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Synthesis and review: delivering on conservation promises: the challenges of managing and measuring conservation outcomes

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Abstract
Growing threats and limited resources have always been the financial realities of biodiversity conservation. As the conservation sector has matured, however, the accountability of conservation investments has become an increasingly debated topic, with two key topics being driven to the forefront of the discourse: understanding how to manage the risks associated with our conservation investments and demonstrating that our investments are making a difference through evidence-based analyses. A better understanding of the uncertainties associated with conservation decisions is a central component of managing risks to investments that is often neglected. This focus issue presents both theoretical and applied approaches to quantifying and managing risks. Furthermore, transparent and replicable approaches to measuring impacts of conservation investments are noticeably absent in many conservation programs globally. This focus issue contains state of the art conservation program impact evaluations that both demonstrate how these methods can be used to measure outcomes as well as directing future investments. This focus issue thus brings together current thinking and case studies that can provide a valuable resource for directing future conservation investments.

Keywords: conservation, risks, uncertainty, evidence, impact evaluation

The field of conservation was founded on a set of core values that centred around the intrinsic value of nature and biodiversity (Soulé 1985). Contemporary conservation shares these fundamental values, but is also more concerned with balancing multiple objectives for the use of natural resources, and achieving efficient outcomes given the limited funds available. The focus of conservation practitioners and the academic literature is therefore often on pragmatic issues of trade-offs and resource allocation (Kareiva and Marvier 2012). Pragmatism has meant that social and economic costs (e.g., Naidoo et al 2006) feature strongly in current conservation debates, and prioritisation frameworks reflect best practice approaches to optimal investment allocation (e.g., Murdoch et al 2007). This recent shift reflects a more business-like approach to investments in conservation, in which investors expect demonstrated outcomes and properly-managed portfolios of conservation investments. Examples of this shift in conservation practice are conservation non-governmental organizations opening their planning and funding processes for evaluation (Fishburn et al 2009, Bottrill et al 2012), encouraging investors to demand reporting on
investment impacts (Max 2014), and a willingness to document both successes and failure (Knight 2009). Although different in tone and language to the foundational conservation literature, pragmatism in research and practice was conceived as a means to delivering on the same fundamental values (Kareiva 2014).

The demand for transparent decision making and clearly defined and measurable outcomes for conservation investments requires continued development in conservation science. In particular, sound conservation investments must be supported by cutting edge risk management, to ensure that risks to investments are properly managed—that is, accounted for, mitigated or ameliorated against—and they must be supported by impact evaluation, to measure the true outcomes of conservation action. The articles contained in this focus issue are thus broadly grouped around these two core issues: (1) measuring and managing risk and (2) impact evaluation. The articles present innovative approaches and applications to these issues that contribute to the ongoing academic debate of how to better deliver on conservation promises.

Measuring and managing risk

Conservation management labours under systemic uncertainty. Uncertainty pervades the structural and parametric description of ecosystem, social and economic dynamics; the observability of the system states; and our ability to control them effectively and efficiently. Risks can be characterised as uncertain events that might have a negative effect on conservation assets, or the outcome of conservation interventions. Thus, quantifying the uncertainties associated with our decision making process is central to risk management (Game et al 2013, Williams and Johnson 2013). If uncertainties are quantified then they can be incorporated into the decision making process to select the portfolio of projects that best deliver the desired outcomes (Williams and Johnson 2013). Conversely, once a project is underway, a quantitative understanding of uncertainty can be used to manage these risks (Game et al 2013). While the value of quantitative risk assessments is well recognized (Burgman et al 2005), their application in conservation to identify and prioritize risk management activities has been limited (although there is growing guidance on ways of incorporating into decision making, e.g. see Polasky et al 2011). Because conservation programs sit within complex socio-ecological systems, risks can arise from many domains including environment, social and economic. Williams and Johnson (2013) present a framework for dynamic optimal decision making which accounts for uncertainties associated with decisions. This is both a review of how uncertainty can impact decisions and a framework for future applications of dynamic decision making. Building on this theoretical investigation of uncertainty and decision making, we present three applied risk assessments addressing risks from different domains. From the very broadest perspective, Dale et al (2013) present a discussion around risks associated with the governance structures that support natural resource management. Identifying the multi-scale and nested nature of the governance systems that control environmental management, they construct a rapid assessment method for risk analysis across governance systems. Game et al (2013) present a method of ‘risk ranking’ which can assess the range of potential risks that face conservation plans: political, social, economic, and environmental. Lastly, Adams and Setterfield (2013) focus on a single risk to a specific conservation activity, and present a quantification of the financial impacts associated with this risk, as well as the costs and benefits of managing this risk.

