Mountain Green Cover Index (SDG Indicator 15.4.2)

Metadata and methodological information

Concepts and Definitions

The "Mountain Green Cover Index" (MGCI) measures changes of the green vegetation in mountain areas - i.e. forest, shrubs, trees, pasture land, crop land, etc. – to provide indications on the status of conservation of their environment.

This index contributes to the achievement of SDG Goal 15:

"Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss"

and more specifically to Target 15.4:

"By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development".

The index is under the custodian of the Food and Agriculture Organization of the United Nation (FAO) through the Mountain Partnership Secretariat.

The Mountain Partnership (www.fao.org/mountain-partnership/en/) is a United Nations voluntary alliance that brings members together to work towards a common goal: improving the lives of mountain peoples and protecting mountain environments around the world. Launched as a voluntary United Nations (type 2) partnership by Italy, Switzerland, FAO and the United Nations Environment Programme (UNEP) in Johannesburg in 2002, the Mountain Partnership has over 300 members from governments, intergovernmental organizations, civil society and the private sector. Its work is supported by a Secretariat hosted at FAO.

The scientific mountain community recognizes that – with a few exceptions, such as the one produced by climate change at high altitudes and latitudes and in zones covered by glaciers - there is a direct correlation between the green coverage of mountain areas and mountain ecosystems' state of health, which also relates to mountains' capacity to fulfil their ecosystem roles.

In this context, the objective of the Mountain Green Cover Index is to monitor changes in mountain vegetation and to provide information on forests and woody / vegetal cover in general. It aims at addressing the need for more detailed information about the status of mountain ecosystems at global and regional levels since there is a serious lack of those disaggregated data required for monitoring and analysing environmental trends on mountain areas.

Methodology

The Mountain Green Cover Index results from the interpretation of remote sensing images used for deriving land cover/land use patterns of the world's mountain areas. Data is analyzed using the FAO Collect Earth software application developed by FAO and Google (consult the site http://www.openforis.org/tools/collect-earth.html for more details) while mountains are defined in accordance with the UNEP-WCMC mountain classification (Kapos et al. 2000).

This classification indicates six elevation classes of mountains according to the following scheme:
- Class 1: elevation ≥ 4 500 m
- Class 2: elevation 3 500–4 500 m
- Class 3: elevation 2 500–3 500 m
- Class 4: elevation 1 500–2 500 m and slope ≥ 2°
- Class 5: elevation 1 000–1 500 m and slope ≥ 5° or LER (Local Elevation Range in the radius of 7 kilometers) > 300 m
- Class 6: elevation 300–1 000 m and LER (Local Elevation Range in the radius of 7 kilometers) > 300 m

The classification adopted for interpreting satellite data in land cover/use classes follows the guidelines on consistent la representation of the Intergovernmental Panel on Climate Change (IPCC) and forest land has been defined following the definition of the FAO Global Forest Resources Assessments (FRA).

The IPCC defines six main land use classes:
(http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_03_Ch3_Representation.pdf)

1 - Forest land - This category includes all land with woody vegetation consistent with thresholds used to define Forest Land in the national greenhouse gas inventory. It also includes systems with a vegetation structure that currently fall below, but in situ could potentially reach the threshold values used by a country to define the Forest Land category.

2 - Cropland - This category includes cropped land, including rice fields, and agro-forestry systems where the vegetation structure falls below the thresholds used for the Forest Land category.

3 - Grassland/Shrubland - This category includes rangelands and pasture land that are not considered Cropland. It also includes systems with woody vegetation and other non-grass vegetation such as herbs and brushes that fall below the threshold values used in the Forest Land category. The category also includes all grassland from wild lands to recreational areas as well as agricultural and silvi-pastural systems, consistent with national definitions.

4 - Wetlands - This category includes areas of peat extraction and land that is covered or saturated by water for all or part of the year (e.g., peatlands) and that does not fall into the Forest Land, Cropland, Grassland or Settlements categories. It includes reservoirs as a managed sub-division and natural rivers and lakes as unmanaged sub-divisions.

