Report to the Inter-agency and Expert Group on Sustainable Development Goal Indicators
Ninth meeting
25 – 28 March 2019, Beirut, Lebanon

This report from the Working Group on Geospatial Information (WGGI) to the ninth meeting of the IAEG-SDGs comprises two parts. The first is for discussion and decision by the IAEG-SDG. The second part contains is additional and relevant information about the work of the WGGI related to geospatial information and geographic location for the IAEG-SDGs.

For IAEG-SDGs' discussion and decision

The IAEG-SDGs report to the 50th session of the Statistical Commission, regarding the WGGI "expressed the concern that the Expert Group was not sufficiently connected to the work of the working group and that there must be an increase in interaction with the statistical community. The recommendation to include a few of the members of the Group (the same representatives as those in the working group) was welcomed and accepted by the working group."[1]

At its third meeting in Mexico, from 30 March – 1 April 2016, the IAEG-SDGs established the working group, which provides a progress report to each of the IAEG-SDGs formal meetings held on a biannual basis. Presently the working group is composed of nine[2] experts representing Member States from the IAEG-SDGs, and a further eight experts[3] representing Member States active in UN-GGIM. There are five members[4] who represent International Organizations. Of these total 22 members, only one of the IAEG-SDGs membership is also a member of the (the same representative). Noting the working group has been in existence for three years and progress to date, the co-Chairs together with the Secretariat are of the opinion that the objectives and remaining tasks of the working group would be better served by a refreshed group of members that will increase its "*interaction with the statistical community*" and "*provide expertise and advice to the IAEG-SDGs and the larger statistical community*"[5].

The recommendation is to have an open call for membership for a three-year period (2019 – 2022) from amongst those who are able and willing to contribute to advance the objectives and task of the working group, beginning with the –

(a) members of the Inter-agency and expert group on sustainable development goal indicators; then
(b) members of High-level Group for partnership, coordination and capacity building for statistics for the 2030 Agenda for Sustainable Development;
(c) representatives of International organizations who have considerable experience in the work of the group;

and to ensure broad expertise and effectiveness, from the wider geospatial information and earth observations communities drawn from

(d) the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM), GWG-Big Data, EG-Integration of Statistical and Geospatial Information and Group on Earth Observations;

as provided for in the WGGI terms of reference.

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1 Report of the Inter-agency and Expert Group on Sustainable Development Goal Indicators to the 50th session of Statistical Commission (https://unstats.un.org/unsd/statcom/50th-session/documents/2019-2-IAEG-SDG-E.pdf)
2 Botswana, Brazil, Canada, Colombia, France, Germany, Mexico, The Netherlands and Sweden
3 Chile, China, Denmark, Germany, Italy, Qatar, Senegal, Trinidad and Tobago and United Kingdom
4 UN-Habitat, WHO, EuroStat, GEO – EO4SDGs and OECD
5 Terms of Reference of the Working Group on Geospatial Information of the IAEG-SDGs (http://ggim.un.org/documents/ToR%20WG%20on%20Geospatial%20Information%20Final.pdf)

For IAEG-SDGs' Information

1. A Review of the First 3 Years of the Working Group on Geospatial Information

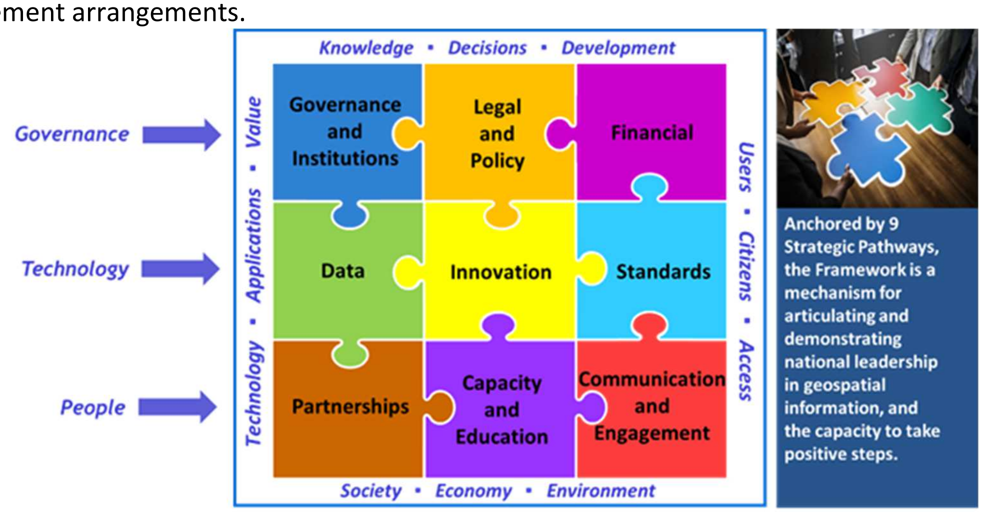
The paper, prepared by the co-Chairs and the Secretariat, reviews the first 3 years of the working group, including the background, impetus, genesis, objective and tasks of working group, its progress over the past three years and to address the concern that the IAEG-SDGs was not sufficiently connected to the work of the working group. The IAEG-SDGs and the larger statistical community needs to understand the relevance of geospatial information, and what the working group is doing.

