An introduction to DOPA Explorer 3.0

Introduction

The DOPA (Digital Observatory for Protected Areas) Explorer 3.0 is a web based tool developed by the Joint Research Centre of the European Commission (EC JRC) to support the European Union's efforts "*to substantially strengthen the effectiveness of international governance for biodiversity and ecosystem services*[1]" and more generally for "*strengthening the capacity to mobilize and use biodiversity data, information and forecasts so that they are readily accessible to policymakers, managers, experts and other users*[2]".

In particular, DOPA aims to provide the best available material (data, indicators and models) made available by a few key institutions (*i.e.* the EC-JRC, the UN Environment - World Conservation Monitoring Centre, the International Union for the Conservation of Nature, BirdLife International, GBIF and others) which can serve for establishing baselines for research and reporting.

DOPA Explorer provides a simple means to explore terrestrial, marine and mixed protected areas, identify those with the most unique ecosystems and species, and assess the pressures they are exposed to because of human development.

The DOPA Explorer 3.0 is available at http://dopa.jrc.ec.europa.eu/explorer/

Citation: Joint Research Centre of the European Commission (*year*), The Digital Observatory for Protected Areas (DOPA) Explorer 3.0 [On-line], [*insert month/year of the version accessed*], Ispra, Italy. Available at: http://dopa-explorer.jrc.ec.europa.eu

Area of interest

Using the July 2018 version of the World Database on Protected Areas (WDPA) (UNEP-WCMC & IUCN, 2018), DOPA Explorer 3.0 provides summary indicators and statistics at the country and ecoregion levels.

The indicator can be used to assess how far countries or ecoregions are from the Aichi Target 11 of having 17% of the land and 10% of coastal and marine areas covered by well-connected systems of protected areas. Inversely, the information highlights where on the globe additional efforts are most needed in expanding or reinforcing the coverage by protected areas (Figure 1).

More detailed assessments regarding species, climate, land cover change and pressures have been computed for all protected areas ≥ 25 km^2 (nearly 30,000 protected areas covering more than 95% of the global protected surface) (Figure 2). Table 1 below provides a summary of the core indicators and statistics proposed in DOPA Explorer 3.0. Note that some information on EU funding for biodiversity conservation have also been imported now from a specific tool developed by the same team, see the Beta version of eConservation at http://econservation.jrc.ec.europa.eu/.

