

Connectivity of terrestrial protected areas

Indicator name Protected Connected (ProtConn) Land

Indicator unit Percentage of an area covered by protected connected lands

Area of interest The indicator is computed and available in DOPA at the country and terrestrial ecoregions levels. Also, aggregations at regional level are provided.

Related targets



[Sustainable Development Goal 15 on life on land](#)



[Aichi Biodiversity Target 11 on protected areas](#)



[Aichi Biodiversity Target 12 on species](#)

Policy question How well connected are the terrestrial protected area systems at the country and ecoregion level? This is a key question for measuring progress on the connectivity element of Aichi Target 11 of the [Convention on Biological Diversity](#) (CBD).

Use and interpretation

The indicator can be used to assess:

- The degree to which the spatial arrangement of Protected Areas (PAs) is successful in ensuring connectivity of protected lands.
- How far countries or terrestrial ecoregions are from the connectivity element of Aichi Target 11 of having 17% of the land covered by well-connected systems of PAs (Figure 1).
- The contribution of different categories of land (protected, unprotected, transboundary) to the connectivity of PAs (Figure 2).
- Where on the globe additional efforts are most needed in expanding or reinforcing the connectivity of PA systems.
- Whether newly designated PAs provide effective connectivity gains in the PA system by acting as corridors or stepping stones between other PAs.

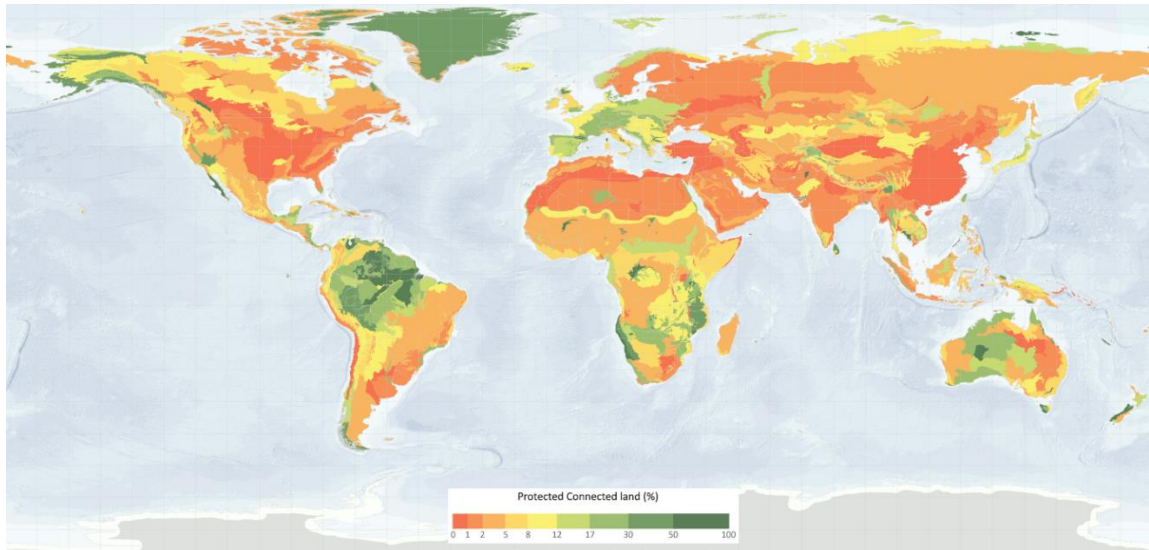


Figure 1. An example of a global assessment: Protected Connected land (% of ecoregion area) for the world's terrestrial ecoregions as of January 2021 for a reference median dispersal distance of 10 km (Saura et al. 2017).