The paper reflects on how the working group continues to best give guidance and clearly articulate the essential value-add to the SDGs and global indicators from the geospatial information and Earth observations community to the IAEG-SDGs and the larger statistical community. Geospatial data and "disaggregation by geographic location" is desperately needed. But we still have difficulty in not only describing where the data is, but also what is its composition, how do countries use it? How do we articulate, in the production of indicators, the role of geospatial information, Earth observations and other data in national case studies and best practices, including for disaggregation by geographic location? What are the principles and guides? What are the data supply chain requirements and solutions for certain indicators? Our knowledge, experience and expertise need to be harnessed. It was observed that the working group is getting into too much detail before articulating the key messages to the IAEG-SDGs according to the needs of their evolving agenda – and requirements from Member States.

The review paper is attached to this written report.

2. Developing geospatial capacity in countries

The United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM), at its eighth session in August 2018 adopted the Integrated Geospatial Information Framework (E/2018/46, Decision 8/113) that provide a basis, a reference and a mechanism for Member States when developing and strengthening their national and sub-national arrangements in geospatial information management and related infrastructures. The Framework aims to translate concepts to practical implementation guidance for use by Member States and does this by leveraging **seven (7) underpinning principles, eight (8) goals and nine (9) strategic pathways** as a means for governments to establish more effective geospatial information management arrangements.



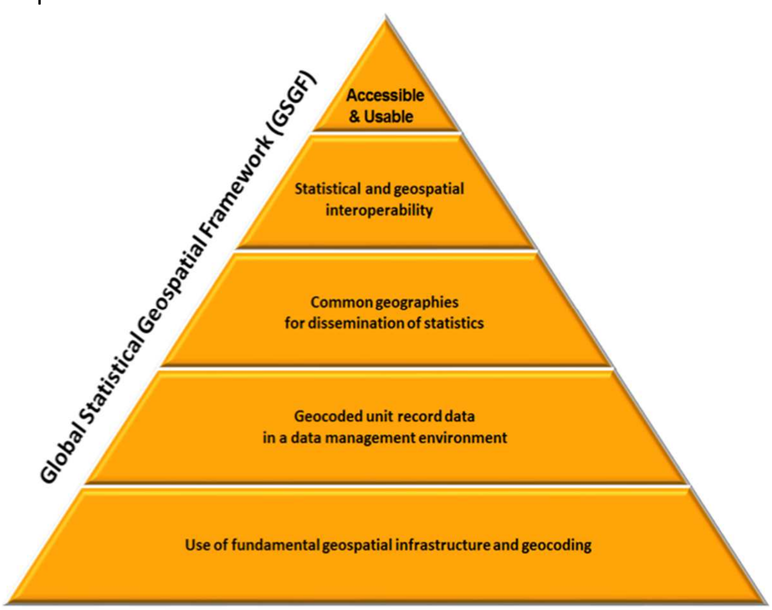
The objective of the **nine strategic pathways** is to guide governments towards implementing integrated geospatial information in a way that will deliver a vision for sustainable social, economic and environmental development.

Relevance for the IAEG-SDGs and the larger statistical community:
The Integrated Geospatial Information Framework is important for developing and strengthening the necessary geospatial capacity in countries, especially developing countries, thus allowing national statistical offices (NSOs) to produce more SDG indicators relying on geospatial information through strategic partnerships with geospatial agencies.

More information on the Integrated Geospatial Information Framework can be found here [http://ggim.un.org/meetings/GGIM-committee/8th-Session/documents/Part%201-IGIF-Overarching-Strategic-Framework-24July2018.pdf].