[1] EC/COM/2006/0216 final
[2] UNEP/CBD/COP/10/27

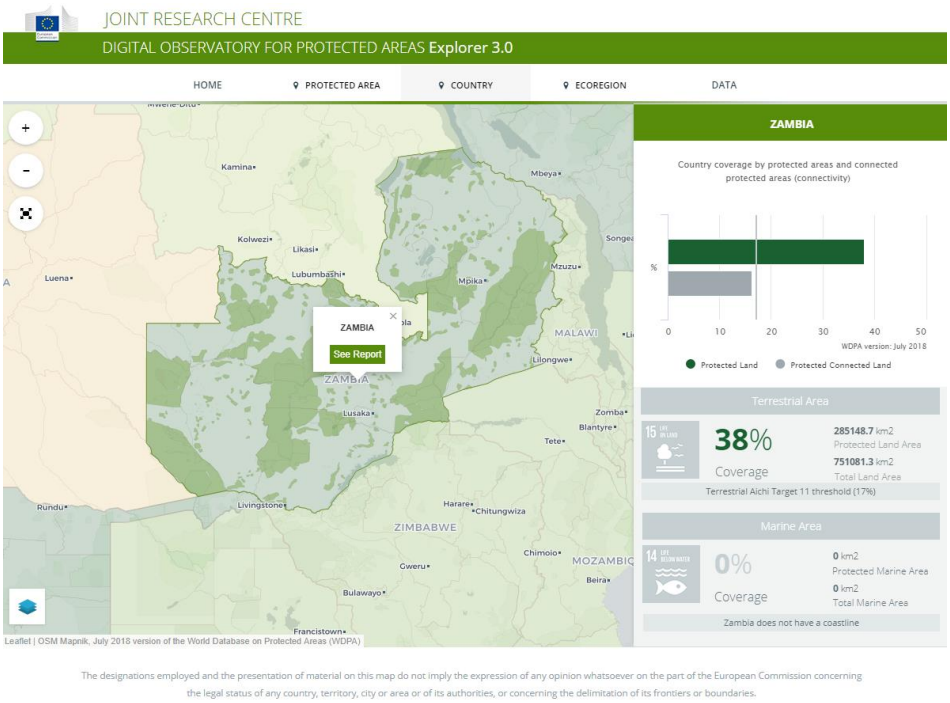

Figure 1. Screen capture of the DOPA Explorer 3.0 showing the main indicators for Aichi Target 11 for a country. Here, we show that Zambia has achieved its target in terms of terrestrial coverage but is still missing its target for what concerns the connectivity of protected areas

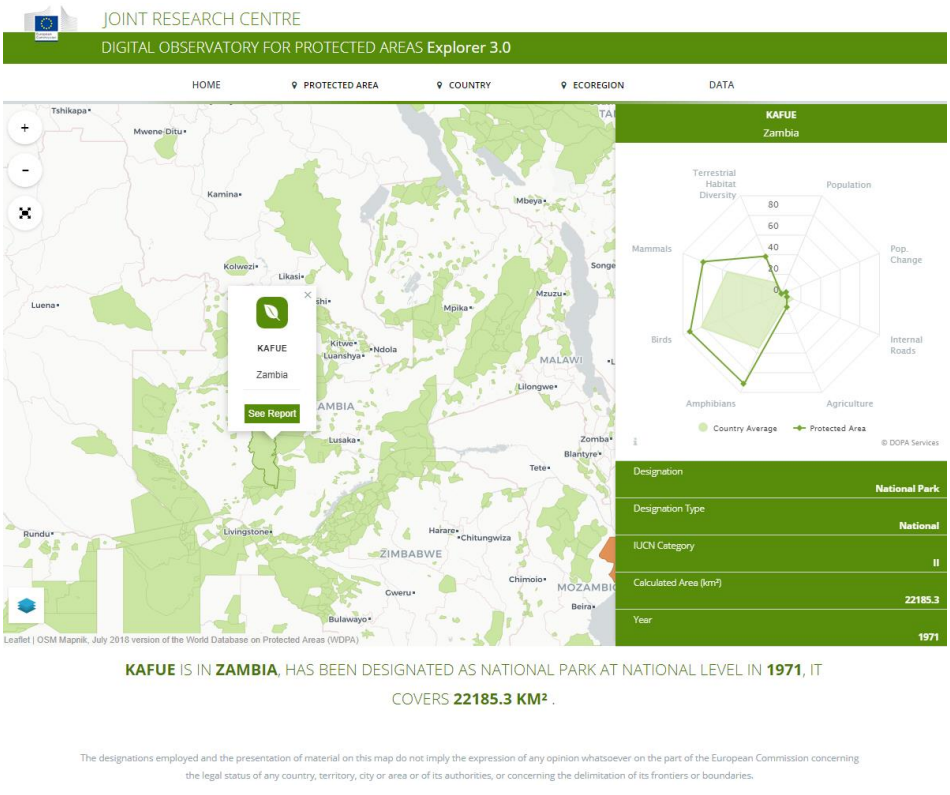

Figure 2. Screen capture of the DOPA Explorer 3.0 showing the main indicators on species, habitat diversity and pressures at the protected area level (bold line In radar plot) compared to the average values of the same indicators for all protected areas of the country (green shaded areas) . Here we show a protected area with a high biodiversity with a complex habitat that is exposed to little pressures.