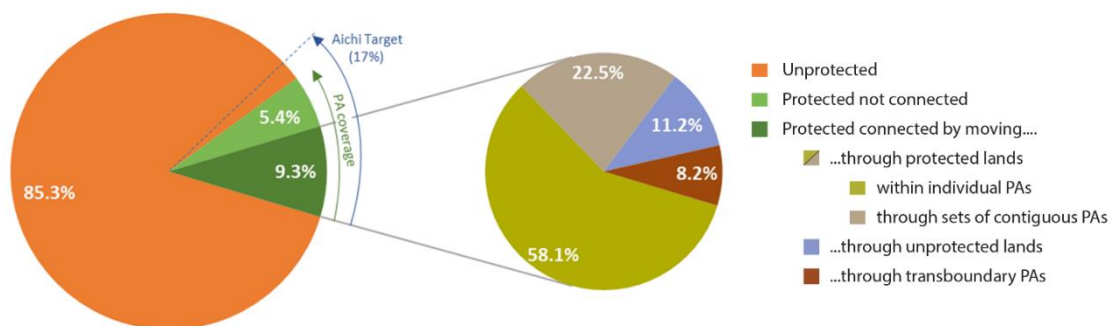


Figure 2. An example comparing ProtConn with PA coverage and showing the contribution of different land categories to ProtConn: Global average of the ProtConn indicator (dark green slice in the left pie chart) and of its fractions (right pie chart) for the world's terrestrial ecoregions and a median species dispersal distance of 10 km as of June 2016 (Saura et al. 2017). Global PA coverage (sum of protected connected and protected not connected land: 14.7%) and the 17% Aichi Target 11 for year 2020 are also indicated in the left pie chart.

Key caveats

The current version of the connectivity indicator:

- Assumes that PAs are effectively conserved and managed as to ensure sufficient connectivity levels that allow the successful movement of species through protected lands.
- Does not consider the heterogeneity of the landscape matrix in between PAs, due to high variability in species responses; instead it aims at a more general assessment for the range of median dispersal distances observed for most terrestrial vertebrates (1 to 100 km). The reference dispersal distance of 10 km is the one used for the ProtConn indicator values shown in DOPA.

Indicator status Published in peer reviewed papers. The method regarding the connectivity at ecoregion level is described in Saura *et al.* (2017). The one describing the connectivity at country level is described in Saura *et al.* (2018).

The ProtConn indicator has been approved by the CBD mandated [Biodiversity Indicators Partnership](#) (BIP) as a new indicator to measure PA connectivity under [Aichi Target 11](#)

Available data and resources

Data available DOPA Explorer provides the ProtConn values at the terrestrial ecoregion and country level for a reference species median dispersal distance of 10 km. Area-weighted averages at regional level are also provided.

Specific interactive and downloadable maps with the ProtConn values at ecoregion and country levels for different years are available on the DOPA website (<http://dopa.jrc.ec.europa.eu/en/mapsanddatasets>)

Data updates Planned at every DOPA update.

Codes All the connectivity indicators were calculated using GIS operations, R and the command line version of the software package Conefor 2.7 (Saura & Torné, 2009), updated at www.conefor.org.

Methodology

Methodology The indicator considers the spatial arrangement, size and coverage of protected areas (PAs), and accounts for both the land area that can be reached within PAs and that which is reachable through the connections between different PAs. The analysis includes all designated PAs in the WDPA (polygons and buffered points) not smaller than 1 km², except UNESCO Biosphere Reserves, and is conducted for a range of median dispersal distances (1 to 100 km) observed for most terrestrial vertebrates. The indicator is calculated through network analysis, with the Probability of Connectivity and the Equivalent Connected Area as the underlying metrics. For more details see Saura *et al.* (2017, 2018, 2019).

Input datasets The method described above uses the following input datasets:

Protected Areas

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

Terrestrial Ecoregions of the World

- TEOW (2001). Terrestrial ecoregions of the world (Olson *et al.*, 2001)

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

Country boundaries

- Global Administrative Unit Layers (GAUL), revision 2015 (2017-02-02).

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

References

Olson *et al.*, (2001). Terrestrial ecoregions of the world: A new map of life on Earth. *Bioscience*, 51: 933–938. [https://doi.org/10.1641/0006-3568\(2001\)051\[0933:TEOTWA\]2.0.CO;2](https://doi.org/10.1641/0006-3568(2001)051[0933:TEOTWA]2.0.CO;2)

Saura, S. & J. Torné (2009). Conefor Sensinode 2.2: a software package for quantifying the importance of habitat patches for landscape connectivity. *Environmental Modeling & Software*, 24: 135-139. <https://doi.org/10.1016/j.envsoft.2008.05.005>

Saura, S. *et al.* (2017). Protected areas in the world's ecoregions: How well connected are they? *Ecological Indicators*, 76: 144-158. <http://dx.doi.org/10.1016/j.ecolind.2016.12.047>

Saura, S. *et al.* (2018). Protected area connectivity: Shortfalls in global targets and country-level priorities. *Biological Conservation*, 219: 56-67. <https://doi.org/10.1016/j.biocon.2017.12.020>

Saura, S., *et al.* (2019) Global trends in protected area connectivity from 2010 to 2018. *Biological Conservation*, 238: xx-xx. <https://doi.org/10.1016/j.biocon.2019.07.028>

UNEP-WCMC & IUCN (2023). Protected Planet: The World Database on Protected Areas (WDPA) [On-line], [February/2023], Cambridge, UK: UNEP-WCMC and IUCN. www.protectedplanet.net

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