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# Supporting the calculation of SDG indicators using GEO and EO data at the German Federal Agency of Cartography and Geodesy

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In September 2015, the Agenda 2030 for Sustainable Development, including the Sustainable Development Goals (SDGs), were adopted by the heads of State and Government during the United Nations Sustainable Development Summit in New York. The SDGs consist of 17 goals, subdivided into 169 targets facing major social and environmental challenges over the next 15 years. 232 quantitative indicators are used to assess and measure the progress of the project.

In Germany, the Federal Agency of Cartography and Geodesy (BKG) is performing a number of feasibility studies on calculation of selected SDG indicators in cooperation with the Federal Statistical Office of Germany. These include the indicators 11.7.1 (Average share of the built-up area), 15.1.1 (Forest area as a percentage of total land), and the “Mountain Green Cover Index” 15.4.2. These studies are part of the BKG research projects Cop4SDGs (verification and monitoring of the SDGs using Copernicus data) and Laverdi, a project developing a land cover change detection web service for Germany.

Germany is publishing a national report on the SDG indicators available for Germany annually. Since 2019 the BKG has been responsible for the calculation of the SDG indicator 15.4.2. This indicator expresses the relationship of the vegetation-covered mountain landscapes to the entire mountain landscape of Germany. The calculated value is used to assess the achievement of goal 15 of the 2030 Agenda, and more specifically assesses the conservation of mountain ecosystems, including their biodiversity. According to the definition of the custodian agency FAO, trees, meadows, shrubs and agricultural fields belong to the considered vegetation types. The vegetation-covered mountain areas are classified according to their elevation, inclination and mountain class. Remote sensing images, like Sentinel 1 and 2 are used as well as own geospatial products for terrain elevation (DGM-DE) and land cover of Germany (LBM-DE). Filtering according to mountain classes shows that 0.19% of Germany is covered by mountainous landscapes. The selected land cover classes of the LBM-DE will be blended with the mountain landscapes. The result shows that 0.96% of the mountains in Germany are covered with vegetation.

Following the metadata of the custodian agency UN-Habitat for the indicator 11.7.1 the calculation workflow starts with selecting land cover objects that have a degree of soil sealing of more than 25%. These objects are transformed into a 10m grid (Sentinel-2 resolution). For these pixels, a spatial analysis is performed. The pixels are classified according to their density in a circle with 1km radius into urban, suburban, and rural. Later, urban and suburban became an urban cluster. To derive the indicator value, it is necessary to determine the "total surface of open public space" and the "total surface of land allocated to streets" to form their total area. When using the LBM-DE, the two classes can be raised together in one step. This is done by selecting the objects based on the land cover. For the feasibility study area (approximately 6000km$^2$) the share of the built-up area of the city that is open space in public use is 9.42%.