Land cover

Indicator name — **Land Cover and Land Cover Change statistics**

Indicator unit — Land cover (classes and change) statistics are expressed in km^2 and percentages of the area of interest.

Area of interest — The land cover classes and land cover change statistics have been generated for each country, ecoregion and terrestrial or coastal protected area of size ≥ 10 km^2.

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 are different ecosystem types, as indicated by land cover, preserved and how strong are anthropogenic changes affecting their distribution in a given area? Human pressures are constantly increasing and it is important to monitor the consequences of the associated changes on the environment, in particular inside and around protected areas to ensure that natural ecosystems and their associated species and ecosystem functions (e.g. goods and services) are preserved. By comparing land cover maps over time at the country, ecoregion and protected area level, land use changes can be identified.

Use and interpretation — Land cover is defined as the physical material at the surface of the earth, usually documented via the interpretation of earth observations. Common land cover types include trees, grass, bare ground, built up areas, water, etc.

The land cover maps used here are

1) The Copernicus Global 100m Land Cover (CGLC) map for the baseline year 2015 providing land cover data using 23 classes and with an overall accuracy of 80% (JRC, VITO & IAASA, 2019).

2) The maps from the Climate Change Initiative – Land Cover (CCI-LC) project which delivers consistent global maps at 300 m spatial resolution on an annual basis since 1992. For five epochs with an interval of 5 years (1995, 2000, 2005, 2010, 2015), we present statistics of the land cover classes using 3 aggregation levels to ease visualization of the main trends (Figure 1): the lowest aggregation level (3) corresponds to the original 22 classes. The second one (level 2) shows 14 classes and the last one (level 1) covers only 4 classes.

We also display the transitions between classes which occurred from 1995 to 2015 (Figure 2). Understanding whether grasslands or forests are converted into cropland or built up areas is essential to identify the land cover types that are most affected but also to understand the potential drivers between these changes (see e.g. Sanchez-Azofeifa *et al.*, 2003; Beresford *et al.*, 2013; Brink *et al.*, 2016). Note that the layer of the land cover change can be visualized to understand where and what types of changes occurred in the protected area.

End-users of the DOPA Explorer might sometimes detect significant differences between these statistics and those provided for the changes in surface water and/or for the changes in forest cover. These differences can be due to the use of different imagery, resolutions and methodologies. The changes reported by the specialized services on surface water and forest cover (see Factsheets G2 and G3, respectively) should be preferred over those derived from the global land cover maps discussed here.