5 - Settlements - This category includes all developed land, including transportation infrastructure and human settlements of any size, unless they are already included under other categories. This should be consistent with national definitions.

6 - Other Land - This category includes bare soil, rock, ice, and all land areas that do not fall into any of the other five categories. It allows the total of identified land areas to match the national area, where data are available. If data are available, countries are encouraged to classify unmanaged lands by the above land-use categories (e.g., into Unmanaged Forest Land, Unmanaged Grassland, and Unmanaged Wetlands). This will improve transparency and enhance the ability to track land-use conversions from specific types of unmanaged lands into the categories above.

A global sampling design based on a stratified systematic grid was adopted to generate land use/cover estimates. The sampling design was developed by the Global Forest Survey (GFS) and it has been used also to assess the extent of forest in Drylands. It includes a total number of 476 329 plots of 0.5 hectare in a grid with an average space of 16 km. This data frame is designed to suit global level analyses of the land use and land cover with a sampling error at global level equal or below ± 1% that raise at ± 2% at continental scale. Circa 120 000 plots follow in mountain areas[1] and they have been used for estimating the Mountain Green Cover Index.
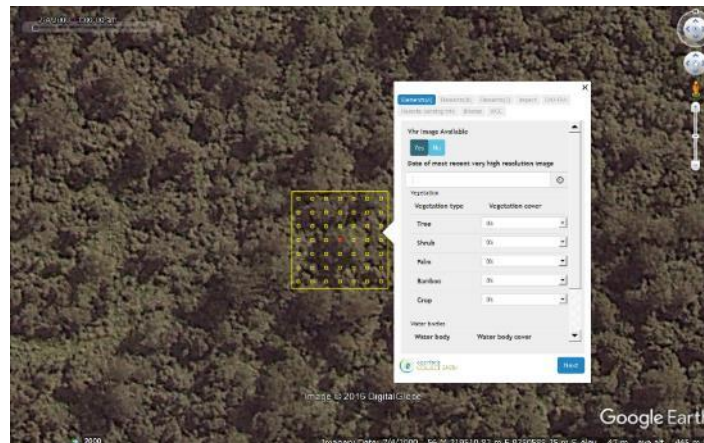
A Collect Earth sample point

The image interpretation process makes use of high and very-high resolution imagery and historical trends in vegetation available from the year 2000 to the year 2015 through Google Earth and Google Earth Engine. It is expected that the accuracy of the Mountain Green Cover Index will improve over time as more countries may expand and intensify the sampling frame within their territory. The land use/cover estimates will be shared with the responsible entities of each country for validation.

Each plot is classified according to the dominant land use, according to the following predominant land use hierarchy:

1) Settlement, if >= 20%
2) Cropland, if >= 20% and Settlement < 20%
3) Forest, if >= 20% and Settlement or Cropland < 20%
4) Grassland, if >= 20% and Settlement or Cropland or Forest < 20%
5) Wetland, if >= 20% and Settlement or Cropland or Forest or Grassland < 20%
6) Other land, if >= 80% and Settlement, Cropland, Forest, Grassland and Wetland < 20%

Besides the dominant land use, the percentage of each IPCC land use class is also reported to cover the entire sample area. The extensions of the area covered by the different land uses are calculated multiplying the number of plots classified per each land use class for their specific area expansion factors.

The estimates of the Mountain Green Cover Index take in consideration the distribution of forest, grassland and cropland classes as per the formula indicated below:

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[1] Mountain areas defined in accordance with the UNEP-WMCM mountain classification (Kapos et al. 2000).

Mountain Green Cover Index = (Area cover by Cropland + Area cover by Forest + Area cover by Grassland) / total mountain area

The index has a range from 0 to 1, where 0 indicates no green vegetation and 1 indicates that the entire area is covered by vegetation.

The amounts of land in square kilometers covered by each of these three IPCC land cover/land use classes are aggregated to calculate the size of the total mountain area that they cover.

The Mountain Green Cover Index statistics are available at country level, disaggregated by IPCC land cover types and mountain elevation classes – both as absolute figures and percentage values.

Methodological References

Open Foris and Collect Earth: http://www.openforis.org/tools/collect-earth.html

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