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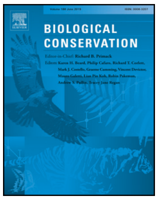

Monitoring national conservation progress with indicators derived from global and national datasets

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ABSTRACT

Developing indicators for monitoring biodiversity, as called for by the Convention on Biological Diversity and 2020 Aichi Targets, is challenging in many countries due to data and capacity gaps. One proposed solution is to disaggregate global datasets to generate national-level indicators for countries where these values do not exist, but to date there are few examples where this approach has been systematically applied and its efficacy investigated. Using comparisons of disaggregated global data and data generated nationally for four indicators in five tropical Andean countries, we show that the two approaches can often lead to divergent values. Differences between values gathered using these two methods vary according to country and indicator, with the average differences for all countries as 26% for forest cover loss (maximum Bolivia 31%), 10% for the Red List Index (maximum Venezuela 27% for birds), 14% for protected area coverage of Key Biodiversity Areas (maximum Colombia 25%), and 67% for carbon sequestration potential (maximum Peru 102%). Most of the variations are due to methodological differences, calling into question the reliability of inter-country comparisons and roll-ups of national indicator data to regional or global scales. Nationally-generated indicators are desirable because they have the greatest power to influence national policy. However, in cases where regional or global consistency is needed, such as assessments by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services and Global Environmental Outlook, assessors should rely on global and regionally-disaggregated global data to elucidate trends and spatial patterns for most indicators. To broaden the utility of nationally-generated indicators, the biodiversity indicators community must agree on methodological standards, ensure that local stakeholders' needs are understood and addressed, develop incentives for the use of these standards, and communicate them to practitioners at all levels.

1. Introduction

Concern about the deteriorating status of biodiversity worldwide has led to the establishment of a number of policy platforms to promote responses to this crisis and chart progress toward specified targets. The Strategic Plan for Biodiversity 2011–2020 and corresponding 20 Aichi Targets (CBD, 2010), the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES; Opgenoorth and Faith, 2013), the Global Environmental Outlook (GEO; UNEP, 2012), and the Sustainable Development Goals (Sachs, 2012) are four such mechanisms that either set biodiversity goals or chart societal progress in reducing declines in biodiversity. The existence of these platforms and others has created a need for the development of indicators for specified targets. Indicators are typically derived from global sources (Butchart et al., 2010; Tittensor et al., 2014), but may also be rolled up from nationally-generated sources.

Abbreviations: AZE, Alliance for Zero Extinction; CBD, Convention on Biological Diversity; DGFFS, Dirección de Gestión forestal y de Fauna Silvestre; FAN, Fundacion Amigos de la Naturaleza, Bolivia; IBA, Important Bird Areas; IPBES, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services; IUCN, The International Union for Conservation of Nature; GEO, Global Environmental Outlook; KBA, Key Biodiversity Areas; MAE, Ministerio del Ambiente del Ecuador; MINAM, Ministerio del Ambiente del Peru; MINAG, Ministerio de Agricultura, Peru; MMAA, Ministerio de Medio Ambiente y Agua, Bolivia; NBSAP, National Biodiversity Strategic Action Plans; RLI, Red List Index; REDD, Reduced Emissions from Deforestation and Forest Degradation; RUNAP, Registro Unico Nacional de Areas Protegidas, Colombia; SERNANP, Servicio Nacional de Areas Naturales Protegidas, Peru; SERNAP, Servicio Nacional de Areas Protegidas, Bolivia; WDPA, World Database on Protected Areas.

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Nationally-generated data play a necessary role in this arena because they address biodiversity issues at a scale relevant to the governments charged with improving the status of biodiversity (Soberon and Sarukhan, 2009; Stephenson et al., 2015). Classification of remotely-sensed data by local technicians familiar with the land forms depicted in the imagery can be more accurate than global classification schemes that lump features into broad categories (e.g., UNEP-WCMC, 2015). Similarly, assessment of population status by field biologists familiar with species in a particular country can provide a more accurate representation of species' extinction risk in that country than estimates made across the ranges of the species, many of which typically include multiple countries where threats can vary substantially. Furthermore, the resolution of mapped data can be finer for nationally-generated indicators than for global indicators derived from relatively coarse resolution global data. Finally, a key value of indicators compiled from nationally-generated data is that they speak directly to targets set by national level stakeholders, the same entities that are often responsible for maintaining healthy ecosystems. Through their contributions to the identification of both targets and indicators for measuring progress, these stakeholders are more invested in achieving positive outcomes (Soberon and Sarukhan, 2009). By contrast, no single entity is responsible for achieving global targets, which are set via multilateral processes.

