Representation of protected areas

Indicator name	**Representation achievement score**
Indicator unit	Average percentage of targets achieved for terrestrial biogeographic units covered by protected areas.
Area of interest	The indicator is available in DOPA at the country level.

Related targets

Sustainable Development Goal 14 on life on water

Sustainable Development Goal 15 on life on land

Aichi Biodiversity Target 11 on protected areas

Policy question
How well do protected area networks represent biogeographic units at the country and global level? This is a key question for measuring progress on the representation aspect of Aichi Target 11 of the Convention on Biological Diversity (CBD).

Use and interpretation
The indicator can be used to assess:
- How far countries are from achieving the representation element of Aichi Target 11 of having 17% of the land, and 10% of coastal and marine areas covered by ecologically representative systems of PAs (Figure 1). This will also be applicable to the targets set for area-based commitments in the post-2020 Global Biodiversity Framework.

- Which biogeographic units are under-represented by protected areas in countries and thus would benefit from additional protection
- Whether newly designated PAs improve the overall representation of PA networks in a country or globally, versus just increasing coverage alone.
- Whether a country has reached an adequate level of representation. We suggest a representation achievement score of 80% is adequate.

Key caveats
The current version of the representation achievement score:
- Assumes a constant protection target (e.g. 17%) for all biogeographic units
- Does not consider effectiveness of PAs
- Only uses coverage statistics for the biogeographic units and does not currently consider quality or condition of the system

Indicator status
Published in peer reviewed papers. The method for calculation is described in Jantke et al. 2019, a variant of the original idea invented in Sutcliffe et al. 2015.

Available data and resources

Data available   DOPA Explorer (http://dopa-explorer.jrc.ec.europa.eu/) provides typical metrics such as the amount of protection for each terrestrial ecoregion within a country; the relative contribution that a country is making to the protection of an ecoregion worldwide; and the number of different ecoregions falling within a particular protected area.

Data updates   Planned with each update of DOPA.

Codes   The simple calculation is documented in Jantke *et al.* (2019) and downloadable as a *R package*.

Additional guidance from the curators of the World Database on Protected Areas can be found at https://www.protectedplanet.net/c/calculating-protected-area-coverage
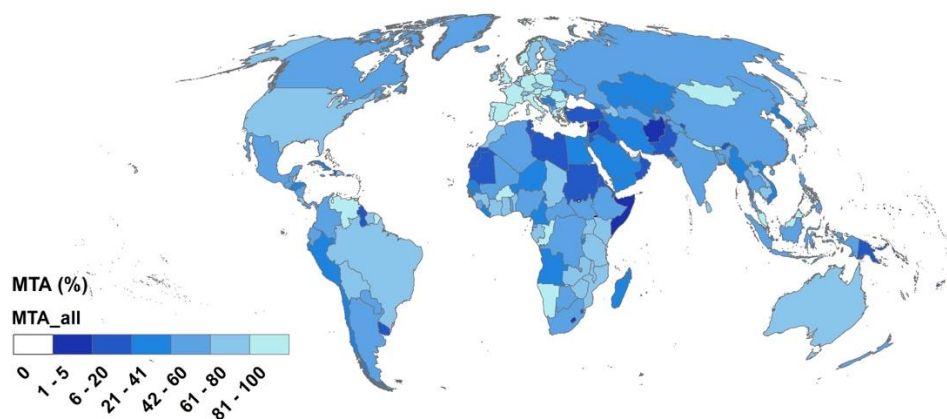
Methodology

Fig 1. An example of how well each country's Protect Area network represents unique biogeographic units.

Methodology   The DOPA uses the Global Administrative Unit Layers (GAUL) to compute protected area coverage of countries. PA coverage statistics are also calculated for terrestrial ecoregions because these represent more meaningful entities within which to analyze the ecological representativeness of the global protected area network (Figure 1). The terrestrial ecoregion boundaries used in the DOPA are provided by WWF, the Nature Conservancy and partners. The Terrestrial Ecoregions of the World (TEoW) dataset identifies 827 ecoregions (Olson *et al.*, 2001). These biogeographic classification systems can help ensure that the full range of ecosystems is represented in global and regional conservation and development strategies.

