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A global systematic review of empirical evidence of ecotourism impacts on forests in biodiversity hotspots

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Ecotourism is growing rapidly in biodiversity hotspots because of its promise to achieve both economic growth and environmental conservation. We reviewed the literature for empirical evidence that ecotourism protects forests. Our conclusions are at once both sobering and encouraging. Ecotourism, as it is typically practiced, leads to deforestation. However, when accompanied by conservation mechanisms (e.g. protected area, Payment for Ecosystem Services, monitoring/enforcement), ecotourism can protect forests. Ecotourism sometimes leads to forest regeneration in agrarian landscapes, but trade-offs, for example old-growth deforestation or water pollution, may occur. From a methodological perspective, we found a dearth (only 17) of articles that empirically analyzed ecotourism impacts on forests, and no studies that used counterfactual impact evaluation approaches. We conclude that there is an insufficient evidence base for inferring effects of ecotourism on forests, and we identify research priorities to build knowledge about how, when, and where to implement ecotourism.

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Introduction

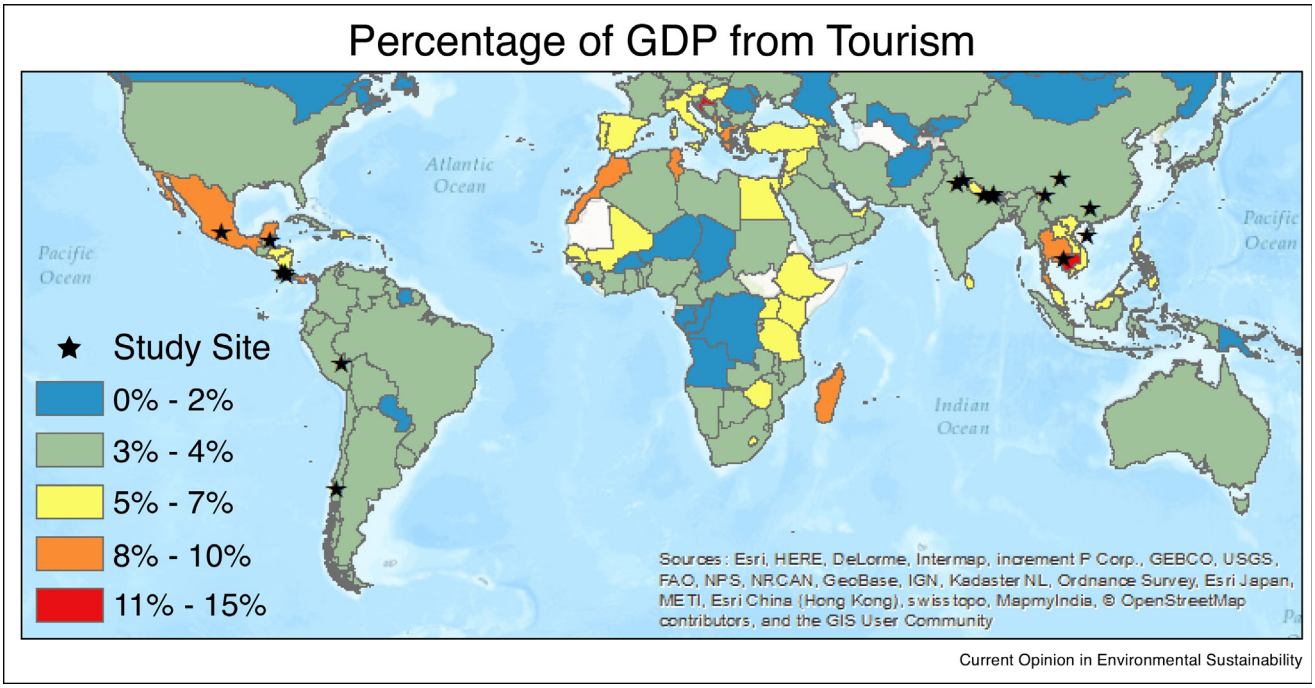
Human population growth and economic development in the next decades will exacerbate the biodiversity crisis [1]. Forests in developing economies face numerous escalating threats. Local livelihoods are dependent on forest resources [2], yet those same forests are exploited to meet international timber demand [3]. Forests could be cleared to provide food for growing populations [4], yet society relies on the conservation of those same forests to mitigate climate change. Less than one-third of the world's remaining forests are inside protected areas, including nearly 30% in developing countries and 16% overall [5]. In coming years, countries will have less ability to place land under strict protection [6]. A grand challenge facing humanity is to identify land use strategies that can both exploit and protect forests simultaneously.

