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Enhancing the utility of visitor impact assessment in parks and protected areas: A combined social–ecological approach

Ashley D'Antonio [a,*], Christopher Monz [b], Peter Newman [c], Steve Lawson [d], Derrick Taff [c]

[a] Department of Environment and Society, Utah State University, 5215 Old Main Hill, Logan, UT 84322, USA
[b] Department of Environment and Society, The Ecology Center, Utah State University, 5215 Old Main Hill, Logan, UT 84322, USA
[c] Department of Human Dimensions of Natural Resources, Colorado State University, 233 Forestry Building, Campus Delivery 1480, Fort Collins, CO 80523, USA
[d] Resource Systems Group, Inc., 55 Railroad Row, White River Junction, VT 05001, USA

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ABSTRACT

Understanding the ecological consequences of visitor use in parks and how visitors interact with resource conditions is essential for avoiding the impairment of park and protected area resources and visitor experiences. This study combined ecological measures of off-trail resource impacts with social science techniques to understand visitor judgments of ecological impacts and visitors' degree of exposure to impacts. Specifically, this paper reports on a novel integration of techniques that was tested in the Bear Lake Road Corridor of Rocky Mountain National Park, CO, USA in which resource change, as a result of visitor use off designated trails and sites, was assessed and combined with social science and visitor use data. Visual survey techniques were used to understand visitor judgments of ecologically important resource impacts and GPS-tracking of visitor use and behavior allowed for the determination of the degree of visitor's exposure to impaired resources. Results suggest that resource impacts are prevalent and intense throughout the area, but tended to be spatially limited in proximity to attraction sites. Visitors are interacting with resource conditions reported to be unacceptable for significant portions of their hikes. Overall, the work represents an advancement of predictive capabilities when managing park and protected area resources.

1. Introduction

Participation in wildland recreation and nature-based tourism activities continues to increase in many parks and protected areas in North America (Cordell, 2008) and worldwide (De Lacy and Whitmore, 2006). Visitor activities in protected areas inevitably have consequences to social and ecological conditions and managers must often take action to minimize undesirable change. Decisions as to the level of acceptable and appropriate disturbance to natural systems are often challenging and must be informed from both a biophysical and social perspective. Historically, biophysical and social science studies have been solitary components in park and protected area management. Recently however, a limited number of studies have worked toward incorporating both biophysical and social methodologies into individual study designs (Goonan et al., 2012; Newman et al., 2005). In this paper we present a unique approach that was tested in Rocky Mountain National Park, which combines many different types of resource management data, with the goal of providing more management utility to resource condition assessments.

The ecological assessment of resource conditions resulting from recreation and tourism use—a field of study often called recreation ecology—is a well developed field of inquiry that examines a wide range of ecosystem responses. Recreation ecology studies have occurred across the globe (Backhurst and Cole, 2000; Campbell and Walker, 2008; Leung, 2012; Monz et al., 2010a, 2010b; Pickering et al., 2010; Rusterholz et al., 2011). However, the majority of methodologies and literature has been developed in North America, Europe, and Australia (Buckley, 2005; Leung, 2012; Monz et al., 2010a, 2010b). Within recreation ecology, impacts to soil and vegetation are two of the most frequently measured and monitored impacts. Various parameters of vegetation and soil impacts are typically evaluated to assess current conditions and provide foundational information for management decisions (Cole, 2004). From this literature, a common generalization of the relationship between use and impact suggests that with increasing use, previously impacted areas tend to be static while unimpacted areas are more

* Corresponding author. Tel.: +1 435 797 1009; fax: +1 435 797 4048.
E-mail addresses: ashleydantonio@gmail.com (A. D'Antonio), chris.monz@usu.edu (C. Monz), peter.newman@colostate.edu (P. Newman), steve.lawson@rsginc.com (S. Lawson), derrick.taff@gmail.com (D. Taff).

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dynamic and susceptible to change (Hammitt and Cole, 1998; Monz et al., 2010a). This "use–impact relationship" underscores the importance of understanding the spatial aspects of visitor use and resultant impacts (Leung and Marion, 2000) although much more research has been directed at understanding localized impacts (e.g., informal campsites) than larger scale, more diffuse visitor disturbance (Cole and Monz, 2004; Pettebone et al., 2006).

Specifically, few studies have thoroughly documented the impacts from off-trail hiking or dispersed visitor use (Leung and Marion, 2000; Marion et al., 2011; Wimpey and Marion, 2011). Off-trail hiking and dispersed use often lead to the formation of two easily observed and measured indicators of resource impacts; the formation of visitor sites and the formation and proliferation of informal (visitor-created) trails. Since these impacts are often dispersed across the landscape, their size and pattern is of particular interest. The advent of geographic information system (GIS) and global positioning system (GPS) technology allows for greater accuracy in the mapping of resource impacts across the landscape. GPS and GIS technology has been used frequently in geography, landscape ecology, and conservation biology and for mapping designated trails and campsites, but only recently has it been used for monitoring visitor impacts (Leung et al., 2010; Leung and Marion, 1995; Liddle, 1997; Monz et al., 2010b; Monz, 1998; Nepal and Nepal, 2004; Newsome and Davies, 2009; Pettebone et al., 2006; Tomczyk, 2010).

