



# Predicting responses to conservation interventions through scenarios: A Cambodian case study

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## ABSTRACT

In this paper, we demonstrate how predictive methods can be used to investigate the effectiveness of conservation interventions prior to their implementation and ensure that limited resources are invested in those interventions that will achieve the strongest outcomes for conservation. Too often, operational, financial and logistical constraints lead to the design of interventions based on past experience and expert opinion, without an assessment of the probable outcomes of alternative approaches. Here, we employ a simple method that can be used by conservation managers to evaluate a range of credible alternatives and select the intervention predicted to have the greatest impact. We apply scenario-based interviews to investigate the effectiveness of interventions aimed at reducing household forest clearance at a REDD+ site in Cambodia. In this context, we show that collective performance payments, structured either as payments to individual households or to village development funds, have the greatest potential to reduce household clearance. In comparison, greater enforcement effort and individually contracted performance payments – options that might otherwise have been considered credible choices – are predicted to perform poorly, with only negligible reductions in forest clearance.

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## 1. Introduction

For those charged with the conservation of wildlife, one of the most critical questions faced is how best to use the resources at their disposal to effect desired outcomes. Yet, as the practice of conservation and the science underlying it have evolved, this question has in many ways become more difficult to answer. In the early days of conservation, forcible evictions from protected areas (PAs) and the removal of access or use rights to the resources within were commonplace (Adams, 2004), the legacy of which is still clearly visible today as PAs and the enforcement of access restrictions continue to be the mainstay of conservation efforts around the world. The underlying logic of this approach of the separation of nature and people is simple but in practice can be difficult to police effectively, not least because the establishment and enforcement of PAs may inflict significant negative impacts on local people (Adams et al., 2004; Brockington et al., 2006; Cernea and Schmidt-Soltau, 2006; Colchester, 2004). Recognition of this and the resentment it fosters has helped to give rise to a raft of less punitive incentive- and rights-based approaches to conservation, most notably integrated

conservation and developments projects (Barrett and Arcese, 1995; Wells and Brandon, 1993), community based natural resource management (Kellert et al., 2000; Singleton, 2000) and payments for ecosystem services (Engel et al., 2008; Ferraro and Kiss, 2002; Wunder, 2007). Yet, while these developments have significantly expanded the options available to conservation managers, the question of which approach, or combination thereof, is most likely to result in the best outcomes for conservation in any given situation remains.

This has brought increasing attention to evidence-based approaches to improving conservation decision-making and evaluating whether or not conservation interventions have been successful in achieving their stated goals (Pullin and Knight, 2003; Sutherland et al., 2004; Stem et al., 2005; Ferraro and Pattanayak, 2006; Pullin and Knight, 2009). But the success of conservation interventions is often difficult to define or measure and may be highly dependent on the local social, political, economic and institutional context (McShane et al., 2011). In many cases, despite a wealth of case studies of how particular approaches have been applied, there is insufficient evidence of outcomes or post-project monitoring to be able to draw conclusions (see recent reviews of the efficacy of livelihood based approaches for examples of this problem; Roe et al., 2015; Wicander and Coad, 2015). Where advances have been made, such as through the application of quasi-experimental matching approaches (e.g. Andam et al., 2008, 2010; Arriagada et al., 2012; Ferraro and Hanauer, 2014; Clements et al., 2016; Clements and

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Milner-Gulland, 2015), barriers remain. In the case of impact assessments, they require technical expertise that may not be available to conservation managers to be done well, are expensive (Agrawal, 2014) and are conducted after projects have been implemented for long enough to provide sufficient data to make the assessment. As such, even if approaches such as adaptive management (Salafsky et al., 2002; Stem et al., 2005) have been put in place to allow for changes in project implementation in light of new evidence, opportunities for improvements, time or goodwill may be lost in the interim. From the perspective of conservation managers, whose immediate concerns are more likely to be the programmes under their control rather than furthering a wider body of knowledge, more relevant tools are those that enable them to estimate the effects of interventions prior to implementation (either in absolute terms or relative to alternative options). Such predictive tools offer the potential to get things right first time and guide decision-making to minimise the risk of unnecessary failures.

One option is to pilot approaches on a small scale. However, when the aim of an intervention is to effect behaviour change and subsequent ecological outcomes, detectable change can take a long time to occur. Even in situations where a change can be detected, it can be difficult to control for other possible drivers of that change or to persuade donors to fund the additional monitoring necessary to do so (Satereson et al., 2004). Yet the alternative, predicting the future response of those targeted by conservation programmes, is rarely considered, with the result that expert judgement and experience are often relied upon (Fazey et al., 2004; Pullin and Knight, 2005; Cook et al., 2010). Such approaches are often flawed or based on insufficient evidence, and so may lead to inferior outcomes, particularly for the complex contexts typically encountered in conservation.