Impact evaluation

A major component of delivering on conservation outcomes is documenting social, economic and environmental impacts of conservation, and responding to lessons learnt, both good and bad. However, there has been little motivation, pressure or funding to rigorously collect unbiased evidence of the impacts of conservation impacts. Only very recently has an increased desire for accountability in conservation spending pushed the field to adopt evidence-based methodologies when assessing the likely impacts of investments (Ferraro 2009, Fazey et al 2004, Ferraro and Pattanayak 2006, Segan et al 2011). This section of the focus issue brings together four studies using cutting edge impact evaluation methods. Two studies test common conservation assumptions about the effectiveness of strategies employed, namely the protection of lands, and the use of education programs. The other two studies demonstrate how impact evaluation methods can be used to identify conservation impact metrics that can prioritize and direct future decisions. Damereel et al (2013) provides the first strong support that environmental education can be transferred between generations, and thereby indirectly induce the desired changes in behaviour. Ferraro et al (2013) measure the impact of strict and less strictly protected areas and find that, while on average stricter protection does more to reduce deforestation rates than less strict protection, the additional impact is not always large. Nolte et al (2013) test common indicators associated with conservation investment priorities and find that there is no statistically significant association with these commonly used indicators and avoided deforestation. However, they do find that the absence of unsettled land tenure conflicts is associated with avoided deforestation, demonstrating the importance of resolving land tenure in protected area management. Their analysis calls into question assumptions about relationships between indicators and conservation success and highlights the need for more rigorous assessments of strategies used for prioritizing management strategies within protected areas. Finally, Haruna et al (2014) demonstrate that the impact of protected areas on deforestation in Panama has shifted with land use. The authors use this analysis to suggest that better understanding and anticipation of shifts in levels and patterns of pressure on forests could be used to plan for protected areas in the future that maximize the impact of protection.
Conclusions

This focus issue presents cutting edge research in risk assessment and management and impact evaluation demonstrating the types of research and approaches needed to support conservation investment. The work ranges from general approaches to optimal decision-making and learning under uncertainty, through to practical examples of evaluation and risk analysis.

Enormous sums of money have been spent on the protection and restoration of biodiversity and there are continued calls to address the shortfalls in global conservation funding (Bruner et al. 2004, McCarthy et al. 2012). Yet conservation management science has found it very difficult to demonstrate any beneficial outcomes for the existing large conservation expenditures. Biodiversity conservation remains unable to provide well-designed empirical support for even its most commonly applied actions, such as protected area implementation and management. Even large and repeated projects in similar ecosystems have not improved our understanding of these systems or their effective management (e.g., Bernhardt et al. 2005, Kanowski et al. 2009, Alexander and Allan 2007, Scofield et al. 2011). There is a clear need for uniform approaches to measuring the impact and effectiveness of conservation actions to allow for documentation of outcomes and comparison across projects (Hockings et al. 2009, Leverington et al. 2010). Furthermore, there is a need for replicable and transparent approaches to measuring and managing the risks to conservation projects such that investors are re-assured that conservation funds are being appropriately managed to deliver on desired conservation outcomes.

The lack of clear reporting of outcomes along with perceived risks associated with conservation programs could not only impact on sourcing additional funding but potentially also reduce the current resources available for conservation activities. Particularly in a field where the disparity between resources and needs is so great, steps must be taken to identify and demonstrate effective interventions, and to effectively manage the risk and uncertainty that remains.

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