Geospatial Information and Earth Observations: Supporting Official Statistics in Monitoring the SDGs

UNSC Statistical-Geospatial Integration Forum
United Nations • 7 March 2016

Session III. Geospatial and Earth Observations Data as Inputs to the Indicators

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Earth Observations & Geospatial Information

Space-based Satellites
Airborne
Ground-based
In Situ
Some Types of Earth Observations . . .

- Land Temperature
- Sea Surface Temperature
- Vegetation
- Sea Surface Salinity
- Total Rainfall
- Aerosols
- Fires & Thermal Anomalies
- Chlorophyll
- Sea Surface Height
What Can We See With Satellites …

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- Sea Surface Temperature
- Vegetation
- Sea Surface Salinity
- Total Rainfall
- Aerosols
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- Fires & Thermal Anomalies
- Sea Surface Height

Some Types of Earth Observations . . .

Environmental factors for malaria transmission
Some Types of Earth Observations . . .

- Land Temperature
- Sea Surface Temperature
- Vegetation
- Sea Surface Salinity
- Total Rainfall
- Aerosols
- Chlorophyll
- Fires & Thermal Anomalies
- Sea Surface Height
- Environmental factors for fisheries management
Target 15.1
By 2020 ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands...

Indicator 15.1.1
Forest area as a percentage of total land area

Forest Area from Earth-observing Environmental Satellites

2013 Tree Cover

Credit: Matthew C. Hansen, Univ. Maryland, et al.
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Forest area as a percentage of total land area

Forests in Contiguous USA:
29% of land area (2011)

Forest Cover ≡
Trees greater than 16 feet tall and make up greater than 20 percent of the total vegetation cover.

Data Source:
U.S. National Land Cover Dataset based on Landsat satellites.

US: http://www.globalchange.gov/browse/indicators/indicator-forest-cover

Credit: NLCD
Target 15.1
By 2020 ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands...

Indicator 15.1.1
Forest area as a percentage of total land area

Vietnam: Forest Cover Mapping

Total annual gross forest cover loss 2001-2014: 3.2 million ha.

Credit: Matthew C. Hansen, Univ. Maryland, et al.
Target 15.1
By 2020 ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands...

Indicator 15.1.1
Forest area as a percentage of total land area

Gross Forest Cover Change: 2000-2014

Credit: M. Hansen, UMd, et al.
Indicator 11.6.2
Annual mean levels of fine particulate matter (i.e. PM2.5 and PM10) in cities (population weighted)

Target 11.6
By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.

Air Quality: Annual Average PM2.5 Grids

Background image: Data from 2010.

Data Source:
Aerosol Optical Depth from MISR and MODIS sensors on Terra & Aqua satellites.

Source:
CIESIN Columbia University.

http://dx.doi.org/10.7927/H4H41PB4

http://dx.doi.org/10.1088/1748-9326/9/8/084013.
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Air Quality: Annual Average PM2.5 Grids

Background image:
Data from 2010.

Circled values:
Two-year (2012-2014) country-specific values based on average population-weighted exposure.

Data Source:
Aerosol Optical Depth from MISR and MODIS sensors on Terra & Aqua satellites.

Source: CIESIN Columbia University.
Indicator 3.9.1:
Population in urban areas exposed to outdoor air pollution levels above WHO guideline values

Approach/Data Sources:
US Census: Urban Areas in US (1:2000); Global gridded population dataset; Global population distribution at subnational level.

NASA: EPA AIRNow point-based air quality network; MERRA aerosol reanalysis.

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

Approach/Data Sources:
US Census: Vector data for infrastructure and public land ownership (1:2000); parcel data and municipal sources for open space definitions.

NASA: Landsat-based mapping of land cover for urban areas and open space.

Indicator 15.3.1:
Percentage of land that is degraded over total land area.

Approach/Data Sources:
US Census: Gridded population distribution (100m grid) Demobase for Sub-Saharan Africa, others.

