doi:10.1038/nature24144

ECOLOGY

A global plan for nature conservation

An international movement is calling for at least half of the Earth to be allocated for conservation. A global study now reveals that, in many ecoregions, enough habitat exists to reach this goal, and ideas are proposed for the next steps needed.

JAMES E. M. WATSON & OSCAR VENTER

Climate change and biodiversity loss are the two greatest environmental challenges of our time. The 2015 Paris climate agreement states that global warming must be limited to a rise in temperature of less than 2 °C above pre-industrial levels to avoid the greatest impacts of climate change[1]. This goal has served as a rallying point for global efforts to limit carbon emissions. However, a comparably clear, agreed target for the amount of natural space that should be conserved to address the biodiversity crisis has been much more elusive. Writing in *BioScience,* Dinerstein *et al.*[2] analyse the current level of ecosystem protection on a global scale, and propose a way to address the problem of biodiversity loss.

The idea of securing at least half of the Earth for nature conservation has been gathering momentum. Various studies indicate that achieving this goal, often discussed under the name 'Half-Earth', coined by the biologist E. O. Wilson[3], would help to avoid widespread biodiversity declines, and prevent the collapse of vital services provided by ecosystems, such as carbon sequestration and climate regulation.

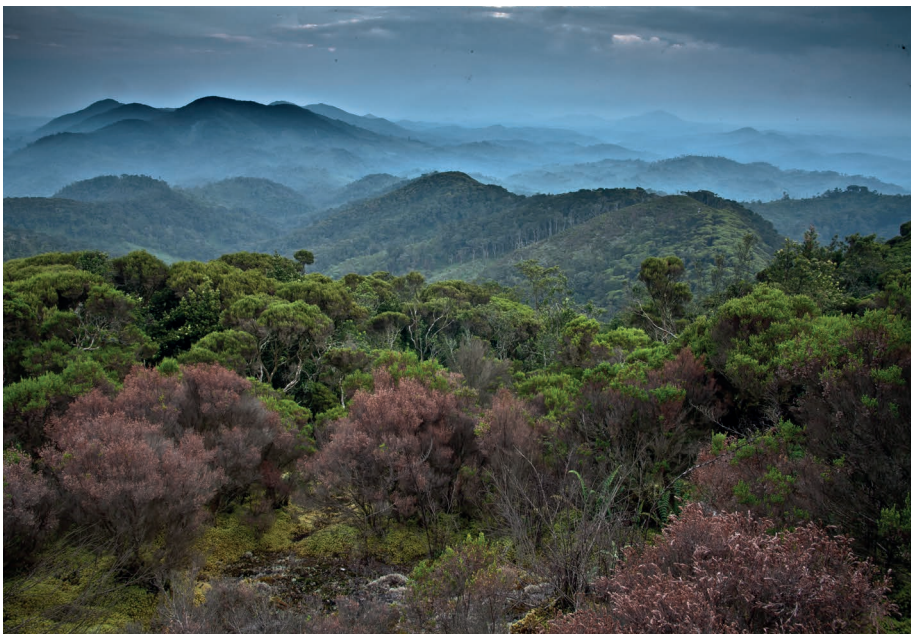
However, one problem with making this goal a reality is that 50% protection of all terrestrial ecosystems far exceeds current global conservation commitments. For example, the plan[4] that is currently accepted by the United Nations Convention on Biological Diversity has a target of protecting 17% of land and freshwater regions and 10% of marine areas by 2020. The much greater scale of conservation needed for Half-Earth protection has left many people questioning whether it is even possible, given that unrelenting habitat conversion is quickly eroding opportunities for large-scale conservation[5,6]. Dinerstein and colleagues have made a first attempt to answer this key question for land areas, and their findings are both encouraging and disheartening.

Achieving an outcome in which half of the Earth is allocated for nature conservation is possible now only in ecoregions that have at least 50% of their natural habitat remaining. Dinerstein and colleagues therefore assessed the level of natural habitat remaining in each of Earth's 846 terrestrial ecoregions, such as the northeastern Congo lowland forest ecoregion (Fig. 1). For this, they used satellite-derived maps of forest cover, as well as other data to identify patterns of land use and human populations[7]. Their analyses reveal that nearly 50% of the world's ecoregions have the remaining habitat necessary to achieve a Half-Earth protection target, and that, of these ecoregions, 12% are now at least 50% protected. The ecoregions with less than 50% of natural habitat remaining would need substantial restoration efforts to achieve this target, and 24% of these ecoregions are described as being in peril given that they have no more than 20% remaining. The authors' data clearly demonstrate that achieving Half-Earth conservation is indeed still possible in many places, but not everywhere.