One of the most rapidly growing sustainable land use strategies is 'ecotourism', because of its promise to achieve both conservation and economic development [7]. From a forest conservation perspective, ecotourism is an incentive-based forest governance intervention, and may interact with institutional interventions (e.g. protected areas (PAs)) or other incentive-based strategies (e.g. payment for ecosystem services (PES)). From an economic standpoint, tourism has huge benefits, accounting for as much as 40% of Gross Domestic Product (GDP) in Maldives (Figure 1), and is growing at a rate of more than 10% annually in other countries (e.g. Thailand, Costa Rica and Mongolia) [8•]. The amount spent on ecotourism is estimated to be 10 times more than that spent by official aid agencies and the United Nations Global Environment Facility on conservation projects [9,10]. However, despite its large and growing economic importance, the impacts of ecotourism on the environment, and on forests in particular, are not well understood [11•,12•,13].

Theoretically, ecotourism could protect forests because of economic incentives. For example, governments invest in PAs to gain revenue from international tourists [14•]. In addition, community ecotourism projects may dedicate a portion of proceeds into conservation [7]. More generally, developing nations typically rely on extraction-based land uses, for example the production of raw goods (e.g. timber or minerals), or the conversion of natural ecosystems (e.g. clearing forest for agriculture). With ecotourism, local residents and governments can generate income from tourism without consuming forest resources [9].

Alternatively, ecotourism could lead to forest loss because it stimulates economic development and related processes that drive deforestation. For example, tourism requires improved transportation networks (i.e. roads, airports, trains), which is strongly associated with

Figure 1



Locations of the 17 empirical articles reviewed, and the percentage of Gross Domestic Product derived from tourism for the world's countries (WTTC 2014) (data not available for countries in white).

deforestation [15]. In addition, tourism stimulates local population growth, both seasonal tourists and economic immigrants, and thus demand for forest resources increases [16]. Finally, tourism inherently leads to market integration, another factor strongly associated with deforestation [17].

Study objective and approach

Our goal here was to review the peer-reviewed literature for empirical evidence that ecotourism protects forests in biodiversity hotspots, where it is particularly urgent to identify effective forest governance strategies. Using search terms: 'ecotourism', 'deforestation', 'impacts', and 'forest conservation', we searched the Web of Science and Google Scholar online databases, and three global comprehensive reviews of ecotourism case studies [18–20]. We included in this review only peer-reviewed publications that used empirical approaches to evaluate the relationship between ecotourism and forests. Our review is structured as follows. First, we discuss the quantity and quality of existing empirical evidence. Second, we identify cases where ecotourism led to (a) deforestation, (b) forest protection, or (c) reforestation, and explore associated mechanisms. Third, we synthesize evidence across the three areas, and finally, we identify research priorities to advance knowledge of ecotourism–forest relationships.

Quantity and quality of evidence

We found a paucity of empirical research on the effectiveness of ecotourism as a forest conservation strategy. To be included in our review pool, we had two criteria: empirical data was used to evaluate both forest change and drivers, and the authors explicitly concluded an association between observed change and ecotourism. We at first restricted our review to recent articles (2015–2017), but found only three, and thus we expanded our search back to 2000. Of the 111 articles we reviewed, we found 17 peer-reviewed publications since 2000 that satisfied our criteria. The majority of the studies (14 of 17) evaluated forest change from satellite data, and three of 17 used social science approaches (i.e. surveys, interviews, or focus groups). We found three general analysis approaches. First, forest change was measured before and after tourism implementation, and in some cases, socio-economic data (e.g. tourist visitors or tourism income) was presented in a descriptive manner to support the association. Second, authors used social science methods, that is, surveys, interviews, or focus groups, to measure people's perceptions of drivers of forest change. Third, linear regression models with forest change as the dependent variable and drivers of change (e.g. distance to market, elevation, percent of counties' income derived from tourism, etc.) as explanatory variables were used to test the relative impact of ecotourism.