

Icons under threat: Why monitoring visitors and their ecological impacts in protected areas matters

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Summary Visitation levels are on the rise in protected areas throughout the world. In response, many icon sites are showing signs of overuse and more protected-area managers report tourism and recreation as threats to sustainable management. Clearly, there is a growing need to assess (monitor) and manage visitors to mitigate their impacts. In this paper, we articulate why targeted visitor-impact monitoring matters and highlight how existing monitoring programmes fail to deliver the necessary information to protected-area managers. We suggest that the availability and quality of visitor data are currently insufficient to facilitate the development of proactive management strategies in most protected areas. We call for more scale-sensitive (time and space) collection of visitor load and environmental (response) data. Specifically, since icon sites (like waterfalls and mountain peaks) are the focus of visitor motivations and activities, we highlight the case for proactive assessment, management and reporting of condition at these sites. Ultimately, visitor trends will be influenced by visitor management. If visitor activities degrade the icon, the financial benefits of tourism and recreation to a protected area may not be sustainable. In addition, the conservation and protection objectives of the protected area will also not be met.

Key words: *protected area management, recreation ecology, tourism impacts, visitor impacts.*

Why targeted visitor-impact monitoring matters

Growing demand for tourism and recreation opportunities in natural areas has led to an increase in visitor loads in protected areas worldwide (Hammit & Cole 1998; Newsome *et al.* 2002). Although visitor growth has the potential to increase revenue for commercial businesses and park management authorities (Gormsen 1997; Weiler & Seidl 2004), there is increasing recognition that high visitor loads can have adverse ecological impacts. Research has demonstrated that visitors influence the ecology of natural systems through their activities; principally via alterations to physical, chemical and/or biological properties of the sites they visit (reviewed by Kuss *et al.* 1990; Leung & Marion 2000; Newsome *et al.* 2002; Buckley 2004). Damage is often most obvious at icon sites in popular protected areas, with impacts including eroded tracks, damaged trees, fire scars, trampled vegetation and the proliferation of weeds (Ceballos-Lascuráin 1996; Hammit & Cole 1998; Buckley 2004). In addition, ecological impacts that are less visually apparent, like changes in energy and nutrient pathways,

have also been demonstrated in heavily visited aquatic (Hadwen & Bunn 2004) and terrestrial (Bridle & Kirkpatrick 2005) ecosystems.

In light of growing visitor numbers and concerns about their impact, protected-area managers in many parts of the world are now required to determine if their management of visitor use is sustainable. For example, managers of wilderness areas in the USA have a legislative obligation to monitor visitor impacts (Cole & Wright 2004). Other conventions, regional processes, individual governments and non-governmental organizations (NGO) impose various reporting requirements on managers that require a range of information, including visitor impacts (Hockings *et al.* 2005).

Despite these reporting regulations, monitoring visitors and their impacts appears to be inadequate (or non-existent) in protected areas worldwide (Newsome *et al.* 2002; Buckley 2004; Cole & Wright 2004; Leung & Monz 2006). This absence of visitor monitoring is significant, as without appropriate data from targeted visitor and impact monitoring programmes, managers are unable to determine if visitation is ecologically sustainable. The challenge therefore remains to develop and imple-

ment targeted and cost-effective visitor monitoring programmes. As researchers in recreation ecology, we hope to assist the process of developing such programmes by helping frame the problem, describe the system, and highlight issues relating to what could be measured and how, in the following comment piece (McCool & Stankey 2004).

What do we need to know about visitors?