Key Indicators	Country	Ecoregion	Site level (25 km2)
Coverage by protected areas			*NA*
Connectivity of terrestrial protected areas			*NA*
Land cover & change			
Forest cover & change			
Surface water cover & change			
Terrestrial habitat diversity	-	-	
Marine habitat diversity	-	-	
Threatened species		-	
Agricultural pressure	*NA*	*NA*	
Population pressure	*NA*	*NA*	
Built-up pressure	*NA*	*NA*	
Road pressure	*NA*	*NA*	
Climate	*NA*	*NA*	
Organic Carbon in soil			
Land productivity			
Land fragmentation			
EU funding for conservation		-	-

Table 1. Summary table of the core indicators and statistics proposed in DOPA Explorer 3.0. *NA* = Not Applicable

Policy targets

Biodiversity loss has continued largely unabated despite increased efforts by the international community and several conservation successes (Butchart *et al.*, 2010; Hoffmann *et al.*, 2010). The 10th meeting of the UN Convention on Biological Diversity (CBD) thus adopted in 2010 an ambitious Strategic Plan for Biodiversity, including the 20 Aichi Biodiversity Targets, for the 2011 - 2020 period. Among the targets, Target 11 states"*By 2020, at least 17 per cent of terrestrial and inland water areas and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.*" The EU has pledged to meet the international biodiversity targets agreed under the CBD by 2020.

Because PAs play a key role in biodiversity conservation and the sustainable use of natural resources (Watson *et al.,* 2014; UNEP-WCMC & IUCN, 2016), these are at the heart of many conservation initiatives such as Natura 2000. This network of PAs is designed to ensure the long-term survival of Europe's most valuable and threatened species and habitats, listed under the Birds Directive and the Habitats Directive (Beresford *et al.*, 2016). Target 6 of the EU Biodiversity Strategy addresses the EU contribution to global conservation and requires that, by 2020, the EU steps up its contribution to avert global

biodiversity loss by greening its economy and endeavoring to reduce its pressure on global biodiversity. The 11th meeting of the CBD in Hyderabad, India (2012) further saw The Parties of the CBD agreeing on an overall substantial increase of total biodiversity-related funding for the implementation of the Strategic Plan. The objectives of the Hyderabad commitment included the setting of a preliminary target of doubling total biodiversity-related international financial resource flows to developing countries by 2015 and at least maintaining this level by 2020. This is a substantial effort for the EU considering that EuropeAid, the European Commission's Directorate for International Cooperation and Development, invested alone already around 1.3 billion in biodiversity-related projects between 2007 and 2013 to support developing countries to meet their targets (EuropeAid, 2016).

Approaching fast 2020, a new global strategy has already been put in place by the United Nations. In January 2016, a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030 was adopted and is articulated around 17 SDGs (Sustainable Development Golas) and 169 associated targets.

We hope the DOPA will contribute to the SDGs 15, 16 and 17 and we will futher focus on Aichi Targets 5, 11, 12 and 20 until 2020.

Sustainable Development Goal 15 on life below water

Sustainable Development Goal 15 on life on land

Sustainable Development Goal 17 on partnerships for the goals

Aichi Biodiversity Target 5 on natural habitats

Aichi Biodiversity Target 11 on protected areas

Aichi Biodiversity Target 12 on species

Aichi Biodiversity Target 12 on financial resources

Key caveats

Although global datasets allow for the development of comparable indicators across countries and regions, these also often suffer from higher local uncertainties when compared to national or regional datasets. The current information presented in the various applications of the DOPA need therefore to be used with care when it comes to site-level assessments. In other words,

applications such as the DOPA Explorer should be seen as a compass rather than a GPS to help decision makers navigate large amounts of biodiversity information that is otherwise difficult to access and manage. Earth observations, on the other hand, become increasingly freely available and portray the world every day with an increasing resolution and frequency. This wealth of additional information that is essential to biodiversity conservation also stresses the need to capture information about PAs directly on the ground, if only to validate the global products. Information that cannot be captured through remote-sensing techniques such as the presence of key species, threats, conservation projects, infrastructure, many land cover types, etc. are critical to assess protected areas and their effectiveness and need to be captured regularly as well.

