



Original research article

Relative efforts of countries to conserve world's megafauna [☆]

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ABSTRACT

Surprisingly little attention has been paid to variation among countries in contributions to conservation. As a first step, we developed a Megafauna Conservation Index (MCI) that assesses the spatial, ecological and financial contributions of 152 nations towards conservation of the world's terrestrial megafauna. We chose megafauna because they are particularly valuable in economic, ecological and societal terms, and are challenging and expensive to conserve. We categorised these 152 countries as being above- or below-average performers based on whether their contribution to megafauna conservation was higher or lower than the global mean; 'major' performers or underperformers were those whose contribution exceeded 1 SD over or under the mean, respectively. Ninety percent of countries in North/Central America and 70% of countries in Africa were classified as major or above-average performers, while approximately one-quarter of countries in Asia (25%) and Europe (21%) were identified as major underperformers. We present our index to emphasise the need for measuring conservation performance, to help nations identify how best they could improve their efforts, and to present a starting point for the development of more robust and inclusive measures (noting how the IUCN Red List evolved over time). Our analysis points to three approaches that countries could adopt to improve their contribution to global megafauna conservation, depending on their circumstances: (1) upgrading or expanding their domestic protected area networks, with a particular

[☆] **Significance statement:** The world is experiencing a 'sixth mass extinction' event due to human impacts on nature. Megafauna species appear to be particularly vulnerable due to their low reproductive rates, large spatial requirements and the pressure being exerted through illegal hunting, human-wildlife conflict and other threats (Ripple et al., 2016a). In light of the inadequacy of current conservation efforts (Ripple et al., 2016b), we conducted an assessment of the contributions of countries of the world to megafauna conservation based on three metrics: distribution and diversity of megafauna, percentage of land area inhabited by large carnivores and herbivores that is strictly protected, and financial investments in conservation at home and abroad. Our aim was to create a floating benchmark that will enable 'underperformers' to improve their performance by investing in these metrics, thus raising the bar for global conservation efforts.

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emphasis on conserving large carnivore and herbivore habitat, (2) increase funding for conservation at home or abroad, or (3) 'rewilding' their landscapes. Once revised and perfected, we recommend publishing regular conservation rankings in the popular media to recognise major-performers, foster healthy pride and competition among nations, and identify ways for governments to improve their performance.

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1. Introduction

Over the course of recent millennia, humans have caused the extinction of large numbers of megafauna species (carnivores that weigh more than ≥ 15 kg and omnivores and herbivores that weigh ≥ 100 kg) (Braje and Erlandson, 2013). The world's remaining megafauna are greatly imperilled and the list of species threatened with extinction by humans is growing (Ripple et al., 2016b, forthcoming). Recent studies have indicated that 60% of the world's largest herbivores and 59% of the world's largest carnivores are threatened with extinction (Ripple et al., 2014, 2015). Such extirpations form part of a wider sixth mass extinction event that seems inevitable unless effective conservation strategies are widely and rapidly implemented (Barnosky et al., 2011).

The loss of megafauna species is particularly worrisome for several reasons. Firstly, megafauna have significant cultural and societal value to humans (Macdonald et al., 2015). The idea that large charismatic animals still persist in their natural habitats is greatly valued by large sectors of human society (Sylvén et al., 2012). Megafauna thus have existence values that arguably surpass those of most other species. The charisma of megafauna means they are disproportionately important in terms of engendering interest and willingness to pay for conservation among sectors of the general public (Macdonald et al., 2013). Secondly, they tend to play particularly important ecological roles, as megafauna species are often critical to predator–prey cycles, nutrient cycling, seed dispersal and other ecological processes (Estes et al., 2011; Ripple et al., 2014, 2015). Thirdly, megafauna can have significant economic value if their use values are harnessed appropriately and sustainably. For example, countries such as Kenya, Botswana and South Africa have successfully harnessed the appeal of large mammals to overseas visitors (Lindsey et al., 2007), and wildlife-based tourism now comprises significant proportions of their GDPs (<http://www.wttc.org/>, accessed October 2015). Finally, megafauna tend to require large areas for their conservation and so are likely to act as umbrella species whereby their conservation will indirectly benefit a suite of other species (Macdonald et al., 2012).

In spite of these values, large mammals are under significant and growing threat. Key challenges include habitat destruction and excessive hunting (Ripple et al., 2014, 2015), the growing international trade in wildlife parts (Challender and MacMillan, 2014), and increasing demand for bushmeat (Bennett, 2002; Lindsey et al., 2013; Ripple et al., 2016a). Human–wildlife conflict represents an additional problem for megafauna in parts of the globe and results in widespread retaliatory killing, particularly of large predators (Kissui, 2008). As a result of these threats, populations of many megafauna species are declining precipitously (Ripple et al., 2014, 2015).

Megafauna is challenging to conserve. Many megafauna species have large spatial requirements, resulting in significant blocks of wilderness set aside to accommodate them (Macdonald et al., 2013). Some megafauna species are dangerous and/or costly for humans to live with and pose a direct risk to human life, crops, livestock and even pets (Thirgood et al., 2005). The high demand for wildlife products means that significant effort and expenditure is required to protect megafauna from poachers (Lindsey et al., 2016).

Key among steps taken to improve the conservation prospects of megafauna and other aspects of biodiversity is the establishment of protected areas as refuges for wildlife. Other mechanisms include allocating funding for conservation, either locally or abroad, to allow for interventions that reduce poaching, trade in wildlife body parts and human–wildlife conflict and promote coexistence between megafauna and people. In contrast, some countries have experienced 'rewilding' as a contribution to re-establish megafauna in areas from which they had previously been extirpated (Sylvén et al., 2012).

Given ongoing declines in populations of megafauna, the nature and scale of these interventions are evidently inadequate, and large budgetary deficits for conservation exist, particularly in the tropics (Bruner et al., 2004; Miller, 2014). Thus far in the relatively short history of conservation, despite widespread public support for conservation goals in places like the United States (e.g. Johns, 2011), action to halt or reverse declines in many species has been insufficient. As a step to mobilise political support and action, we conducted an assessment of the contributions of nations towards the conservation of megafauna, with the objectives of establishing a running average of conservation effort and encouraging countries falling below that level to increase their efforts (thereby pushing the benchmark upwards).

Here we present a 'Megafauna Conservation Index' (MCI) as a first attempt at establishing this baseline. Specifically, we estimated the diversity of megafauna conserved and the proportion of land area that such species occupy, the proportion of land occupied by these species that is strictly protected, and lastly, the financial contributions of countries to conservation. The last one is more general than the first two, but remains of direct relevance to megafauna conservation in many developing countries due to the importance of funding for ensuring megafauna effective protection.

We present our index with the hope of achieving two outcomes: (a) entrenching the idea that measuring the conservation performance of countries (both relative to other countries and to themselves over time) is a key step towards motivating global elevated effort following (Bradshaw et al., 2010); and (b) to present a first attempt at measuring conservation performance, in the expectation that it will be refined over time.

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