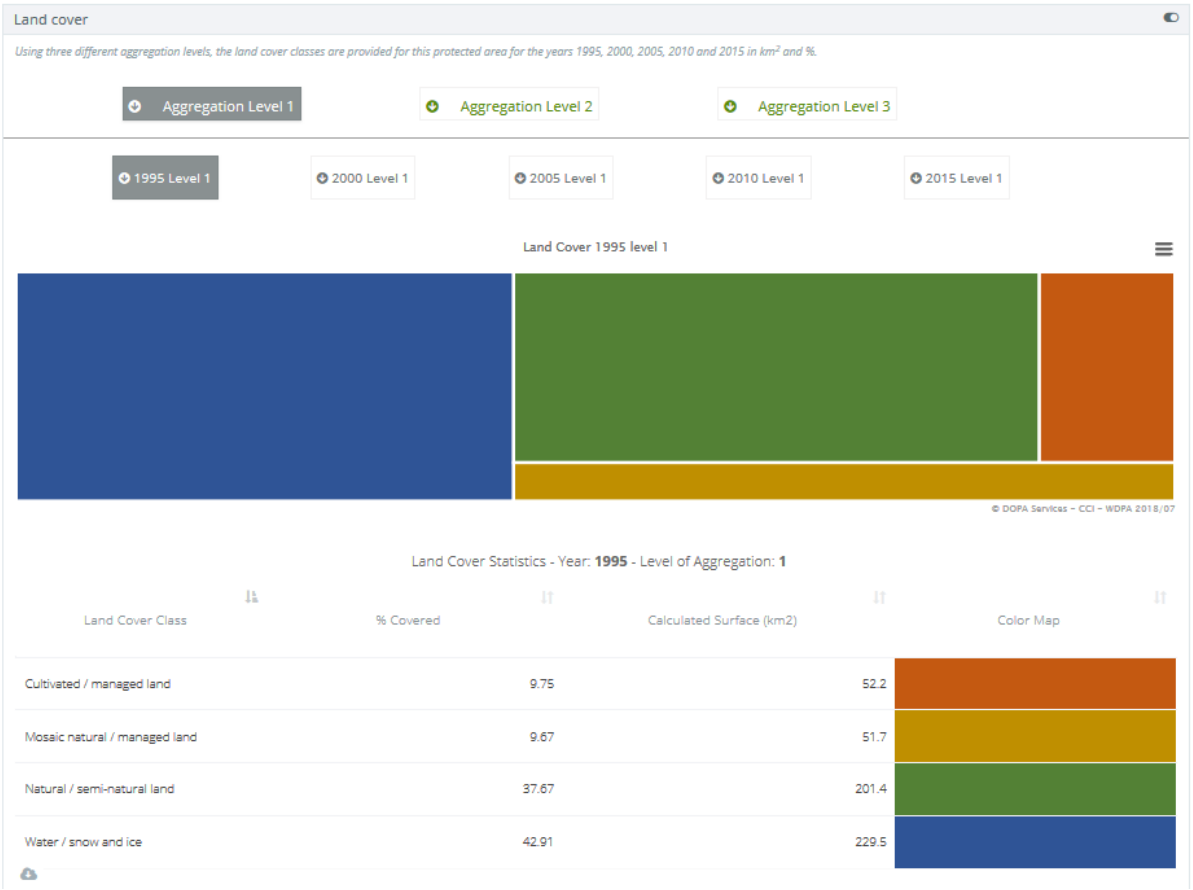

Figure 1. Land cover statistics for aggregation level 1 (4 classes only) for the year 1995 for the Doñana National Park, Spain.

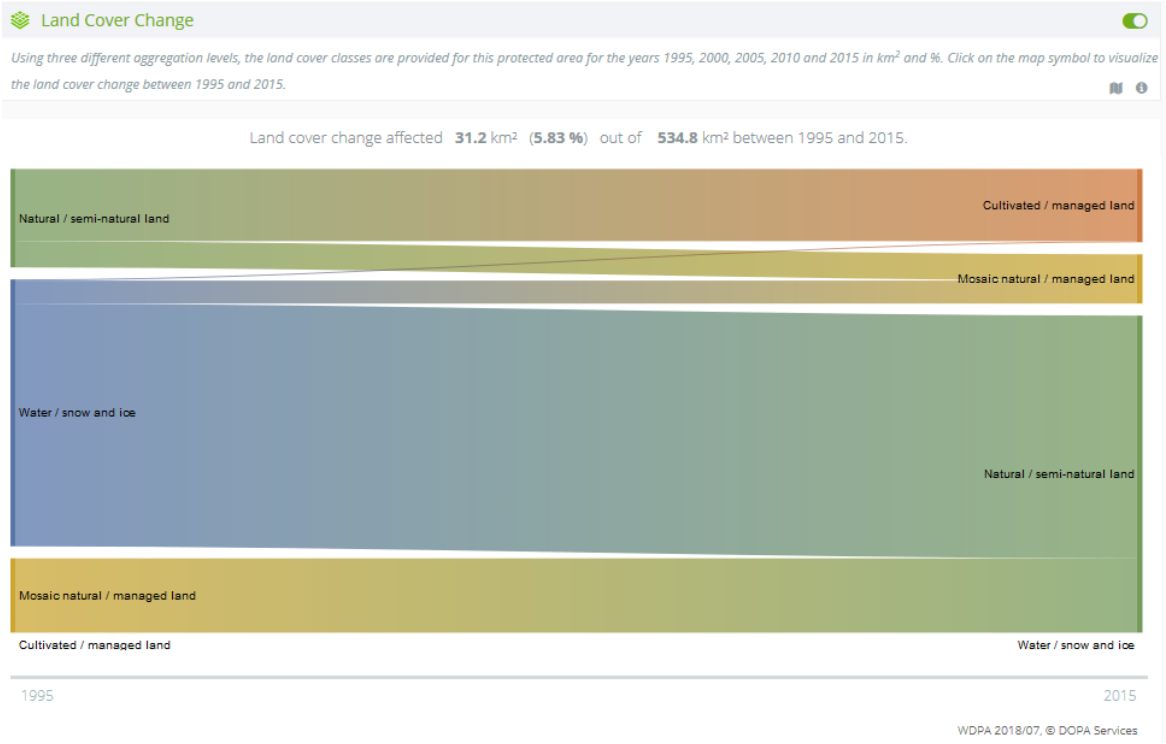

Figure 2. Transitions between different land cover classes (for the aggregation level 1) over the period 1995-2015 for the Doñana National Park, Spain.