The first step in monitoring visitor impacts is to determine the frequency, timing and location of visitors within the park (Eagles *et al.* 2002; Buckley 2003, 2004). Very few protected areas have sufficiently detailed visitor data upon which proactive management plans can be based (Newsome *et al.* 2002; Cole & Wright 2004; Leung & Monz 2006). At present, the extent to which visitor data collection occurs is variable and depends on the staff and financial resources of the protected area, its popularity and the degree to which visitation is seen as either a threat or an opportunity to meeting the management objectives for the park (Buckley 2003). Indeed, protected areas are generally very short on financial resources

and are often understaffed. In addition, agency staff often lack the skills to design and implement sophisticated visitor monitoring programmes. Nevertheless, some agencies have the capacity to collate visitor load information for some protected areas through the compulsory issuing of permits or through the implementation and enforcement of visitor caps. Given these data acquisition limitations and the error associated with some visitor monitoring methods (Cessford & Muhar 2003; Arnberger *et al.* 2005), it is clear that for many protected areas, managers are making decisions without reliable information on the amount of visitation and the distribution of their recreation activities (Wilson *et al.* 2004; W. Hill & C. Pickering unpub. data, 2006).

We view the inadequate collection, storage and analysis of visitor data as a significant impediment to sustainable tourism and recreation in protected areas. We also suggest that managers need to collect additional visitor data, relating to where visitors go and what they do, particularly for parks with high and/or growing visitor numbers. To this end, we believe that the key areas of information shortfall are (i) How many visitors does the protected area receive? (ii) When do visitors come to the protected area? (iii) Where do visitors go within the protected area? and (iv) What activities do visitors undertake once inside the protected area?

How many visitors?

Surprisingly, few protected areas have up-to-date, accurate records on visitor loads whether measured as number of visitors (different people), number of visits (counts number of separate visits) and/or as visitor day/nights (number of people in park each day summed for all days). In many cases, this relates to institutionalized and/or logistic constraints on data collection, collation and analysis (Eagles *et al.* 2000; Marion & Farrell 2002). Regardless of the reason, a lack of reliable and accurate data on visitor numbers represents a major obstacle to detecting, evaluating and managing visitor impacts in natural areas. For example, at the crudest analytical level, changes in environmental condition can be examined against visitor numbers to

examine the potential influence of visitor numbers on environmental parameters of interest. This simple approach has been successfully employed to examine the likelihood of visitor-mediated effects on nutrient and chlorophyll *a* concentrations in pristine dune lakes on the World Heritage Listed Fraser Island (Hadwen *et al.* 2003). At broad spatial and temporal scales, these analyses may be useful in determining the degree to which change has been influenced by trends in visitation. However, although recognizing that data on visitor numbers represents the easiest component of visitor monitoring, only more detailed information relating to the timing, duration, spatial extent and activities of visitors will enhance the capacity of protected-area managers to detect visitor impacts and proactively manage both visitors and ecosystems within their protected areas (Hadwen *et al.* 2003, 2005).

When do visitors come to the protected area?

Knowledge of the temporal variability in visitor loads to any given protected area is particularly important in the context of examining (and mitigating) visitor impacts. For example, protected areas with strongly seasonal visitation may suffer from acute impacts during peak visitation periods, yet there may be few impacts in low visitation periods. This pattern was observed for Australia's highest mountain, Mount Kosciuszko, where most people visited during major holidays (Christmas/New Year and Easter) resulting in crowding on the peak and damage to surrounding fragile alpine vegetation during the short growing and flowering season (Pickering & Buckley 2003). In contrast, reduced seasonality in visitor numbers in extremely popular protected areas (like World Heritage Areas) may result in chronic impacts that persist all year round (Hadwen 2003).

At even finer temporal resolutions, researchers have documented changes in visitor loads in response to days of the week and antecedent weather conditions (Ploner & Brandenburg 2004; Johnston & Growcock 2005). For some ecological systems, such fine-scale resolution in visitor loads may not be important, yet for others, increased visitation at specific times may

have profound effects on the functioning of key environmental processes.

Where do visitors go within the protected area?

Whole-of-park level assessments do not provide adequate details of the importance (and consequences) of high visitation (and associated impacts) to icon sites within protected areas. By generalizing visitation across the entire park, managers are left with insufficient clues as to where tourism and recreation impacts might be occurring and when, and why. Furthermore, total park visitor loads are misleading because the spatial distribution of visitors within a park is never homogeneous (Hammit & Cole 1998; Marion & Farrell 2002). Roads, trails, waterways and campsites (in addition to different management zones) focus visitors within key regions and at key sites (Eagles *et al.* 2002). It is at these focal locations that visitor impacts are most likely to occur and therefore are most effectively monitored. Even within a site, the spatial extent of visitor access can have a significant effect on visitor-mediated disturbances to the environment (Hadwen *et al.* 2005).

