Built-up areas pressure

Indicator name	**Built-up area pressure index (BUAPI)**
Indicator unit	The built-up area pressure index (BUAPI) assesses the surface covered by constructions per km^2 in a given area for the year 2020.
Area of interest	The BUAPI has been calculated for each country, each ecoregion, each terrestrial protected area and the terrestrial parts of each coastal protected area. We further computed the indicators for the 10 km unprotected buffer zone around protected areas. BUAPI is reported in DOPA Explorer for each terrestrial and coastal protected area of size ≥ 1 km^2 and their unprotected buffers.

Related targets

Sustainable Development Goal 14 on life below water

Sustainable Development Goal 15 on life on land

Aichi Biodiversity Target 11 on protected areas

Aichi Biodiversity Target 12 on species

Policy question

How much potential impact may humans living in a protected area have on that protected area and on the habitats, species and ecological processes therein? How much land is lost to constructed areas? How fast is this impact increasing over time? By identifying protected areas with high percentages of built-up areas, it is possible to highlight locations that are most threatened by human activities. Built-up areas can also contribute to the assessment of physical barriers for species dispersion.

Use and interpretation

There are several reasons why a high population density inside a terrestrial or coastal protected area may be of concern and lead to negative outcomes for the conservation of the habitats, species and ecological processes therein (see e.g. Mcdonald *et al.*, 2009; Güneralp & Seto, 2013). To assess such pressure, in addition to information on road density (see Factsheet H2), on population density and population change (see Factsheet H3) and on land-cover change (see Factsheet G1) inside protected areas, the DOPA further provides estimates on built-up areas and their increase over the time period 1975-2020. The information is computed using the Global Human Settlement Layer which is derived from spatial-temporal interpolation of observed collections of multiple-sensor, multiple-platform satellite imageries: Landsat (MSS, TM, ETM sensor) and Sentinel-2 (S2) image composite (GHS-composite-S2 R2020A) . It provides therefore a more detailed picture than the one proposed by the land cover

maps. The evolution of built-up areas is an important indicator of the level of land consumption and of the potential fragmentation of our environment.
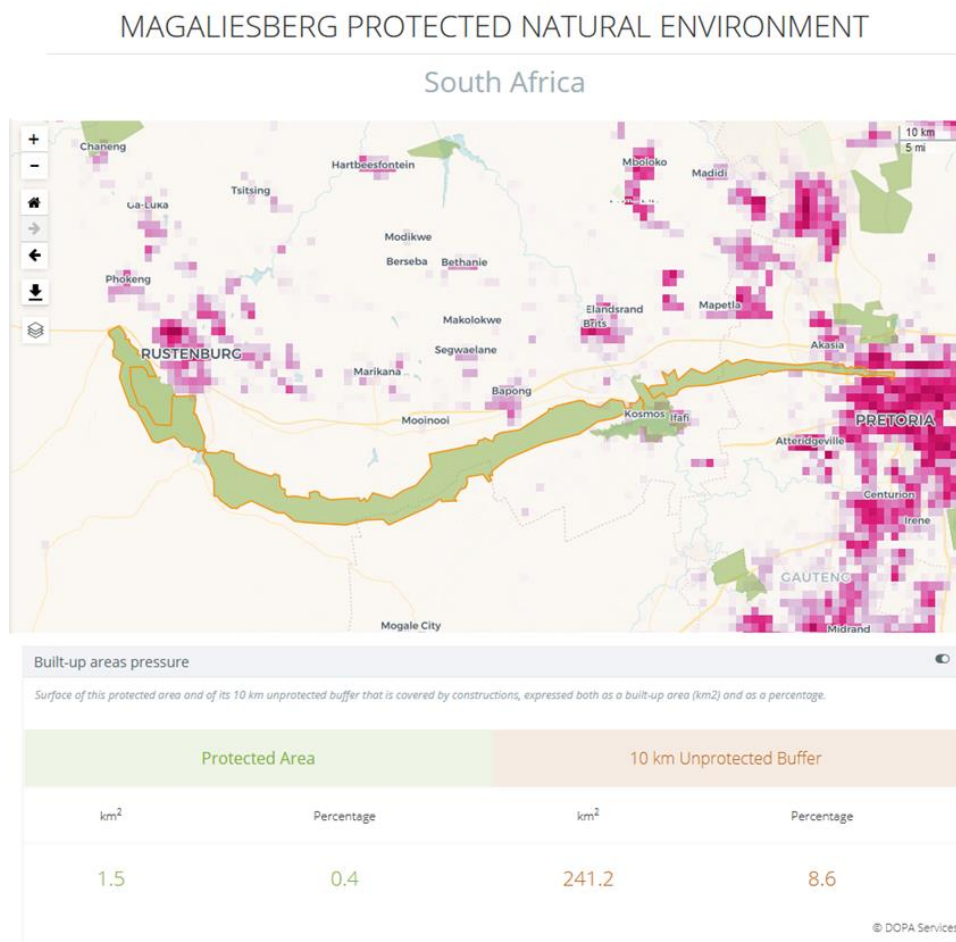
Figure 1. Map of the Magaliesberg Biosphere Reserve (RSA) with current built-up areas

