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Optimising recreation services from protected areas – Understanding the role of natural values, built infrastructure and contextual factors

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ABSTRACT

Effective management of recreation within protected areas requires a comprehensive understanding of the drivers of site visitation. To date, large multi-site studies that compare recreation demand for protected areas in response to underlying site attributes are rare, and have generally been restricted to high-profile, high-visitation sites. Our study, undertaken in south-eastern Australia, is the first to use random utility travel cost methods to explore recreational preferences across all sites within a large protected area network. We applied a novel zero-inflation statistical correction to identify the value of recreation demand arising in response to a broad range of site attributes, including protected area size, remoteness, natural values and built infrastructure. We find a strong influence of built infrastructure on recreation demand, but only a subset of the 9 infrastructure types modelled consistently generated recreation demand across the protected areas network. Other infrastructure contributed positively or negatively to tourism demand depending on contextual factors like site remoteness and the availability of recreation substitutes. We discuss the implications for protected area management at both the site- and network- scales, and as well as implications for designing more effective travel cost studies that allow the robust transfer of study findings to other protected area sites.

1. Introduction

Recreation and tourism in protected areas make an important economic contribution to individuals, and to the community more broadly. For individuals, the benefits from accessing protected area sites can include health and wellbeing, as well as cognitive and cultural benefits (Thompson et al., 2012; Kabisch et al., 2015). In economic terms, the consumer surplus that accrues to recreational users of protected areas can be large. Neher et al. (2013) undertook a meta-analysis of travel cost studies from 58 protected areas in the U.S.A to estimate the recreational value of the US protected area network at ~$31 billion per annum (in $USD 2016). Our own travel cost study estimated the recreational value of the protected area network in south-eastern Australia at $3.1 billion per annum (equivalent to $USD 2.85 billion), and reported per-hectare values that exceeded those of other land-uses like agriculture and forestry (Heagney et al., 2016). Economic expenditure from protected area visitors can also generate economic benefits across the broader community (Driml and Common, 1995; Fortin and Gagnon, 1999; Orr, 2011; Selby et al., 2011) – including in some small regional or remote communities that may have otherwise limited opportunity for economic growth and development (Sims, 2010; Ferraro et al., 2011; Heagney et al., 2015). A growing body of literature identifies the provision of economic benefits as a powerful means of engendering local community support for protected areas and other biodiversity conservation initiatives (Armsworth et al., 2007). As such, the ability to demonstrate and quantify the economic benefits associated with recreation in protected areas is likely to become an increasingly important mechanism for securing local and political support for ongoing conservation of protected area sites into the future.

Despite the *potential* for protected area visitation to generate economic benefits, the mere provision of a protected area may not be sufficient to automatically generate recreation demand, nor the associated economic benefits it provides. Stevens et al. (2014) report declining rates of visitation to the 58 major nature-based parks managed by the U.S. National Parks Service, including well known parks like Yellowstone, Yosemite and the Grand Canyon, in the 13 years to 2010. They attribute the decline to increasing cost of travel relative to income. Balmford et al. (2009) report

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falling per capita protected area visitation rates in 6 of 20 countries studied over the period 1992–2006. They also linked falling visitation rates to wealth, with declining visitation mainly observed in high income OECD countries, including Australia. It follows that realising, and optimising, recreation benefits may require that protected areas are designed to align with visitor preferences. Moreover it may require that protected areas are *re*-designed to *re*-align with *changing* visitor preferences and budgetary constraints as countries' economies change and develop through time.

Travel cost modelling has been used to estimate the economic value of recreation in protected areas since the late 1940s. It was first proposed by Hotelling in a letter to the Director of the U.S. National Parks Service in 1947 (Arrow and Lehmann, 2005). It has since been used to estimate the recreational value of a large number of protected area sites around the globe, and to justify the ongoing management and protection of those sites (e.g. Beal, 1995; Gurluk and Rehber, 2008; Saraj et al., 2009). However, studies of individual protected area sites are of limited use for protected area managers (Pendleton, 1999) who seek to balance conservation and recreation across protected area networks that can typically encompass tens or even hundreds of individual sites. Single site studies cannot provide insights into which site attributes are the key drivers of recreation demand, much less identify complexities arising from interactions between those site attributes and contextual factors like site remoteness and population distributions (e.g. Lansdell and Gangadharan, 2003). This means they cannot be used to assess the likely impact of a change in any site attribute on overall site quality or associated recreational value (Pendleton, 1999). It also means the findings from one site-specific study cannot easily be applied to other protected area sites. The economic literature consistently supports the notion that benefit transfer is best undertaken through the transfer of a utility function, rather than an overall of per-hectare dollar figure, and even then, it recommends that careful consideration should be given to contextual factors like the socio-demographics characteristics of the surrounding population (Loomis, 1992; Brouwer, 2000; Plummer, 2009).

