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Changes in protected area management effectiveness over time: A global analysis

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ABSTRACT

Protected area coverage has reached over 15% of the global land area. However, the quality of management of the vast majority of reserves remains unknown, and many are suspected to be "paper parks". Moreover, the degree to which management can be enhanced through targeted conservation projects remains broadly speculative. Proven links between improved reserve management and the delivery of conservation outcomes are even more elusive. In this paper we present results on how management effectiveness scores change in protected areas receiving conservation investment, using a globally expanded database of protected area management effectiveness, focusing on the "management effectiveness tracking tool" (METT). Of 1934 protected areas with METT data, 722 sites have at least two assessments. Mean METT scores increased in 69.5% of sites while 25.1% experienced decreases and 5.4% experienced no change over project periods (median 4 years). Low initial METT scores and longer implementation time were both found to positively correlate with larger increases in management effectiveness. Performance metrics related to planning and context as well as monitoring and enforcement systems increased the most while protected area outcomes showed least improvement. Using a general linear mixed model we tested the correlation between change in METT scores and matrices of 1) landscape and protected area properties (i.e. topography and size), 2) human threats (i.e. road and human population density), and 3) socio-economics (i.e. infant mortality rate). Protected areas under greater threat and larger protected areas showed greatest improvements in METT. Our results suggest that when funding and resources are targeted at protected areas under greater threat they have a greater impact, potentially including slowing the loss of biodiversity.

1. Introduction

Protected areas are one of the most important conservation tools for protecting biodiversity and ecosystem services (Naidoo et al., 2006; Rodrigues, 2006; Klein et al., 2007; Coad et al., 2008; Scharlemann et al., 2010). This has led to the development of a global network of protected areas covering more than 15.4% of the terrestrial land surface (Juffe-Bignoli et al., 2014). Despite this extensive coverage, biodiversity continues to decline (Butchart et al., 2010; Tittensor et al., 2014) and protected areas are not immune to biodiversity and habitat loss (Craigie et al., 2010; Laurance et al., 2012; Geldmann et al., 2013), or increases in human-caused pressure (Geldmann et al., 2014).

Expanding the coverage of protected areas has been suggested as a strategy to mitigate the present negative biodiversity trajectories (Target 11, Aichi Biodiversity Targets, Convention on Biological Diversity, 2010) and as much as a third of the total global terrestrial area is estimated to be necessary to fully meet all elements of Target 11 (Butchart et al., 2015). However, coverage is only one aspect of protected area performance and effectiveness. Protected areas need to be managed effectively within appropriate legal frameworks and governance structures to meaningfully contribute to halting the loss of biodiversity (Leverington et al., 2010; Watson et al., 2014). Given declines in biodiversity continue even within protected area boundaries (Butchart et al., 2010; Tittensor et al., 2014) it is probable that current levels of

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management within protected areas at a global scale are insufficient to "*halt the loss of biodiversity*" (Watson et al., 2014). Allocating conservation funds cost-effectively to achieve maximum conservation benefit is therefore a key question in conservation science (Wilson et al., 2006).

Measuring whether protected area management improves over time, as well as understanding what external factors affect the observed changes in management, is a crucial benchmark for Aichi Target 11 and the overall delivery of the CBD Strategic Plan (Convention on Biological Diversity, 2010). While tools such as the World Database on Protected Areas (WDPA) provide information on the locations, number, and size of more than 210,000 protected areas, information on the quality of management, or biological outcomes within the same sites is much scarcer. Protected Area Management Effectiveness (PAME) assessments have been used in many countries to evaluate the strengths and weaknesses of protected area management, and help guide improvement to the conservation delivery of these areas (Leverington et al., 2010). The IUCN World Commission on Protected Areas (WCPA) has developed an evaluation framework for management effectiveness assessment allowing specific evaluation methodologies to be designed within a consistent overall approach (Hockings, 2003; Hockings et al., 2006). In general, PAME assessments are conducted by one or more of: protected area managers, government agency employees and donor institutions including NGOs. Most PAME tools are questionnaires measuring the management inputs, activities, and outputs associated with a conservation intervention, in order to assess management strengths, weaknesses, and needs (Mascia et al., 2014). Evaluation tools generally rely on qualitative indicators to assess management success and are therefore heavily dependent on knowledge amongst protected area stakeholders (Cook and Hockings, 2011; Cook et al., 2014).

To date more than 18,000 PAME evaluations have been conducted using 95 methodologies in over 9000 protected areas across 180 countries (Coad et al., accepted). These provide baseline data to evaluate management performance and are also used as one of the indicators for tracking international commitments to halt the loss of biodiversity (that is, the 2020 Aichi targets inviting "…Parties to…expand and institutionalize management effectiveness assessments to work towards assessing 60% of the total area of protected areas by 2015 using various national and regional tools and report the results into the global database on management effectiveness…" (CBD Aichi Targets, COP 10 Decision X/31, 19a)). This target has only been reached by 17.5% of all countries (Coad et al., accepted).