3. Global Statistical Geospatial Framework

The linking of data about people, businesses and events or occurrences to a place or geographic location, and its integration with geospatial information through the medium of location, can result in a fuller understanding of social, environmental and economic and issues; much greater than is possible if viewing statistical or geospatial information in isolation. The Global Statistical Geospatial Framework provides the underlying mechanism to achieve this integration, a common method for geospatially enabling statistical and administrative data that ensures data from across a range of sources can be integrated based on location, as well as ensuring that these data can be integrated with other geospatial information. This will enable new, better and more integrated information for analysis and decision-making processes including the production of indicators; comparisons within and between countries; increased information at smaller geographies; and generally, more efficient production of information.



The Framework as a principles-based framework provides broad processes to take input data (statistical, administrative and other data) and apply a range of statistical and geospatial processes and infrastructures to enable it for integration.

Relevance for the IAEG-SDGs and the larger statistical community:
The framework provides an important guide for NSOs on how to integrate statistical and geospatial information, enabling production of statistics on urban/rural geographies as well as calculation of accessibility in line with requirements in the SDG indicators.

More information on the Global Statistical Geospatial Framework can be found here [http://ggim.un.org/meetings/GGIM-committee/8th-Session/documents/Global-Statistical-Geospatial-Framework-July-2018.pdf].

4. Fifth expert meeting of the working group on geospatial information, 5 – 8 December 2018, Nairobi, Kenya

The fifth expert meeting the working group brought together 24 participants - 14 of whom are members and invited experts on the Working Group. Another ten national, regional and international experts participated as invited observers. Participants of the fifth expert meeting were joined by another 28 national, regional and international experts for the International Seminar on United Nations Global Geospatial Information Management with the theme "Geospatial Information for Sustainable Development". The meeting was hosted by the Global Urban Observatory/Data and Statistics Unit of UN-Habitat in Nairobi, Kenya. The list of participants and meeting materials can be accessed at: http://ggim.un.org/meetings/2018-WG-IAEG-SDG/ and http://ggim.un.org/meetings/2018-International-Seminar-Kenya/.

5. Paper on Global, New and Complementary Data for SDGs

The contribution of global, new and complementary data for the SDGs was identified as a cross cutting issue working group at its meeting on 12-14 December 2016 in Mexico City. Two tasks teams were formed to address the potential role and utilization of these data sources. The first task to examine globally available geospatial data with a particular focus on land cover. The second task sought to identify complementary (non-authoritative) data sources which may be used in cases where official or authoritative geospatial data may not be available. The paper summarizes the results of discussions at expert meetings of the working group through to 2018 and is structured to examine the concepts and historical development of global and complementary (non-authoritative) data and discusses the potential roles and utilization in the production of indicators. The paper can be accessed at: http://ggim.un.org/UNGGIM-wg6/.

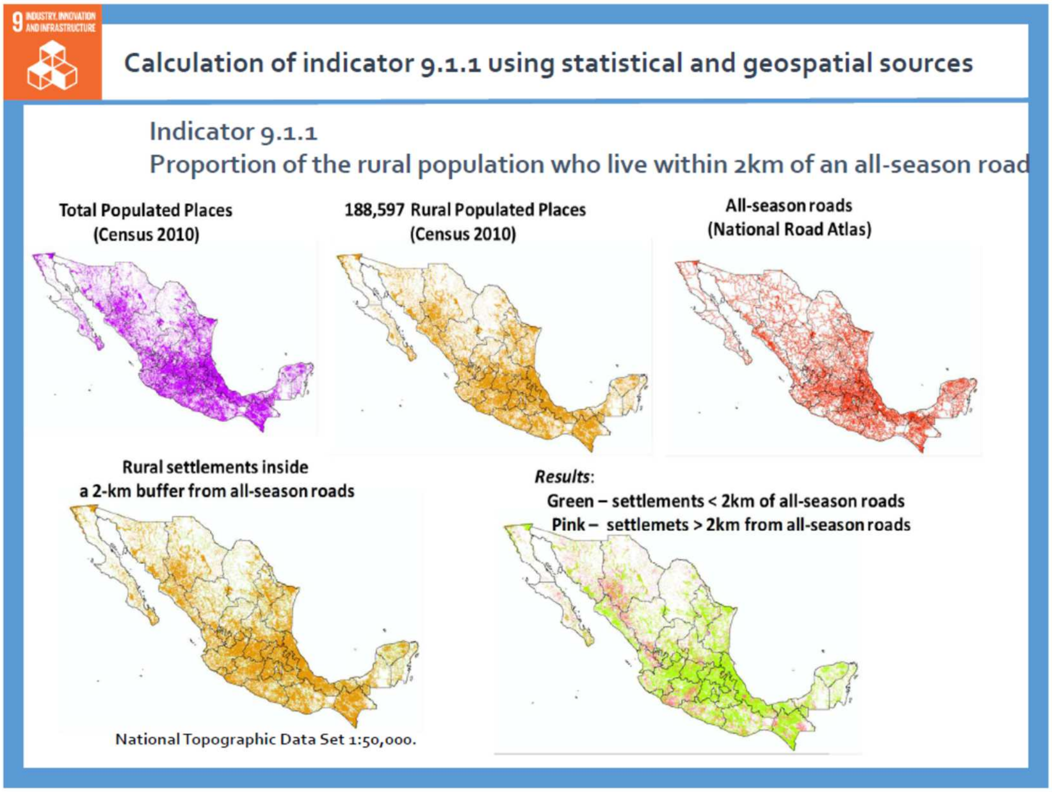
6. Paper on Land Cover Datasets for SDGs