Despite the advantages of nationally-generated indicator data, the availability of these data and the capacity and willingness to generate indicator data vary among countries (Bubb, 2013; Han et al., 2014). To fill gaps in nationally-generated data, the conservation community has proposed disaggregating global datasets at the national level to use as a bridge until countries develop their own capacity to compile data and derive indicators (Bowles-Newark et al., 2015a; Bubb, 2013; Secades et al., 2014; Stephenson et al., 2015). The resulting indicators could be used, for example, in National Biodiversity Strategic Action Plans (NBSAPs), which are key to implementing the CBD at the national level. However, to date there have been few examples where this approach has been systematically applied, and its efficacy is untested. Here we explore the concordance of a sample of disaggregated global and national indicators that track different aspects of biodiversity. We ask whether the indicators tell the same story, what factors might cause differences, and in which situations each data source might be more powerful. The answers to these questions provide important input to determining strategies for future indicator development and use.

2. Material and methods

2.1. Biodiversity indicators from tropical Andean countries

We selected five tropical Andean countries (Fig. 1) for our comparison of globally disaggregated and nationally-generated indicators for two reasons. First, the tropical Andes is representative of many tropical regions that harbor exceptionally high biodiversity and are confronting urgent threats. Second, a previous study indicated that monitoring capacity is higher in tropical Andean countries than in some other tropical regions of Africa and Asia (Han et al., 2014) and thus nationally-generated data should be more readily available and for a longer time series.

We chose four indicators for comparison, one each from the pressure-state-response-benefit framework used by the CBD (Bubb et al., 2011; Sparks et al., 2011; UNEP-WCMC, 2009) (Table 1). These indicators are largely consistent with those presented via the Biodiversity Indicators Dashboard (BID; http://dashboard.natureserve.org) and are highly relevant to global biodiversity monitoring initiatives, including the 2020 Aichi targets. The availability of national data varied by indicator; we sought to compare as many countries as possible for any given indicator, and in one instance needed to restrict the assessment area to sub-national units to be consistent with data availability. The small sample size, both in terms of the number of countries with data for any given indicator and the number of indicators for which comparison of global and nationally derived values was possible, is indicative of the general difficulty of obtaining comparable metrics between countries. This small sample size precludes statistically robust comparisons of differences in nationally and globally derived biodiversity indicators, yet our results still provide a compelling means to illustrate issues that arise when applying data from these disparate sources.

2.1.1. Forest cover loss

We calculated the annual loss of forest cover as an indicator of the rate of deforestation. For both the global and national indicators, this value represents the annual loss in forests as a percent of the year 2000 forest cover baseline. The disaggregated global values were derived from the Global Forest Change dataset (Hansen et al., 2013), which mapped global forest tree cover and its change from 2000 to 2012 using Landsat imagery at 30-m spatial resolution. Data sufficient for calculating national forest loss values have been produced and published for Bolivia, Colombia, Ecuador, and Peru, but not Venezuela (Table 1). These values were derived from national forest cover maps developed using satellite imagery (primarily Landsat, but also ASTER; see the Supplemental materials Appendix for more information).

National data on forest cover differed among countries and from the global data in the minimum mapping units used, how forests were defined, the specific classification techniques employed, and the dates for which data were available (see the Supplemental materials Appendix for a complete summary). Whereas the Global Forest Change data did not consider a minimum mapping unit, each national estimate did; the areas ranged from a low of 0.3 ha for Bolivia to a high of 25 ha for Colombia. Forests were defined based on percent canopy cover and canopy height. The Global Forest Change data mapped tree cover, and we defined forests as 30-m pixels with at least 25% cover of trees at least 5 m high following Hansen et al. (2010), whereas nationally, canopy cover requirements ranged from 10% (Peru) to 30% (Ecuador) and canopy height requirements ranged from 3 m (Peru) to 5 m (all other countries for which canopy height was specified). Forest plantations were included in the definition of forest for the global data, Ecuador and Peru, but not for Colombia (whether they were included in Bolivia is not clear). Regenerating forest was considered as forest in the global and Ecuadorian estimates, but the method descriptions for the remaining countries do not address this point. For Bolivia, Colombia, and Peru, national data were available for 2000 and 2010, and the national and global indicators of forest loss reflect change between these dates. For Ecuador, national data were available only for 2000 and 2008; the national and global indicators presented for Ecuador reflect forest loss between these years.

2.1.2. Red List Index (RLI)

The Red List Index is a measure of trends in survival probability (the inverse of extinction risk) for sets of species within broad taxonomic groups. It is based on the numbers of species within each IUCN Red List category and the changes in these numbers over time resulting from genuine improvement or deterioration in status between assessments (Butchart et al., 2004, 2005, 2007, 2010; Hoffmann et al., 2010; IUCN, 2010). This standardized RLI varies between 1 (all species Least Concern) and 0 (all species Extinct or Extinct in the Wild). We sought to compare RLI results from national assessments with country-specific results derived from comprehensive global assessments, contrasting both the most recently calculated RLIs by taxonomic group for each country, and, where assessments from multiple years were available, calculating the annual change in aggregate extinction risk by dividing the difference in RLI from the last to first assessment by the number of intervening years.

For the disaggregated global value of this indicator, we used the last comprehensive Red List assessment for each of three vertebrate groups for the RLI, and first and last comprehensive assessments to calculate annual change in RLI (1988 and 2008 for birds, 1996 and 2008 for mammals, and 1980 and 2004 for amphibians) following Butchart et al.

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