Protected areas undergoing multiple and systematic evaluations often represent protected areas with outside investments from donor organizations (e.g. the World Bank, the Global Environment Facility (GEF), WWF) or reserves where there is increased national focus on improving the management and governance foundation. Additionally, some countries, for example Australia, Colombia and South Africa, have implemented systematic repeated PAME assessments to track changes in management. However, the implementation of PAME evaluations in itself is no panacea for improving or fully understanding protected area delivery of ecological and social outcomes (Coad et al., accepted). It does however provide valuable information on the potential of protected areas to secure biodiversity and, in the absence of appropriate data on the status of and trends in biological attributes, can serve as a proxy of protected area performance (Kleiman et al., 2000; Hockings et al., 2006). In addition, anecdotal evidence suggest that the process of evaluation often leads to management improvements, through protected area managers sharing information and redirecting resources to the most serious issues.

Previous analyses have looked at the global coverage of PAME evaluations (Coad et al., 2013) as well as mean management effectiveness scores and strengths and weaknesses (Leverington et al., 2010). These analyses address whether protected areas are being evaluated for management effectiveness and calculate average total evaluation scores, as well as average scores for individual elements, at a global scale. While we are aware of repeat evaluations being analyzed at agency or protected area level in a number of cases, most of this information is unpublished, and the scarcity of repeat evaluations has meant that only limited analysis of trends in scores has so far been possible at a global scale.

Here we use one of the most widely used PAME tools; the management effectiveness tracking tool (METT) (Stolton et al., 2007) to complete a global analysis of relevance to international policy and practices. We restrict our analysis to protected areas where METT assessments have been conducted multiple times so that we can investigate how management and governance change over time. We map the global distribution of sites where METTs have been repeated and use these sites to derive general statistics on the general direction of changes in management, and the characteristics of countries where these assessments occur. Using theories of management and governance we further analyze which dimensions of management and governance have changed most substantially. Finally we use a suite of globally collected and validated contextual variables covering protected area attributes, landscape, human pressure, and socioeconomic context to understand what determines changes in management effectiveness.

2. Methods

2.1. The management effectiveness tracking tool

METT assessments collect information on 1) objectives, 2) threats, 3) budgets, 4) staffing, 5) size, and 6) designations of protected areas. METT also documents the status of 30 specific management-elements ranging from legal status, equipment, and quality of management plans, to outreach programs and tourist facilities (Table A1). Each METT assessment is conducted by local assessors who assign scores on a four point scale from 0 to 3 depending on the status of the specific management element (for example law enforcement: 0 = The staff have no effective capacity/resources to enforce protected area legislation and regulations, 1 = There are major deficiencies in staff capacity/resources to enforce protected area legislation and regulations (e.g. lack of skills, no patrol budget), 2 = The staff have acceptable capacity/resources to enforce protected area legislation and regulations but some deficiencies remain, and 3 = The staff have excellent capacity/resources to enforce protected area legislation and regulations) (Stolton et al., 2007). Several local adaptations of the METT evaluation exist, based on experiences and needs from protected area managers, organizations and country officials (Coad et al., 2013).

We extracted all METT assessments from the global database on PAME assessments (Coad et al., accepted). This database was started in 2006 as a research project with the University of Queensland (Leverington et al., 2008, 2010) and has been used by UNEP-World Conservation Monitoring Centre to provide data on management effectiveness through the Biodiversity Indicator Partnership (Walpole et al., 2009) and as a key tool for measuring CBD Aichi Target 11 (e.g. Tittensor et al., 2014). METT evaluations originate from a range of sources, including NGOs, national governments and international agencies (e.g. WWF, the World Bank and the GEF). From the METT assessments included in this analysis we selected a random subset of 88 from the database for which we calculated the error rate between the original data sheet and the database entry. We found an error rate of 2.5% (Table A2). New METT assessments are still being collected and entered into the database.

From all available METT assessments (n = 4748) we identified all PAs that had multiple entries (n = 933). From these we kept only sites with at least one year between first and last assessment. Where more than two METT assessments existed from different years we used the earliest and most recent to provide the greatest number of years between assessments. Subsequently we removed all protected areas where year of assessment was missing, or where less than 10 of the 30 questions were answered (n = 722).

The total number of METT questions is 30, but as two questions have been changed these 30 are not comparable over time. We removed these two questions — leaving 28 questions for analysis. We then