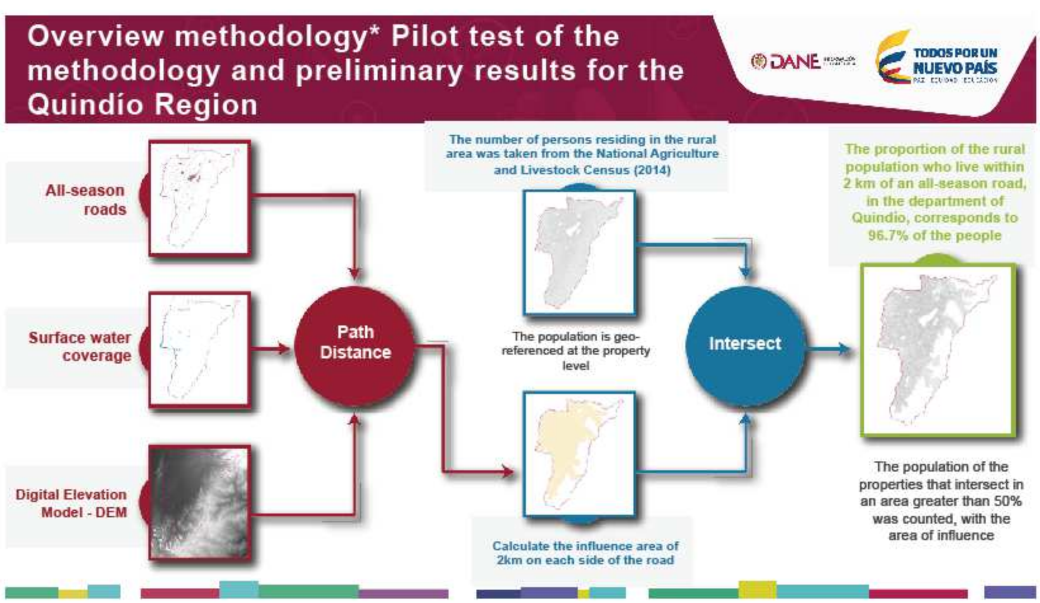
This paper intends to provide information on the earth observations contribution to the SDGs with a focus on land cover datasets. The aim will be to assess which land cover datasets and how they are proposed for use in the indicators, identify other land cover datasets which could be used as alternatives, and identify how land cover datasets might replace or complement other data types. Other geospatial datasets which are not discussed in this document are also useful for the SDGs, for example, digital elevation models, or soil maps. The paper can be accessed at: http://ggim.un.org/UNGGIM-wg6/.

Some of the currently available (free and open data) land cover datasets which may be applied to the production of indicators are listed under Appendix I. These global datasets cover a number of different timeframes and spatial resolutions, and in general, both the spatial and temporal resolution of these datasets are improving, with a number of annual or decadal 30m products being available, which provides a promising future for the use of these products for the SDGs.