Where information on the spatial distribution of visitors within a protected area is inadequate, unavailable or non-existent, alternative predictive approaches may be useful for the assessment of sites at risk of visitor-mediated environmental change. One such example is the Tourist Pressure Index (TPI) of Hadwen *et al.* (2003), which uses a simple semiquantitative mathematical formula to calculate the likely visitor pressures (loads) at nominated sites within a protected area. The index uses both quantitative and qualitative measures relating to the site to come up with a score that relates to the appeal (aesthetic and utilitarian) of the site to visitors and has been used successfully to examine patterns of visitation to lakes within the Fraser Island World Heritage Area in Australia (Hadwen *et al.* 2003).

What activities do visitors partake in within the protected area?

Although visitor numbers, timing and distributions can give us an idea of the

magnitude of visitation as an environmental pressure, information on the activities undertaken by visitors provides us with our greatest opportunity to design targeted monitoring programmes to assess visitor impacts particularly at icon sites. Despite the absence of infrastructure in many protected areas, the range of recreational activities undertaken by visitors is quite diverse (Cole 1986, 2004). Invariably, the most popular activities are related to the natural setting and aesthetics of the icon site, but there is also a wide range of other activities that are undertaken within protected areas that place no real emphasis on the location per se (Moscardo *et al.* 1996). Many of these other activities have the potential to influence the quality and condition of the environment.

Given both the wide range of types of protected areas and the activities undertaken by visitors during their visits, it is probably necessary for each protected area to have an independent assessment of visitor activities and the taxa, communities or ecosystems at risk. However, some impacts (like trampling of vegetation) are common in many terrestrial protected areas and have already received significant research and management attention (Cole 2004). In contrast, site-specific activities may require detailed evaluation and monitoring of the nature of the activity as well as the system in which the activity occurs.

How should we monitor the environmental impacts of visitors?

Existing monitoring programmes in protected areas may be useful in detecting long-term trends in condition (*sensu* Hadwen *et al.* 2003), but are rarely designed to detect the contemporary impacts of visitors at key sites (Buckley 2003). To this end, it is extremely important that visitor loads and activities be viewed as forms of environmental disturbance to enable managers to design, implement and interpret monitoring output in a useful and proactive way. For example, some activities are much more spatially and temporally acute than others (e.g. camping *vs* hiking) and consequently have a greater immediate capacity to change the environment. In

contrast, less acute activities may occur over longer periods of time and over larger spatial extents. As a result, the prevailing activities at any given site should guide protected-area managers in their selection of appropriate (scale-sensitive) indicators and monitoring programme objectives. By associating particular visitor activities with these ecological disturbance categories, we can begin to build an optimized monitoring approach, both through careful indicator selection and through clever implementation of monitoring schedules (to capture peak tour times or seasonality of particular activities). This represents a much better approach to visitor-impact monitoring than the standard monitoring approaches currently in place in some protected areas that simply try to use baseline data to explore long-term trends in ecosystem health and condition (Hadwen *et al.* 2003).

In addition to the scale sensitivity required of indicators and monitoring programmes, it is also important that the indicators used can facilitate early detection of impacts before they become serious and/or irreversible (Boulton 1999; Buckley 2003). Boulton (1999) noted that this is a vital, yet often overlooked, component of monitoring programmes and it is particularly important in protected areas. The fact that park revenue is increasingly tied to the health and appeal of icon sites is likely to ensure that managers will be keen to optimize their monitoring approach. The implementation of a range of indicators, of varying sensitivities, represents one of the best ways to discriminate between long-term trends and acute impacts over periods of peak visitor activity.