By assessing the possibility of achieving Half-Earth conservation, Dinerstein and colleagues have helped to take the first step towards a road map for implementing such a goal. The authors outline the idea of a "global deal for nature", whereby nations agree to achieving Half-Earth conservation, where possible, by 2050. Such an agreement would offer a biodiversity-focused counterpart to the Paris climate accord.

What is needed now is a clear, science-based plan for the next steps to making Half-Earth conservation a reality. We propose that this plan and the science agenda should be based around three fundamental questions.

The first question is in many ways the key question in conservation biology: which are the most important places to conserve? The answer must take into account both the scale of the Half-Earth undertaking and the immense diversity of conservation objectives being considered. As a start, to halt imminent biodiversity loss, places that are home to the last remaining populations of a species and the last samples of any ecosystem type should be prioritized. To complement these irreplaceable sites, places that are still large, intact and functioning in ways that are unimpeded by large-scale human activities should also be identified and protected. Such places provide the backbone of planetary and regional-scale ecosystem services, as well as



LIANA JOSEPH

Figure 1 | Lowland forest ecosystems of the Congo. It has been proposed[3] that half of the Earth should be kept for conservation as a way of preventing biodiversity loss. Dinerstein *et al.*[2] assessed the current extent of natural habitat remaining in Earth's 846 terrestrial ecoregions. Part of the plan for the next steps needed should focus on ensuring that the last remaining intact forests of the world, such as those found in the Congo Basin, are conserved.

offering the resilience that enables species and ecosystems to self-regenerate and to adapt to stressors that arise from human activity[8].

Second, what is the scope, severity and trajectory of the threats to local biodiversity, and what are the processes that sustain them? To address this, it will be necessary to understand not only the drivers of habitat loss and degradation, but also the nebulous effects that other factors, such as the presence of invasive species, over-harvesting, disease, climate change and altered fire regimes[9], can have on a habitat. All of these tend to reduce habitat quality without necessarily affecting its spatial extent. All threats are inherently linked to social and economic forces, and an interdisciplinary approach should therefore be adopted to appraise them. Understanding threats can aid assessment of the places where action is most urgently needed to conserve and restore habitats, and can allow conservation efforts to focus on minimizing the number of ecoregions that dip below retention of half of their natural habitat.

Finally, for priority areas for intervention, what measures will be needed to ensure that these areas maintain their natural integrity? Although protected areas have been the cornerstone of conservation action so far[10], they would probably have a reduced role in a conservation network that scales up to the level of Half-Earth. Instead, the roles of indigenous governance, private conservation tenants, land and sea stewardship arrangements, and payment to land stewards through ecosystem services schemes run by public and private institutions, must all be appraised[11]. Moreover, in many places, active conservation might not be required to maintain ecological integrity.

Completing the research required to answer these three questions should provide an effective framework for reaching Half-Earth by 2050. The analysis produced by Dinerstein and colleagues has shown that this goal is possible in many places, and has helped to embolden this call for action. Half-Earth is about thinking big, and we urge conservation scientists to play their part in this process. ■

James E. M. Watson *is at the Wildlife Conservation Society and School of Earth and Environmental Sciences, University of Queensland, Brisbane 4072, Australia.*
Oscar Venter *is in the Natural Resources and Environmental Studies Institute, University of Northern British Columbia, Prince George V2N 2M7, Canada.*
e-mail: jwatson@wcs.org

1. United Nations. *Adoption of the Paris Agreement* (UN, 2015).
2. Dinerstein, E. *et al. BioScience* **67,** 534–545 (2017).
3. Wilson, E. O. *Half-Earth: Our Planet's Fight for Life* (Norton, 2016).
4. Convention on Biological Diversity. *COP Decision X/2: Strategic Plan for Biodiversity 2011–2020* (2012).
5. Büscher, B. *et al. Oryx* **51,** 407–410 (2017).
6. Watson, J. E. M. *et al. Conserv. Lett.* **9,** 413–421 (2016).
7. Ellis, E. C. & Ramankutty, N. *Front. Ecol. Environ.* **6,** 439–447 (2008).
8. Martin, T. G. & Watson, J. E. M. *Nature Clim. Change* **6,** 122–124 (2016).
9. Maxwell, S. L., Fuller, R. A., Brooks, T. M. & Watson, J. E. M. *Nature* **536,** 143–145 (2016).
10. Watson, J. E. M., Dudley, N., Segan, D. B. & Hockings, M. *Nature* **515,** 67–73 (2014).
11. Boyd, C. *et al. Conserv. Lett.* **1,** 37–43 (2008).