Appendix I – Some outputs and outcomes from tasks of the working group

Some national pilots and approaches for the production of indicators:

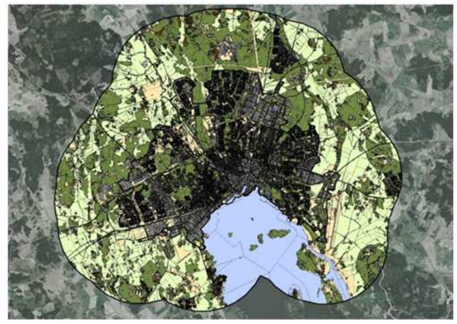




Indicator 11.7.1
Average share of the built-up area of cities that is open space for public use for all

Workflow resulting in a "Data cube"

- Geocoding population data
- Delimitation of urban agglomerations
- Creation of urban land cover data
- Post-processing of urban land cover data



The result is a "data cube", which holds information about each spatial object in three thematic layers:

- land cover (green space and impervious land)
- land use (airports, quarries or other restricted areas etc)
- fiscal information on ownership and type of real property (private vs public ownership and housing, industry, business etc)

From the Paper on Global, New and Complementary Data for SDGs

Topographic maps contain most of the fundamental data themes and provide information about various features on the land surface. Besides topographic mapping activities Digital Elevation Model (DEM) datasets have been collected at a global scale with the help of satellite-based sensors (see Table 1). The Shuttle Radar Topography Mission (SRTM) produced the first Global DEMs with 30m to 90m spatial resolution and 10-15m vertical accuracy. Data was collected from the space shuttle Endeavour in 2000 and covers latitudes 56°S to 60°N. ASTER GDEM, World DEM and ALOS World 3D are the other Global DEM datasets which have since become freely available or commercially available at cost.

Table 1: Global DEM data sets available for SDGs

Product	Spacing	Vertical accuracy	Year	Remarks
SRTM	30m/90m	10–15 m	2000	Generated by Shuttle IfSAR, and covering 56°N to 60°
ASTER GDEM	30m	7–14 m	2009-2011	Generated by ASTER and gaps filled with SRTM
World DEM	12m	2m (rel) 4m (abs)	2014	Generated by TanDEM-X; DSM and DTM commercially available at cost
ALOS World 3D	30m	5 m	2016	Generated by ALOS PRISM; freely available and based on 5 m global DEM which is available commercially at cost

Satellite-based observation dataset is another main source of geospatial information providing data in many differing formats, spatial and temporal resolutions. Many of the datasets resulting from these satellites are openly available through the GEOSS Common Infrastructure (GCI: http://www.geoportal.org/) coordinated under the auspices of GEO. While many commercial satellites of very high spatial resolution may not be the obvious source of information for developing countries due to their associated high costs, in recent times high resolution satellite time series imagery have been freely available, such as Landsat and Sentinel. Major obstacles for the use of such freely available satellite data however, are often the insufficient spatial resolution (for certain applications or information requirements) and the necessity to process and interpret data before the generation of useable information. Coupled with capacity-related challenges (both human and systems) limits the utilization of such datasets for information extraction, and in turn for the SDGs.

For example, the new generation Sentinel satellites with its broad variety of spectral bands and relatively high revisit rates (e.g. 5 days by optical Sentinel-2) offer a rich archive to be explored over the coming years. With research and development activities, assessing new methods and approaches of multi-temporal and sensor-fusion approaches, a better interpretation and extraction of SDG-relevant related information can be achieved through specific application services and products. The concept of providing Analysis Ready Data (ARD) is being developed where satellite data are processed to a minimum set of requirements and organized into a form that allows immediate uptake with minimum additional user effort.

Table 2: Some examples of freely available satellite data which may be useful for SDGs