NASA: Vegetation rigor from satellites (1981-present); 50cm satellite imagery; NASA GMAO reanalysis precipitation.
Indicator 3.9.1: Population in urban areas exposed to outdoor air pollution levels above WHO guideline values

Approach & Data Sources:

**US Census**: Urban Areas in US (1:2000); Global gridded population dataset; Global population distribution at subnational level.

**NASA**: EPA AIRNow point-based air quality network; MERRA aerosol reanalysis; Satellites.
Earth Observations and Geospatial Information

Support to SDGs

Direct measures of some Indicators and indirect support to others.

Contribute to progress on the Targets, which will show up in the Indicators.
**Taking it to scale . . .**

**Next Steps**

Work with statistical agencies to ensure the methods are sound for use with Indicators and Targets.

Ensure the methods and solutions are available for all to use.

Support countries and stakeholders to use the methods and build capacity.
Taking it to scale . . .

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other organizations
NASA offers hands-on training courses to build skills in accessing and using Earth observations data through computer-based sessions for professionals. We will design ones specific to SDG topics and audiences.

- Webinars
- Introductory
- In person
- Advanced

Air Quality
Water Resources
Flooding
Ecosystems
Drought
Land Management
Conservation
Health (new in 2016)
Others TBD

2015: 11 Trainings with 2,877 Participants, 123 Countries and 1,021 Organizations
Training: Earth Observations & SDGs

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Which topics does UNSC suggest for 2016-2017?

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GEO Initiative 18:
Earth Observations in Service of the 2030 Agenda for Sustainable Development

Image Credit: The Economist, 2003
Session III. Geospatial and Earth Observations Data as Inputs to the Indicators
Data models that use gridded population data

Source: CIESIN Columbia University.
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Indicator 15.1.1
Forest area as a percentage of total land area

Vietnam: Forest Cover Mapping

2000 2006 2014

Credit: Matthew C. Hansen, Univ. Maryland, et al.
Target 2.c Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility.

MONITORING CROP CONDITIONS WITHIN COUNTRIES AT RISK OF FOOD INSECURITY

Crop condition map synthesizing information for all Early Warning Crop Monitor (EWCM) crops. Crop conditions over the main growing areas are based on a combination of national and regional crop analyst inputs along with Earth observation data. Crops that are in other than favourable conditions are displayed on the map with their crop symbol.

“Development planning and SDG outcomes can be visualized with maps.” (CIESIN)
Target 6.3 By 2030, improve water quality by reducing pollution, illuminating dumping and minimizing the least hazardous chemicals and materials, halving the proportion of untreated waste water and substantially increasing recycling and safe reuse globally.

**POPULATION DENSITY OVERLAID ON UNTREATED WASTEWATER LEAKING TO THE ENVIRONMENT, ETHIOPIA SUB NATIONAL**

Integrating data from Earth observations and geospatial information with national surveys to monitor the impact of untreated wastewater on the population. The map on the left shows the extent of leakage of wastewater, excreta and grey water, with areas in red denoting extensive pollution. The map on the right integrates all data and shows where there is high impact, i.e., high leakage in densely populated areas.
**Target 11.6** By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.

**MEASURING AIR QUALITY IN CITIES AND ACROSS REGIONS**

Global Annual PM2.5 Grids from MODIS, MISR and SeaWiFS Aerosol Optical Depth (AOD), 2001–2010: Asia

Measurements from satellites provide information on air quality in communities and regions. For example, this map shows baseline data on particulate matter that could be used by statistical agencies, public health organizations, and environmental protection officials to develop more in-depth indicators, for example by deploying sensor networks to efficiently generate complete national data in near real-time.

![PM2.5 Concentration Map](image)
Target 15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally.

EARTH-OBSERVING SATELLITES CAN TRACK TREE COVER EXTENT AND FOREST LOSS AND GAIN OVER TIME

The border between Malaysia and Indonesia on the island of Borneo stands out in the Landsat-based map of forest disturbance. Red pixels represent forest loss between 2000 and 2012.

“Mapping SDG-related data will improve measuring and monitoring of progress toward the SDG Indicators.”