Key caveats

- Built areas are derived from earth observations and associated uncertainties and accuracy will vary in space and time. Clouds are often obstructing observations in tropical regions and coastal areas, and vary a lot from year to year.

- There is little imagery that is freely available for 1975 and information obtained for this year should be interpreted with great care.

- While the information can be used as a proxy to assess the potential impact of human activities on the marine environment in coastal areas, the information from the GHSL covers most of the global terrestrial surface and might be missing smaller isolated islands.

We refer to Pesaresi *et al.*, (2015), Pesaresi *et al.* (2023) and Freire *et al.* (2016) for more details regarding the use of the product.

Indicator status   Published in De la Fuente B. *et al.*, (2020)

Available data and resources

Data available   BUAPI values are available for each terrestrial and coastal protected area of size ≥ 1 km^2 and its associated 10 km unprotected buffer zone. The values and can also be compared at country and ecoregion levels, on the DOPA Explorer website: http://dopa-explorer.jrc.ec.europa.eu/dopa_explorer/.

Data updates   Planned with each update of DOPA.

Codes   Standard GIS operation applied to raster data.

Methodology

Methodology   The GHS-BUILT-S data contain a multi-temporal information layer on the distribution of built-up surfaces, expressed as number of square metres, derived from multiple collections of Landsat and Sentinel-2 images. Provided with a resolution of 100 m, the GHS-BUILT-S data were overlaid with the boundaries of countries, ecoregions and protected areas to calculate the absolute (km^2) and relative surface (%) of the area covered by the built-up areas. UNESCO Biosphere Reserves were discarded as well as protected areas with known areas but undefined boundaries.

Input datasets   The indicator uses the following input datasets:

Protected Areas
● WDPA of February 2023 (UNEP-WCMC & IUCN, 2023).

   o   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.

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

● Exclusive Economic Zones (EEZ) v9 (2016-10-21)

   o   Latest version available from:
        http://www.marineregions.org/downloads.php

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

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

Global Human Settlements
- GHS built-up surface (R2023) for the years 1975, 1990, 2000, 2005, 2010, 2015 and 2020.

    - Available from:
    https://ghsl.jrc.ec.europa.eu/download.php?ds=bu

References

De la Fuente B. *et al.*, (2020). Built-up areas within and around protected areas: Global patterns and 40-year trends. In: *Global Ecology and Conservation*, Volume 24, 2020, e01291, ISSN 2351-9894. https://doi.org/10.1016/j.gecco.2020.e01291. (http://www.sciencedirect.com/science/article/pii/S2351989420308325)

European Commission, GHSL Data Package 2023, Publications Office of the European Union, Luxembourg, 2023, doi:10.2760/098587, JRC133256

Freire S., *et al.* (2016). Development of new open and free multi-temporal global population grids at 250m resolution. In: *Proc. of the 19th AGILE Conference on Geographic Information Science*. June 14-17, Helsinki, Finland, 2016. [Download]

Güneralp, B. & K. C. Seto (2013). Futures of global urban expansion: Uncertainties and implications for biodiversity conservation. *Environmental Research Letters*, 8, 1, 014025. http://dx.doi.org/10.1088/1748-9326/8/1/014025

McDonald, R. I., *et al.* (2009). Urban effects, distance, and protected areas in an urbanizing world. *Landscape and Urban Planning*, 93, 1: 63-75. https://doi.org/10.1016/j.landurbplan.2009.06.002

Pesaresi, Martino; Politis, Panagiotis (2023): GHS-BUILT-S R2023A - GHS built-up surface grid, derived from Sentinel2 composite and Landsat, multitemporal (1975-2030). European Commission, Joint Research Centre (JRC) [Dataset] doi: 10.2905/9F06F36F-4B11-47EC-ABB0-4F8B7B1D72EA

Pesaresi, M., *et al.* (2015). GHS built-up grid, derived from Landsat, multitemporal (1975, 1990, 2000, 2014). European Commission, Joint Research Centre (JRC) [Dataset] PID: http://data.europa.eu/89h/jrc-ghsl-ghs_built_ldsmt_globe_r2015b.

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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Factsheet last updated

October 5, 2023

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