Key caveats

Since land cover data are derived from earth observations, uncertainties and accuracy in the land cover classification varies in space and time. Clouds are often obstructing observations in tropical regions and coastal areas, and vary a lot from year to year. Because land cover change affecting areas smaller than 1 km^2 will remain unnoticed, only, change statistics for small protected areas will have to be interpreted with more caution. Different sensors have also been used over time and the older yearly land cover maps are less reliable than the most recent ones. Still, because we use a time interval of 20 years, the main trends in land cover change are expected to be captured, especially if changes occur clearly between the aggregated classes. We refer to the documentation of the land cover CCI product (Land Cover CCI, 2017) for a detailed discussion about the main limitations of the product.

Because all the above indicated statistics are computed within the boundaries for each protected area ≥ 10 km^2, these will be affected by the accuracy of the park boundaries.

Indicator status

Published in peer reviewed papers and technical reports (see References).

Available data and resources

Data available

Land cover statistics are available for the years 1995, 2000, 2005, 2010 and 2015 at 300 m resolution and all protected area at least as large as 10 km^2 in the DOPA Explorer using three different levels of aggregation. Statistics regarding the

transitions between classes from 1995 to 2015 are provided graphically only for each protected area at least as large as 10 km^2, each country and ecoregion. See http://dopa-explorer.jrc.ec.europa.eu/dopa_explorer/

Data updates Planned with each update of DOPA.

Codes The processing of the land cover statistics has been done using GRASS. More details are provided in the Documentation section of the DOPA web site, see http://dopa.jrc.ec.europa.eu/

Methodology

Methodology Each land cover map has been used and overlaid by countries, ecoregions and all protected areas of size ≥ 10 km^2 provided by the UNEP-WCMC and IUCN (2019). UNESCO Biosphere Reserves have been discarded as well as protected areas recorded only as points. The sum of the different land cover classes were computed for each area and for each year. This operation has been performed for three levels of aggregation (4, 14 and 22 land cover classes) corresponding to an increased level of detail. The aggregation rules are given in our technical documentation.

For the time series, each pixel of 300 m within the protected area, the country and the ecoregion, the land cover type has been stored for the years 1995 and 2015 to allow the detection of changes between classes from the same product over these years.

Input datasets The computed statistics have been produced using the following input datasets:

Protected Areas

- WDPA of May 2019 (UNEP-WCMC & IUCN, 2019).
    - Latest version available from: www.protectedplanet.net

Land Cover

- JRC - VITO - IIASA Copernicus Global 100m Land Cover map for the year 2015 (JRC, VITO & IAASA, 2019)
    - Latest version available from: https://land.copernicus.eu/global/products/lc
- 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

References

Beresford, A. E., *et al.* (2013). Protection reduces loss of natural land-cover at sites of conservation importance across Africa. *PLoS ONE, 8*: e65370. https://dx.doi.org/10.1371/journal.pone.0065370

Brink, A., *et al.* (2016). Indicators for assessing habitat values, pressures and threats for protected areas – an integrated habitat and land cover change

approach for the Udzungwa Mountains National Park in Tanzania. *Remote Sensing*, 8(10), 862. http://dx.doi.org/10.3390/rs8100862

JRC, VITO & IIASA (2019). Copernicus Global Land Operations "Vegetation and Energy", Product User Manual, Moderate Dynamic Land Cover 100m, version 2. https://land.copernicus.eu/global/sites/cgls.vito.be/files/products/CGLOPS1_PUM_LC100_V2_I2.10.pdf

Land Cover CCI (2017). Product User Guide Version 2.0 http://maps.elie.ucl.ac.be/CCI/viewer/download/ESACCI-LC-Ph2-PUGv2_2.0.pdf.

Sanchez-Azofeifa, G. A., *et al.* (2003). Integrity and isolation of Costa Rica's national parks and biological reserves: Examining the dynamics of land-cover change. *Biological Conservation*, 109: 123-135. https://doi.org/10.1016/S0006-3207(02)00145-3

UNEP-WCMC & IUCN (2019). Protected Planet: The World Database on Protected Areas (WDPA) [On-line], [May/2019], Cambridge, UK: UNEP-WCMC and IUCN. www.protectedplanet.net

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