# Optimizing management of threats to biodiversity across large scales

Jeffrey O. Hanson1, Dobrochna M. Delsen2, Allison D. Binley1, Martin Jung3, Virgilio Hermoso4, Piero Visconti3, James Allan2, Melissa Chapman5, Richard Schuster1,6, Joseph R. Bennett1

1 Department of Biology, Carleton University, Ottawa, Canada 2 Institute for Biodiversity and Ecosystem Dynamics (IBED), University of Amsterdam, Amsterdam, The Netherlands 3 Biodiversity, Ecology and Conservation Research Group, International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria 4 Departamento de Biología de la Conservación y Cambio Global, Estación Biológica de Doñana (EBD-CSIC), Sevilla, Spain 5 Department of Environmental Science, Policy, and Management, University of California, Berkeley, USA 6 Nature Conservancy of Canada, Toronto, Ontario, Canada \*email: jeffrey.hanson@uqconnect.edu.au

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## Abstract

Global biodiversity is rapidly eroding due to anthropogenic threats. These threats are myriad, including agriculture, energy production, mining, pollution, and roads. Since resources are limited, plans for conserving biodiversity need to be cost-effective. Yet little guidance exists for prioritizing conservation efforts to manage threats—especially at national and continental scales. Here we examine strategies for managing threats to biodiversity across such large scales. Using Europe as a case study, we obtained spatial distribution, habitat affiliation, and threat data for the majority of imperiled vertebrate species. We also obtained maps for eight threatening processes. By combining these datasets, we modeled how managing combinations of threats in particular places would alter species’ habitat availability. To minimize anthropogenic conflicts, we also parametrized opportunity costs. After compiling these data, we generated optimized conservation plans to (i) manage threats inside and outside existing protected areas, (ii) manage threats only within existing protected areas, and (iii) establish protected areas without managing threats. Our results reveal priority areas for managing threats to improve biodiversity conservation. Not only do our results help identify the most cost-effective locations for conservation efforts, they also identify which threats are important to manage at each of these locations. We found that managing threats both inside and outside existing protected areas provides much greater conservation benefits than only within existing protected areas. Moreover, even when optimized, simply establishing protected areas without managing threats did not substantially improve biodiversity conservation. Our findings highlight the importance of carefully considering threats in conservation assessments and planning.