Recreation ecology assessments have traditionally been standalone pieces of information provided to managers as descriptors of baseline resource conditions. Recent advancements in social science methodology, including the use of GPS technologies, provide a means for an increased ability to integrate recreation ecology and social science approaches. Previously, visitor behavior in off-trail areas was examined using survey or observational techniques (D'Antonio et al., 2010; Hallo et al., 2005; Park et al., 2008). However, recent developments in GPS-based tracking methodology have led to more accurate means of evaluating how visitors behave in recreation settings (D'Antonio et al., 2010; Hallo et al., 2005; Lai et al., 2007; O'Connor et al., 2005; Wolf et al., 2012). The resulting GPS tracking data can be integrated with traditional recreation ecology data to better understand how visitors are using resources and the degree of visitor exposure to current resource conditions.

Recreation ecology measures can also be integrated with data from social science surveys in order to understand visitors' perceptions of resource conditions. Normative theory was developed in the fields of sociology and socio-psychology and this approach has been extensively applied in recreational settings to measure visitor-based standards, most commonly visitor determinations of crowding (e.g. Heberlein, 1977; Jackson, 1965; Manning, 2010; Shelby et al., 1983; Shelby and Heberlein, 1986; Vaske and Whittaker, 2004). Standards or levels of acceptability, for a particular condition or issue are often measured using visual survey methodologies for individuals and then the results are aggregated for members of the user group; the result is what is known as an acceptability curve (Manning, 2007).

Acceptability curves provide a variety of information valuable to managers. The top of the curve represents the optimal preferred condition by the user group (Manning, 2010). Each curve contains a neutral line; conditions below this line are considered unacceptable to the user group and conditions above are considered acceptable. The point at which the acceptability curve intersects the neutral line is the minimum acceptable condition (Manning, 2010). Overall, the methodologies can inform managers about what conditions visitors find acceptable in a recreation experience. The vast majority of studies have used visual methods for examining visitor experience attributes, such as degree of crowding, with very few studies using this approach for ecologic conditions especially diffuse, larger-scale resource impacts such as informal trail formation (e.g., Goonan, et al., 2012; Newman et al., 2005; Moore and Polley, 2007).

1.1. Integration technique

The objective of this study was to integrate traditional recreation ecology measures with social science data in Rocky Mountain National Park (RMNP). Three main types of data were collected (Fig. 1); an assessment of ecological conditions, visitor standards of

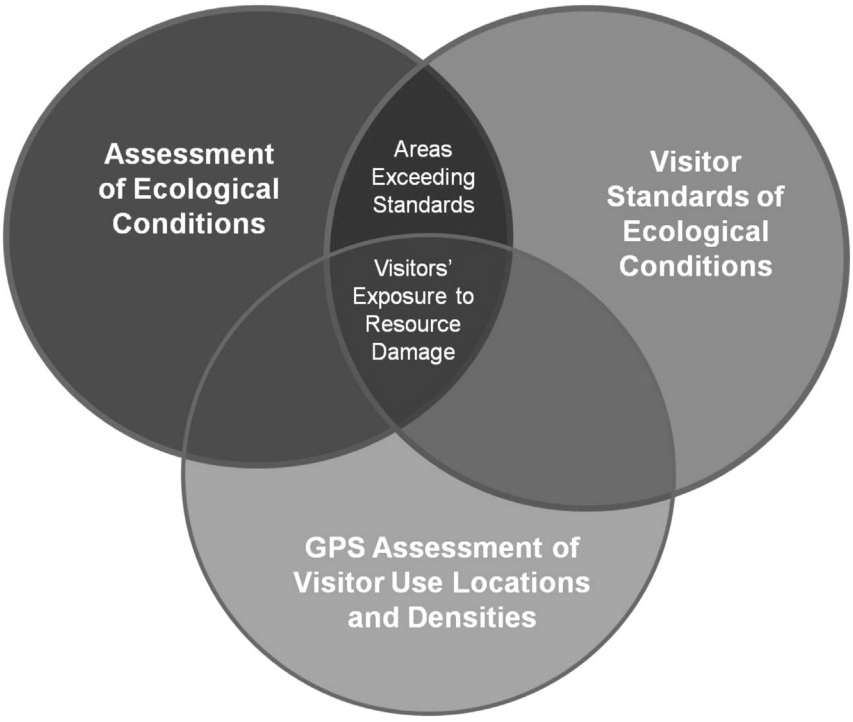

Fig. 1. Conceptual model of the integration approach taken in this study. Figure shows how different data sets were combined to create integrated results.