Why general ecological monitoring is not enough

Existing baseline monitoring programmes and threat-specific monitoring programmes in protected areas (like those addressing problems of weeds and pests), although valuable, do not provide resource managers with adequate information relating to visitor impacts at key sites or even the degree to which visitors contribute to the problems (Buckley 2003). There are three main reasons why this is the case. First, the

location, timing and types of indicators selected for use in general monitoring programmes may not recognize (or respond to) tourism and recreation as a potential threat. For example, collection of baseline data on the condition of a series of lakes, by sampling water quality indicators in the middle of lakes, is unlikely to provide useful information on the response of these systems to visitor use and activities in the littoral zone (*sensu* Hadwen *et al.* 2003, 2005). Second, the scale of protected area operations and reporting are not always conducive to the measurement and assessment of visitor impacts. Specifically, given limited resources and mandated state-of-the-park reporting, site-specific initiatives can tend to be overlooked in favour of scaling-up activities that feed into existing reporting structures (Eagles *et al.* 2000; Buckley 2003). These park-level reporting mechanisms can lead to differences in the perceived relative threat of tourism and recreation, especially between high-level protected-area agency managers and on the ground agency staff and visitors (Chin *et al.* 2000; Hillery *et al.* 2001). Finally, many monitoring programmes are not able to detect impacts quickly enough to facilitate the implementation of management and mitigation efforts, particularly at the temporal and spatial scales at which visitor use of focal sites occurs. As Boulton (1999) suggested, the primary goal of a monitoring programme is to provide early warning indications of changes in condition and for many existing monitoring and baseline data collection activities; this goal cannot be achieved for visitor-mediated changes that most often occur at small temporal and spatial scales.

Constraints that currently limit visitor (and impacts) monitoring

Although the appraisal of visitor activities in protected areas as an ecological disturbance is a major conceptual hurdle that should facilitate proactive monitoring and management, there are also a range of other factors that currently prohibit the implementation of visitor monitoring in protected areas. These include aspects of funding, staffing (expertise and availability)

and database/computing system requirements (Buckley 2003; Worboys *et al.* 2005). Some of these issues also apply to overall management performance evaluation, not just tourism-impact monitoring. Recent research examining protected area management evaluation worldwide has highlighted that managers are (i) over-worked, and have many requirements to evaluate management performance, (ii) under resourced, and (iii) often lack the necessary skills to develop and undertake appropriate ecological monitoring programmes (G. Worboys, Griffith University, unpub. data, 2007).

Another constraint that limits the capacity of protected-area managers to monitor visitors and their ecological impacts is the obvious need for appropriate systems to be in place to collate, report and respond to trends in visitors and impacts as they occur (Eagles *et al.* 2002; Worboys *et al.* 2005). Very few protected-area agencies are currently sufficiently resourced to collect, collate, analyse, store and report on the necessary attributes detailed above. To facilitate this process, systems need to be put in place. This will, of course, require resources (personnel time and computing), but we suggest that such expense would be well justified in most parks with high and growing visitation and visitor demand.

A recent major review of protected-area staff internationally highlighted that these organizations need to be better funded and trained to achieve their mandates of conserving the natural values while allowing visitor use and appreciation (Worboys 2007). To this end, we urge protected-area agencies to proactively lobby for resources to monitor visitor activities, especially in heavily visited parks, before their icons are damaged to the point that visitor response and ecological condition are compromised.

Conclusions

Visitors have been shown to significantly and deleteriously alter the ecological health and aesthetics of icon sites within protected areas (Hadwen *et al.* 2005). With visitor numbers increasing in the most popular protected areas in response to marketing and growth in the wilderness tourism industry (Newsome *et al.* 2002), it

is likely that icon sites will be further impacted by visitors and their activities. Recognition of the threat that tourism and recreation can pose to icon sites within protected areas should therefore come hand-in-hand with the development of monitoring and mitigation objectives.

Monitoring visitors and their impacts in protected areas matters, particularly in vulnerable and valuable icon sites. We believe that sustainable objectives of park management (including conservation and sustainable tourism) can only be met through a focused examination of visitor use and activities, particularly at the key icon sites within each park.

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