Country boundaries include disputed territories which may contain protected areas. In such cases, protected areas are assigned to all the countries claiming this territory. Note that the designations employed and the materials and maps produced in DOPA do not imply the expression of any opinion whatsoever on the part of the European Commission concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Protected areas with a reported area and a point but no boundaries are artificially generated using buffers. This approach can underestimate or overestimate the level of protection of an ecoregion as well inaccurate estimates of the elements that are marine or terrestrial when buffered points cover coastal areas. See Visconti *et al.* (2013) for further discussions.

System status

DOPA Explorer 3.0 has been released in November 2018. Its underlying infrastructure has been documented in Dubois *et al.* (2016). For further technical details regarding the data processing we refer to Bastin *et al.* (2017).

Earlier releases (DOPA Explorer Beta and DOPA Explorer 1.0 have been documented in Dubois *et al.*, 2013 and 2015, respectively). DOPA Explorer 2.0 was documented only in parts in Dubois *et al.* (2016).

What's new?

Compared to the earlier release (2.0 of February 2018), DOPA Explorer 3.0 has seen the following main improvements

- A new graphical interface with improved search functions and a single downloadable dataset.
- DOPA Explorer 3.0 is based on the July 2018 version of the World Database on Protected areas (last version was October 2017)
- A minimum size of documented protected areas of 25 km^2 instead of 50 km^2 (an increase from around 24 000 documented areas to nearly 30 000)
- New indicator on land productivity dynamics (see factsheet I1)
- New indicator om land fragmentation (see Factsheet I2)
- New indicator on soil organic carbon (see Factsheet J1)
- New information on conservation funding (see Factsheet K1)
- Most metrics and indicators computed at the protected area level have also been computed at the country and ecoregion levels (i.e. land cover

change, land fragmentation, soil carbon, population and built up pressures,…)
- New interface to allow the display of species occurrences as provided by the GBIF.

Available data and resources

Data available

The data proposed in DOPA are made available in the DOPA Explorer 3.0 which is available at http://dopa-explorer.jrc.ec.europa.eu/ but also directly via our web services. See http://dopa-services.jrc.ec.europa.eu/services/ (registration is required, data distribution depending on the license agreements of the data providers). We also provide in a downloadable file, in a tabular format, all the quantitative results proposed.

Data updates

We expect the core indicators of the DOPA to be updated regularly (2 times / year), targeting monthly updates to align with the monthly updates of the World Database on Protected Areas by UN Environment-WCMC & IUCN. However, a number of indicators require extensive computational efforts and these will be updated only once a year for the time being. This is the case for the connectivity indicators.

Codes

We started sharing and documenting our codes in the technical section of the DOPA website at http://dopa.jrc.ec.europa.eu/en/technicaldocumentation. This section still needs to be significantly improved.

Methodology

Methodology

Assessing protected areas for biodiversity conservation at national, regional and international scales implies that methods and tools are in place to evaluate characteristics such as the protected areas' connectivity, their species assemblages (including the presence of threatened species), the uniqueness of their ecosystems, and the threats these areas are exposed to. Typical requirements for such analyses are data on protected areas, information on species distributions and threat status, and information on ecosystem distributions. By integrating all these global data consistently in metrics and indicators, the DOPA provides the means to allow end-users to evaluate protected areas individually but also to compare protected areas at the country and ecoregion level to, for example, identify potential priorities for further conservation research, action and funding.