Satellite	Spatial resolution	Mission objectives	Potential application
Sentinel 1	• Strip Map Mode: 80 km swath, 5 x 5 m spatial resolution • Interferometric Wide Swath: 250 km swath, 5 x 20 m spatial resolution • Extra-Wide Swath Mode: 400 km swath, 20 x 40 m spatial resolution • Wave-Mode: 20 x 20 km, 5 x 5 m spatial resolution.	• Land monitoring of forests, water, soil and agriculture • Emergency mapping support in the event of natural disasters • Marine monitoring of the maritime environment • Sea ice observations and iceberg monitoring • Production of high-resolution ice charts • Forecasting ice conditions at sea • Mapping oil spills • Sea vessel detection • Climate change monitoring.	• SDG-2: Agriculture • SDG-6: Water • SDG 11: human settlements monitoring • SDG-15: Forest, Biodiversity, Land degradation
Sentinel 2	• 13 spectral bands: four bands at 10 m, six bands at 20 m and three bands at 60 m spatial resolution. The orbital swath width is 290 km.	• Monitoring agriculture, forests, land-use change, land-cover change; mapping biophysical variables such as leaf chlorophyll content, leaf water content, leaf area index; monitoring coastal and inland waters; risk mapping and disaster mapping	• SDG-2: Agriculture • SDG-6: Water • SDG 11: human settlements monitoring • SDG-15: Forest, Biodiversity, Land degradation
Landsat 7/8	• 15 meters/30 meters/100 meters (panchromatic/multispectral/thermal)	• Provide data continuity with previous Landsat missions • Offer 16-day repeat coverage of the Earth's surface • Build and periodically refresh a global archive of sunlit, substantially cloud free, land area and coastal images • Make data widely and freely available. As of 2008, Landsat data with standard processing are available at no cost through digital access • Support Government, international, and commercial communities • Play a vital role in NASA's EOS by promoting interdisciplinary research via synergism with other EOS observations. (In particular, by orbiting in tandem with NASA's Terra satellite to obtain near coincident observations.)[6]	• SDG-6: Water • SDG 11: human settlements monitoring (and multi-temporal comparisons) • SDG-15: Forest, Biodiversity, Land degradation

[6] https://landsat.usgs.gov/landsat-7-data-users-handbook-section-1

From the Paper on Land Cover Datasets for SDGs

Some of the currently available (free and open data) global land cover datasets

Product	Spatial resolution	Temporal coverage	Contents/overall reported accuracy	Notes	Source
Global forest change	30 m	Annual (2000-) for forest area and losses	Forest canopy cover %, gains, losses/ unknown		University of Maryland https://earthenginepartners.appspot.com/science-2013-global-forest/download_v1.5.html
Landsat Tree Cover Continuous Fields	30 m	2000	Percentage cover/ unknown	No updates scheduled	Global Land Cover Facility, University of Maryland http://glcf.umd.edu/data/landsatTreecover/
Landsat Forest Cover Change	30 m	Annual (2000-)	Forest)/ unknown	No updates scheduled	Global Land Cover Facility, University of Maryland http://glcf.umd.edu/data/landsatFCC/
Forest and non-forest global map	25 m	Every year 1993-1998, 2007-2010, 2015-2016	Two classes (forest/non-forest)/ 84% accuracy /L-band SAR		Earth Observation Research Center Japan Aerospace Exploration Agency http://www.eorc.jaxa.jp/ALOS/en/palsar_fnf/fnf_index.htm
Intact Forest Landscapes	30 m	2000, 2013, 2016	Intact forest / unknown		http://www.intactforests.org/world.map.html
Copernicus land service: dynamic land cover (Copernicus Land)	100 m	Annual (2015-)	10 classes / 74% (2015)	Currently only available for Africa, but global version is expected[7]	Copernicus Global Land Service https://land.copernicus.eu/global/products/lc
ESA Land Cover CCI (CCI-LC)	300 m -1 km	1992-2015 (annual)	22 classes/ 74% (2008-2012)		European Space Agency http://maps.elie.ucl.ac.be/CCI/viewer/download.php
MODIS Land Cover	500 m	2001-2012 (annual)	17 classes/75% (2005)	No updates scheduled	University of Maryland http://glcf.umd.edu/data/lc/
GlobeLand30	30 m	2000, 2010	10 classes/ 80.3%		National Geomatics Center of China http://www.globeLand30.com
Global Land Cover – SHARE (GLC-SHARE)	~1 km (30 arc-seconds)	Variable	11 classes/80.2%	Only one time – step (combines best available national, regional, subnation	FAO http://www.fao.org/land-water/land/land-governance/land-resources-planning-toolbox/category/details/en/c/1036355/

[7] http://www.iiasa.ac.at/web/home/research/researchPrograms/EcosystemsServicesandManagement/C-Glops.html

