take other forms, and some studies have described a sigmoidal relationship (Monz, Pickering & Hadwen, 2013).

Walking tracks (trails) are generally subject to ongoing physical deterioration unless they are designed sustainably (which generally requires low gradients, with trails more closely aligned to contours rather than fall lines) or are located on self-maintaining substrates that resist erosion (Leung & Marion, 2000); otherwise artificial stabilisation or 'hardening' is required to avoid deterioration. The deterioration of unimproved walking tracks (generally visitor-created trails on which no stabilisation or hardening works have been undertaken) poses a serious management problem in many natural areas worldwide (op. cit.), especially as soil loss is generally considered irreversible (Olive & Marion, 2009). In addition to the obvious environmental impacts associated with gullying, track widening, quagmire development and track braiding or duplication, they can at the same time adversely affect the recreational experience of walkers (Lynn & Brown, 2003) and generally run counter to the management objectives of protected areas.

The factors that predispose unimproved tracks to degradation have been well studied, with key factors being gradient, track alignment relative to topography, drainage and substrate characteristics (e.g. Leung & Marion, 1996, 2000; Dixon, Hawes & McPherson, 2004; Morrocco & Ballantyne, 2007; Olive & Marion, 2009). Campsite impacts such as vegetation trampling and loss and site expansion, which typically develop rapidly and recover slowly, have also been studied extensively (Cole 2004). Campsite conditions are particularly important for the visitor experience because visitors are strongly influenced by what they find at campsites (Flood, 2003).

1.2. Monitoring techniques

A wide range of techniques has been described for measuring and monitoring recreational impacts in wild settings (e.g., Monz, 2000; Marion & Leung, 2001). They include sampling-based track surveys, the assessment of permanently marked sampling plots, and assigning condition-class ratings to campsites. Similarly, a range of techniques has been described for monitoring visitor numbers and itineraries (Cessford & Muhar, 2003). The choice of techniques for a particular situation depends on a range of factors including the type and accuracy of information required by managers, the efficiency with which information can be obtained and the resources available for monitoring. Practical considerations are also important; for example, the practicality of taking measurements at sites subject to extreme weather conditions was a consideration in our study (see Section 4).

1.3. Management options

A variety of management techniques has been developed to mitigate recreational impacts (Leung & Marion, 2000). They include hardening tracks and campsites, redirecting visitation through regulation or education, modifying visitor behaviour, and modifying visitor expectations. Each technique has its advantages and limitations, and the choice of technique(s) to address a particular impact will depend on a range of factors including cost, likely effectiveness and the impact of the technique on recreational values. For example, track hardening can locally solve the problems of track widening and erosion, but it can also increase the artificiality of recreation settings and is often expensive (Olive & Marion, 2009). It may also have unintended side effects such as attracting increased visitation to fragile areas.

Education programs are a light-handed recreation management practice and are generally viewed favourably by visitors (Manning, 2011). Studies of the effectiveness of education compared with other management actions have shown varied results (Manning, 2011; Newsome et al., 2013), and an educational approach alone is unlikely to solve impact problems in the short term (Cole, 1995). Nevertheless, user education is important in impact management because it can support other more direct actions (Newsome et al., 2013).

2. The study area

The Arthur Range lies in the remote southwest wilderness region of Tasmania, Australia's island state (Fig. 1). This region is