We refer to Dubois *et al.*, 2016 and Bastin *et al.*, 2017 for detailed discussions on the methods used. Note that our key indicators are further documented in specific factsheets which can be downloaded in the documentation section of our homepage, at http://dopa.jrc.ec.europa.eu/en/documentation

Input datasets

The core indicators and metrics proposed by the DOPA are derived from the following input datasets:

Country boundaries

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

- Global Administrative Unit Layers (GAUL), revision 2015 (2017-02-02).
    - Latest version available online: http://www.fao.org/geonetwork/srv/en/metadata.show?id=12691
- Exclusive Economic Zones (EEZ), World EEZ v9 (2016-10-21)
    - Latest version available online http://www.marineregions.org/downloads.php

Terrestrial Ecoregions of the World

- TEOW (Olson *et al.*, 2001)
    - Latest version available from: https://www.worldwildlife.org/publications/terrestrial-ecoregions-of-the-world

Marine Ecoregions of the World

The marine ecoregions are the Marine Ecoregions Of the World (MEOW) and the Pelagic provinces of the world (PPOW)

- MEOW (Spalding *et al.*, 2007)
    - Latest version available from: https://www.worldwildlife.org/publications/marine-ecoregions-of-the-world-a-bioregionalization-of-coastal-and-shelf-areas
- PPOW (Spalding *et al.*, 2012)
    - Latest version available from: http://data.unep-wcmc.org/datasets/38

Protected Areas

- WDPA of July 2018 (UNEP-WCMC & IUCN, 2018).
    - Latest version available from: http://www.protectedplanet.net

Species ranges

- IUCN Red List of Threatened Species ™ 2017 version 2 (IUCN, 2017)
    - Latest version available from: http://www.iucnredlist.org

Species country statistics

- IUCN Red List of Threatened Species ™ 2018 version 2 (IUCN, 2018)
    - Latest version available from: http://www.iucnredlist.org

Species Occurrences

- Species occurrences provided by the Global Biodiversity Information Facility (GBIF):
    - Latest version available from: https://www.gbif.org/

Temperature and precipitations

- WorldClim 2, Release 1, June 2016 (Fick & Hijmans, 2017)
    - Latest version available from: www.worldclim.org/version2

Sea Surface Temperature

- Global monthly data distributed by the Copernicus Marine Environment Monitoring Service (Product identifier: SST_GLO_SST_L4_NRT_OBSERVATIONS_010_001) where extracted for the period January 2007- December 2016 (Donlon *et al.*, 2012).
    - Latest version available from: http://marine.copernicus.eu

Elevation (bathymetry and topography)

- GEBCO 2014 Grid (Weatherall *et al.*, 2014)
    - Latest version available from: http://www.gebco.net/data_and_products/gridded_bathymetry_data/

Land Cover

- Annual global land cover maps for the years 1995, 2000, 2005, 2010, 2015. (Land Cover CCI, 2017).
    - Latest version available from: http://maps.elie.ucl.ac.be/CCI/viewer/index.html

Global Human Settlements (built-up areas and population densities)

- GHS population grid for the years 1975, 1990, 2000, 2015 (Pesaresi et al., 2015; EC-JRC & CIESIN, 2015,)
    - Latest version available from : http://ghsl.jrc.ec.europa.eu/datasets.php

Road maps

- gROADS version 1. 1980-2010. (CIESIN-ITOS, 2013)
    - Latest version available from: http://sedac.ciesin.columbia.edu/data/set/groads-global-roads-open-access-v1

Agricultural Areas

- IIASA-IFPRI cropland map for the year 2005 (Fritz *et al.*, 2015)
    - Latest version available from: https://www.geo-wiki.org/downloads/

Inland Surface Water

- Global Surface Water Explorer (Pekel *et al.*, 2016)
    - Latest version available from: https://global-surface-water.appspot.com

Forest Cover

- Global Forest Change (Hansen *et al.*, 2013)
    - Latest version available from : http://earthenginepartners.appspot.com/science-2013-global-forest

Land Productivity Dynamics

- Land productivity trends from 1999 to 2013 (Cherlet *et al.*, 2018)
    - Latest version available from : https://wad.jrc.ec.europa.eu/landproductivity

Soil Carbon

- Global Soil organic carbon (FAO and ITPS, 2018)
    - Latest version available from : http://www.fao.org/global-soil-partnership/pillars-action/4-information-and-data-new/global-soil-organic-carbon-gsoc-map

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Contact Please contact us at: JRC-DOPA@ec.europa.eu

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@EU_DOPA