In order to address this information short-fall, researchers often use random utility travel cost modelling to investigate patterns of recreational use within a single protected area, or across multiple protected area sites. Random utility travel cost studies consider site-level visitation to be an aggregate outcome arising in response to a range of underlying site attributes; they seek to disaggregate total site value to determine the contribution made by each attribute (Brown and Mendelsohn, 1984) and characterise consumers' recreational preferences (Beal, 1995; Von Haefen and Phaneuf, 2003). A small number of multi-site travel cost studies have been undertaken to assess the relative contribution of various site attributes to recreation demand in protected areas. For example, Amoako-Tuffour and Martinez-Espineira (2012) assessed the influence of camping and other accommodation options, as well as the potential to hike or visit fjords on visitation rates to Gros Morne National Park in Canada; Font (2000) assessed the influence of a range of attributes, including accessibility, tree cover, area of recreational infrastructure, and the presence of cafes and other facilities, on tourism demand for protected areas in Mallorca, Spain. Looking to the broader travel cost literature, a number of studies have estimated the recreational value of forest sites and the relative contribution made by various site attributes, including length of walking trail, elevation, quality of view, the presence or absence of specific ecosystem types or water features, to recreational site demand (Englin and Shonkwiler, 1995; Englin et al., 2006).

Although they represent a considerable improvement on single site studies, we believe most of the multi-site random utility travel cost studies of protected areas undertaken to date still encounter a number of issues that limit their ability to identify and generalise visitor preferences. First, such studies typically assess visitation at only a small number of sites. This means they are only able to discriminate the influence of a small number of site attributes (a maximum of $n - 1$ if n is the number of sites included in the study). In contrast, the literature identifies a very broad range of attributes that might influence visitation to protected areas, including both site-specific attributes (as identified in the preceding paragraph) and additional contextual factors like remoteness, the size of the surrounding local population (Balmford et al., 2015), and the availability of substitute recreation sites within the surrounding region (Hanink and White, 1999; Henrickson and Johnson, 2013; Cho et al., 2014). A study that includes only a small number of sites must necessarily omit some of these key attributes, and in doing so it carries a high risk that the associated model will be mis-specified.

Second, most travel cost studies use on-site data collection processes. Traditionally this has meant that park visitors are surveyed at selected protected area sites, but more recently 'on-site' survey techniques have also included the interrogation of visitor logs or licensing databases (Neher et al., 2013; Stevens et al., 2014). From our review of the literature we conclude that on-site surveys are typically undertaken at high-profile, high-visitation parks (e.g. Font, 2000; Amoako-Tuffour and Martinez-Espineira, 2012; Neher et al., 2013; Stevens et al., 2014). Undertaking travel cost studies in high profile parks can be a valid and sensible research decision for a range of reasons. Surveying at high visitation parks enables researchers to encounter visitors in sufficient numbers for statistical analysis within a reasonable time and/or budget constraint, or there may be more complete visitor logs and other datasets available for these sites. Moreover, quantifying the value of recreation at high-profile, high-visitation parks is important for ensuring that the recreational values of those sites are appreciated and accounted for during site management. But an ongoing systematic bias towards travel cost studies that are undertaken almost exclusively at high-profile high-visitation parks is problematic. High profile parks are likely to share a range of characteristics that distinguish them from lower visitation parks, confounding attempts to discern which park attributes are responsible for generating visitor demand. This limits the potential for informed management decisions that optimise recreational services from protected areas at both site- and network-scales.

Our study is the first to use random utility travel cost methods to explore and characterise recreational preferences across a large protected area network. Our study aims to identify the role of various site attributes, including natural values, 9 types of built infrastructure, and contextual factors, in generating recreational demand. We propose and apply a new statistical correction (a random zero-inflation technique) to ensure that information about the attributes of very low (zero) visitation protected area sites are adequately incorporated into travel cost modelling. We use the results of our analysis to suggest how strategic protected area management might help to optimise recreational opportunities at both site- and network- scales.

2. Methods

2.1. Study site

This study analyses travel patterns across a network of 728 protected areas in the state of New South Wales (NSW) in south-eastern Australia. The NSW protected area network spans the length and breadth of the state's 800km^2 land area – from densely populated urban areas to very remote locations (Fig. 1). The protected areas of NSW are very varied with respect to their size, conservation status (each has been assigned an IUCN conservation category) and natural features. Each protected area site also