Following current practice, the UNESCO Man and Biosphere Reserves are not included in the calculations, as many of their buffer areas do not meet the IUCN's protected area definition (Watson *et al.*, 2014; UNEP-WMC & IUCN, 2016). PAs

that are proposed (but not yet fully designated or established) and PAs recorded as points without a reported area are also excluded. In addition, all overlaps between different PA records are removed from the calculations to avoid double counting.

A GIS analysis is used to calculate terrestrial protection. For this a global protected area layer is created by buffering the points recorded in the WDPA based on their reported areas and combining them with the polygons recorded in the WDPA. This layer is overlaid with country boundaries and ecoregions to obtain the absolute and relative coverage of protected areas at national, regional and global scales.

Calculating the Representation Achievement Score requires calculating the total area of a feature (unit) and the proportion of that feature that is currently protected. The average shortfall across all features, globally or within countries, is then used to calculate the score using the Mean Target Achievement method described in Jantke et al. 2019.

Below we provide two examples of how Representation Achievement Scores can be derived for two hypothetical countries, each with ten equal area biogeographic units (Figure 2). Each country has 30% coverage of its PA network. They both have 10 features, and 5 out of the 10 are meeting their targets of 30% coverage or above. However, one country is making more progress than the other in protecting features, even though both countries have half of their features meeting the target. The Representation Achievement Score reflects the contribution of all protection efforts more sensibly than merely counting the proportion of ecoregions that meet a target.

Overall coverage: 30%
Ecoregions meeting target: 50%
Representation Achievement: 50%

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Ecoregions meeting target: 50%
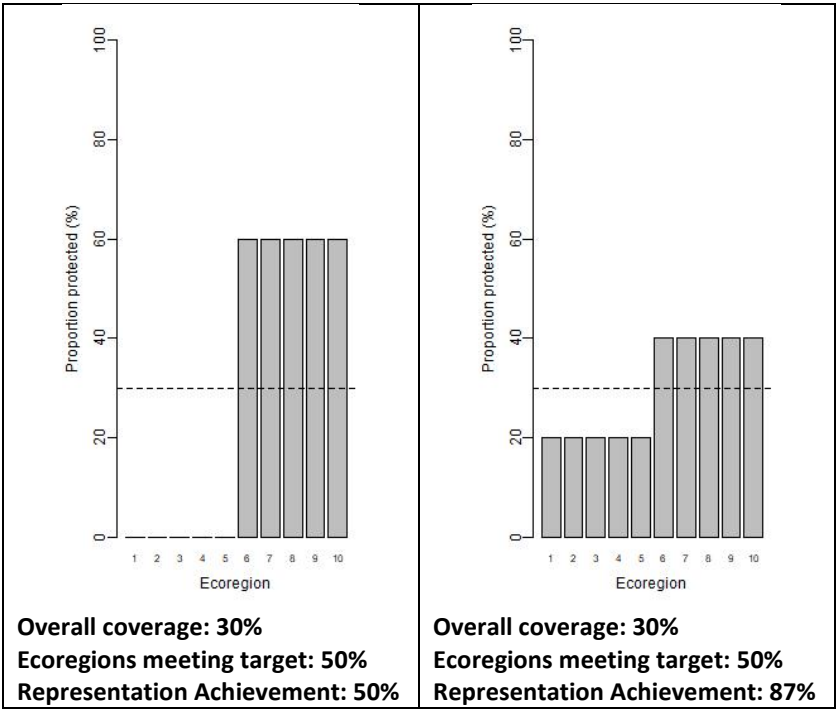**Representation Achievement: 87%**