In this paper, we employ a simple alternative, scenario-based interviewing, that overcomes the shortcomings of such approaches by providing evidence of probable responses to a range of possible interventions or policy changes prior to their implementation. Although scenario-based approaches have often been used in environmental sciences to predict changes under conceivable futures (Alcamo, 2001), their use to date in conservation has so far been limited (see Cinner et al., 2009 for an exception to this). Yet, by limiting the length of time and changes considered within each scenario, scenario-based approaches can be used to control for contextual complexity to produce meaningful predictions of behaviour (Gordon, 1992), making them highly suitable for predicting conservation outcomes under different policy or intervention conditions.

As scenarios are presented in the form of qualitative narratives, they can be easily understood by respondents, which enable them to be used to examine behaviour in contexts that might be more difficult to investigate using alternative methods. Discussing the future in this way provides valuable insight into not only *how* people are likely to respond to the scenarios presented, but also the reasons *why* they might respond that way. It can also serve to help minimise the risks presented by heterogeneity amongst the target populations for conservation interventions, or by exogenous changes such as external market fluctuations. Accounting for such complexity is one of the principal challenges facing conservation; something that integrated conservation and development projects are often said to have failed to do (Blom et al., 2010; McShane and Newby, 2004; Waylen et al., 2012). In part, this is because conservation often operates within highly complex socio-ecological systems in which relationships between society and natural systems are dynamic and multi-scale (Berkes, 2004). Even at the site level, heterogeneity within target populations may be high (Chan et al., 2007; Waylen et al., 2013). Scenario-based approaches enable the response to conservation interventions to be tested for different agents and, hence, the extent of homogeneity of response to be estimated for a target group.

Such qualitative methods are not without limitations however. For example, the ability of respondents to accurately forecast their actions reduces as scenarios become more complicated. There is also a possibility of strategic responses (Carson and Groves, 2007), particularly in

situations in which respondents may prefer the implementation of one particular scenario over another, or social desirability bias, whereby responses may be influenced by the desire to conform to social norms and be viewed favourably by others (Fisher, 1993). Although such limitations are impossible to negate entirely, careful follow up questioning and triangulation of responses can do much to improve the external validity of results.

Here, we use scenario-based interviews to examine the potential outcomes of different approaches to changing incentives within Keo Seima Wildlife Sanctuary, a protected area in eastern Cambodia. We do this through an analysis of the stated responses of smallholder farmers from several villages within the project area to seven future scenarios, which include exogenous changes to the sale price of cassava (the dominant agricultural commodity in the area) and different intervention options aimed at reducing deforestation at the site (increased enforcement effort, communal and individual conditional payments and a village fund for infrastructural development). For each scenario, interview respondents were asked how their land use and livelihood practices might change and, hence, the responses given provide an indication of the expected variation in farmer reactions to the intervention options under consideration at the study site. Within this methodological framework, we investigate the predicted effectiveness of each option for incentivising reductions in forest clearance and compare this against the response to exogenous changes in the price of cassava. By analysing responses at the household level but within three distinct livelihood zones, we examine the effect of economic well-being and livelihood strategy on the responses given to each scenario. In this way, we seek to identify, in the context of our case study, which intervention would result in the greatest reduction in household deforestation and whether opportunities exist to target interventions towards the livelihood zones with households most likely to respond positively.

## 2. The Keo Seima Wildlife Sanctuary REDD + demonstration project

Keo Seima Wildlife Sanctuary (formerly Seima Protection Forest) is a protected area located in eastern Cambodia and covers an area of 2927 km<sup>2</sup> consisting of a complex mosaic of forest types that is rich in biodiversity (Fig. 1; Evans et al., 2012). Management of the PA is split into a core protection zone and outside buffer areas. Since 2002, the site has been managed by the Cambodian government, with technical and financial assistance provided by the Wildlife Conservation Society (WCS), and has been designated as one of two national REDD + demonstration sites since 2010.

The PA is characterised into three livelihood zones in which different livelihood activities dominate: a cash crop zone, a lowland paddy zone and an upland zone. These zones reflect the major inter-community heterogeneity with respect to bio-physical characteristics, institutional framing, opportunity costs of stopping deforestation and economic well-being. As such, the majority of variation in clearance behaviour is expected to be represented by these zones. The cash crop zone is characterised by easy road access and mature cash crop markets (predominantly cashew and cassava, with some rubber) and is currently experiencing the highest rate of land conversion (WCS, 2013). The lowland paddy zone is located in the most remote part of the site. Access to this area is difficult (particularly during the wet season) and the dominant livelihood strategy is centred on the cultivation of paddy rice, supported by liquid resin collection from native dipterocarp trees. The upland zone is also located further from market centres, although access is largely better than for the paddy zone. In this zone, households cultivate a greater diversity of crops, including upland rice varieties, vegetables and maize, and have recently made the transition towards commercial production of cassava and cashew. It has previously been shown that economic well-being as measured by the basic necessity score, a participatory poverty score calculated as a weighted proportion of a list of assets and services that a household owns or has access to (Davies and Smith, 1998), varies between the three livelihood zones

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