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ECOLOGY

The effect of conservation spending

Statistical analysis of data on threatened species provides a model that can predict how rates of investment in conservation affect biodiversity under changing human population levels and agricultural and economic conditions.

HUGH P. POSSINGHAM & LEAH R. GERBER

Global biodiversity loss is occurring at a rate that is 1,000 times greater than the estimated background rate of species extinction[1]. The factors affecting the decline in biodiversity, and the actions and resources needed to arrest that decline, change over time and geographical region[2]. Without conservation interventions, the rate of species extinctions will continue to increase. For the interventions undertaken, how can the effectiveness of these attempts be assessed? In a paper online in *Nature*, Waldron *et al.*[3] use statistical analysis to provide evidence-based insights into the relationship between a country's national investments to protect threatened species and the country's rate of biodiversity decline.

The field of conservation science has been hampered by the limited evidence linking investments to conservation and measurable biodiversity outcomes[4–7]. Because a systematic approach for monitoring the impact of investment in biodiversity conservation is lacking, the absence of this type of assessment tool hinders progress towards achieving the global conservation targets specified in the United Nations Convention on Biodiversity plan (see go.nature.com/2xqkifv). These targets include preventing the extinction of threatened species and improving the conservation status of such species by 2020. Such a tool would also be a useful resource for achieving the United Nations Sustainable Development Goals.

One of the biggest differences when assessing the success of financial investments rather than conservation spending is that financial investors calculate the main benefit of their investment using a single metric: money. Because both investment and pay-off are measured by the same unit — a cash return bigger than the investment is a successful outcome — assessing financial investments is relatively simple.

In conservation, there are many measures of successful outcomes, including carbon sequestered, water quality improved, species secured, habitat structure improved and forest losses averted. Most conservation actions deliver several outcomes, each measured in a different way[5]. And even if one conservation objective is specified, such as saving species from extinction, it is still not clear how that can be measured. Would the desired outcome be to minimize extinctions, maximize the number of species that recover, provide a net increase in the overall abundance of threatened species, or reduce the rate of species loss? Waldron *et al.* now offer a way to tackle this problem of outcome assessment.

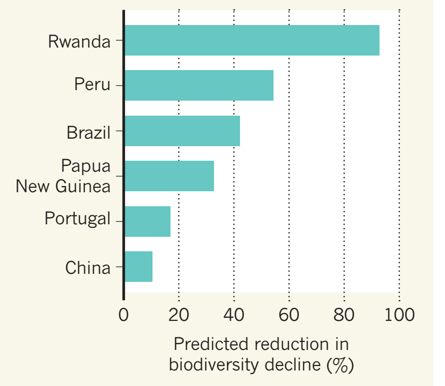

Figure 1 | Predicting the effect on biodiversity if extra national-level conservation investments had been made. Waldron *et al.*[3] used statistical analysis of data on changes in the endangered-species status of birds and mammals between 1996 and 2008 in 109 countries to generate a model of the relationship between national-level conservation spending and changes in biodiversity in each country analysed. Their work provides evidence for a link between conservation spending and improvements in biodiversity, as assessed by decreases in the endangered status of species. This allowed them to estimate the effect that a further 5 million 'international' dollars of conservation spending would have had on biodiversity at a national level, and data are shown for a few of the countries analysed (international dollars represent a conversion from US dollars to account for differences in purchasing power in each country).

The authors' work demonstrates an effective way to estimate the impact per dollar of conservation spending, and to quantify how changes in investment affect biodiversity. They analysed how conservation spending in 109 countries affected biodiversity declines on a national level for these countries between 1996 and 2008. They used an adjustment technique to reflect differences in purchasing power per dollar in different countries, converting money into 'international' dollars.

To assess biodiversity changes, the authors tracked the endangered status of bird and mammal species assigned to risk-of-extinction categories in a standard resource for such global assessments, known as the International Union for Conservation of Nature Red List[8]. By determining the net change in the Red List status of all the birds and mammals in a country over time, and correlating that change with conservation investment, Waldron and colleagues' model demonstrates a statistically significant, positive correlation between how much a country invests in the protection of threatened species and its success in limiting biodiversity declines. This work provides evidence that an increase in direct national investment in conservation actions is essential to achieve globally agreed biodiversity goals.

As well as analysing conservation spending, another key aspect of the author's model is that it incorporates the effects of other facets of human societies that can affect biodiversity, such as human population growth and increases in agricultural land use. Because human activities that can promote or threaten biodiversity are included in the analysis, the results provide a useful perspective, given that many biodiversity studies do not usually take such a comprehensive approach. When the authors tested their model against additional data, the results validated the model's predictive power.

The authors' findings have broad implications for global biodiversity policy. Notably, given predicted patterns of human population growth and other socio-economic changes, the model indicates that achieving a certain level of biodiversity conservation will cost comparatively more in the future (taking inflation into account) than the cost of taking action now. The level of conservation funding is one of the factors most tightly linked to the successful recovery of endangered species. However, a study of funding in the United States revealed that it is both insufficient and allocated in an uneven way between different groups of species[9]. When a strategy for good conservation investment is being chosen, it should, like any other investment strategy, be guided by balancing benefits and risks[10–13].

Conservation models that are simple and

that can be used for forecasting are particularly suited for national-level decision-making. By showing biodiversity outcomes under different economic, agricultural and population-change scenarios, Waldron and colleagues' model provides a flexible tool for estimating the impacts of different policies, and for finding approaches to resolve the potential conflicts that can arise when trying to achieve different Sustainable Development Goals — for example, by determining the increased funding for biodiversity conservation needed to counterbalance the negative consequences for biodiversity that agricultural expansion may incur.

Humans rely on nature in countless ways. As biodiversity declines, we will lose these tangible benefits, as well as opportunities to delight in the beauty of biodiversity itself. Waldron and colleagues' model affirms a frequent theme in evaluations of the effect of expenditure on biodiversity conservation, which is that halting the decline in global biodiversity would be remarkably cheap. For example, the model suggests that investment of an extra 5 million international dollars in Peru, one of the world's most biodiverse nations, would have halved the rate of biodiversity decline in this country during the 1993–2008 period (Fig. 1). Less than 0.01% of global gross domestic product would be enough to all but stop species extinctions[11]. Small changes in public policy in a few key nations, and some targeted international investment, could dramatically reduce global biodiversity loss. ■

Hugh P. Possingham *is at The Nature Conservancy, South Brisbane, Queensland 4101, Australia, and The University of Queensland.* **Leah R. Gerber** *is at the School of Life Sciences and Center for Biodiversity Outcomes, Arizona State University, Tempe, Arizona 85287, USA.*
e-mails: hugh.possingham@tnc.org; leah.gerber@asu.edu

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