Figure 2. Examples of how Representation Achievement Scores reflect the contribution of all protection towards meeting the goals.
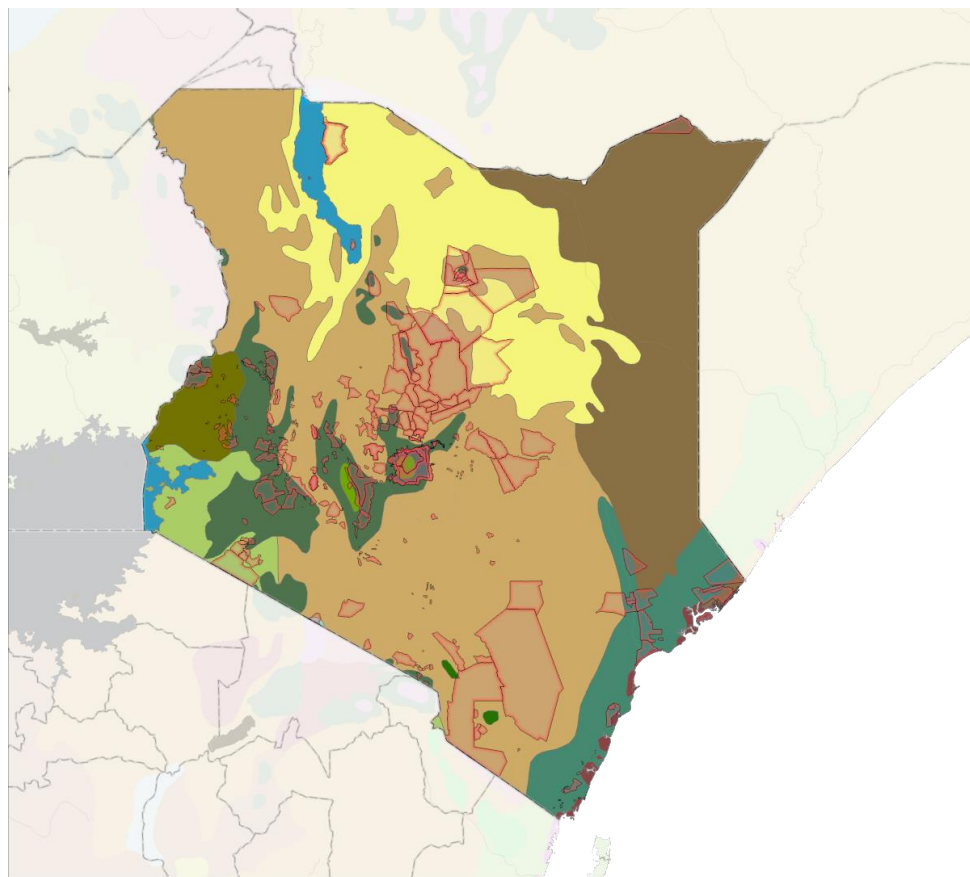
Figure 3. An example of the underlying data used to calculate the RAS for Kenya's ecoregional representation and PA estate.

ECOREGIONS (given 17% target)				
Total Number	Overall coverage	Number Meeting Target	% Ecoregions Met	Representation Achievement Score
13	12.5	4	30%	60%

Input datasets   The indicator uses the following input datasets:

Protected Areas
- WDPA of February 2023 (UNEP-WCMC & IUCN, 2023).
  - Latest version available from: www.protectedplanet.net

Country boundaries
Country boundaries are built from a combination of GAUL country boundaries and EEZ exclusive economic zones (see Bastin *et al.*, 2017).

- Global Administrative Unit Layers (GAUL), revision 2015.

- Latest version available online :
  http://www.fao.org/geonetwork/srv/en/metadata.show?id=12691

Terrestrial Ecoregions of the World
- TEOW (Olson *et al.*, 2001)

  - Latest version available from:
    https://www.worldwildlife.org/publications/terrestrial-ecoregions-of-the-world

References

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Sutcliffe PR, CJ Klein, CR Pitcher and HP Possingham. 2015. The effectiveness of marine reserve systems constructed using different surrogates of biodiversity. Conservation Biology 29 (3), 657-667. https://conbio.onlinelibrary.wiley.com/doi/abs/10.1111/cobi.12506

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