Product	Spatial resolution	Temporal coverage	Contents/overall reported accuracy	Notes	Source
				al databases)	
Global Urban Footprint (GUF)	12 m	2010-2013	3 classes: urban fabric, non-built up land surface, water / unknown		German Aerospace Center (DLR) https://www.dlr.de/eoc/en/desktopdefault.aspx/tabid-9628/16557_read-40454/
Global Human Settlement Layer (GHSL) – built up	38 m	1975, 1990, 2000, 2014	Scale from 0-98 / Confidence map about built up presence, and supporting data mask are available		Joint Research Center (JRC) of the EU https://ghsl.jrc.ec.europa.eu/ghs_bu.php and https://ghsl.jrc.ec.europa.eu/ghs_bu_qual.php
Global Human Settlement Layer (GHSL) – population grids*	250 m	1975, 1990, 2000, 2014	Number of people per cell / unknown		Joint Research Center (JRC) of the EU https://ghsl.jrc.ec.europa.eu/ghs_pop.php
Global Human Settlement Layer (GHSL) – settlement model	1 km	1975, 1990, 2000, 2014	Rural, Urban Cluster, Urban Centre/ unknown		Joint Research Center (JRC) of the EC https://ghsl.jrc.ec.europa.eu/ghs_smod.php
Atlas of Urban Expansion	Not wall to wall (200 cities). 30 m	3-time steps: C.1990, C. 2000 C. 2014	Urban extent: Urban built up, Suburban Built-up, Rural Built-up, Urbanized Open Space; Exurban Area: Exurban Built-Up Area, Exurban Open Space; Rural Open Space / For urban areas, user's accuracy 91%, producer's accuracy 89.3%		NYU Urban Expansion Program http://www.atlasofurbanexpansion.org/
Global Surface Water: Water Occurrence	30 m	Covers time frame 1984-2015	0-100% / unknown		Joint Research Center (JRC) of the EC https://global-surface-water.appspot.com/
Global Surface Water: Water Occurrence Change Intensity	30 m	Covers time frame 1984-2015	High – low / unknown		Joint Research Center (JRC) of the EC https://global-surface-water.appspot.com/
Global Surface Water: Water Seasonality	30 m	2014-15	1-12 / unknown		Joint Research Center (JRC) of the EC https://global-surface-water.appspot.com/
Global Surface Water: Annual Water Recurrence	30 m	Covers time frame 1984-2015	0-100% / unknown		Joint Research Center (JRC) of the EC https://global-surface-water.appspot.com/
Global Surface Water: Water Transition (First Year to Last Year)	30 m	Covers time frame 1984-2015	Permanent, New Permanent, Lost Permanent, Seasonal, New Seasonal, Lost Seasonal, Seasonal to Permanent, Permanent to		Joint Research Center (JRC) of the EC https://global-surface-water.appspot.com/

Product	Spatial resolution	Temporal coverage	Contents/overall reported accuracy	Notes	Source
			Seasonal, Ephemeral Permanent, Ephemeral Seasonal / unknown		
Global Surface Water: Maximum Water Extent	30 m	Covers time frame 1984-2015	One class / unknown		Joint Research Center (JRC) of the EC https://global-surface-water.appspot.com/
Copernicus land service: water bodies	300 m / 1 km	Every 10 days	Sea / water / no water Variable / unknown quality		Copernicus Global Land Service https://land.copernicus.eu/global/products/wb
Global Inundation Extent from Multi-Satellites (GIEMS) Average yearly minimum inundation	15 arc-seconds (approximately 500 meters at the equator)	Covers time frame 1993-2004	1 class / unknown	Data available on request	McGill University http://www.estellus.fr/index.php?static13/giems-d15
Global Inundation Extent from Multi-Satellites (GIEMS) Average yearly maximum inundation	15 arc-seconds (approximately 500 meters at the equator)	Covers time frame 1993-2004	1 class / unknown	Data available on request	McGill University http://www.estellus.fr/index.php?static13/giems-d15
Global Inundation Extent from Multi-Satellites (GIEMS) Long term maximum inundation	15 arc-seconds (approximately 500 meters at the equator)	Covers time frame 1993-2004	1 class / unknown	Data available on request	McGill University http://www.estellus.fr/index.php?static13/giems-d15
Global Mangrove Watch	Approx. 30 m	2010 (1996, 2007, 2008, 2009, 2010, 2015 and 2016 are expected shortly	1 class / 94%	New time frames expected early 2019	Aberystwyth University and solo Earth Observation https://www.globalmangrovewatch.org/
Global Reservoir and Dam (GRanD) Database	Unknown	Unknown	Unknown	Website currently not working	Center for development Research (ZEF), University of Bonn http://www.gwsp.org/products/grand-database.html

*This is not strictly a land use/cover product but is part of a set of others which are.