Panel III:
Satellite Observations for the Sustainable Development Goals

Argyro Kavvada
NASA Earth Science / BAH & EO4SDG Initiative
Together, we can make the full, transformative ambition of the 2030 Agenda a reality for all.

- António Guterres

"Advocate and communicate to political decision makers the importance and impact of geospatial technologies, including Earth observations, in informing policy, and that tech savvy, flexible and open leadership is fundamental to establishing and sustaining data innovation and its associated creation, systems and services, sharing and management to support the measurement and monitoring of the SDG’s."

Mexico City Declaration from 5TH High Level Forum on UN-GGIM

Everything happens somewhere.

- Nancy Tosta
Argo floats are used to observe the ocean [image from Commonwealth Scientific and Industrial Research Organization]

The GOES-R Series—a collaborative program between NASA and NOAA.

Ground-based instruments used to observe precipitation include rain gauge tipping buckets, cylinders, and disdrometers & radar systems [top]

A sensor pod from NASA – Jet Propulsion Laboratory

Researchers with the University of Alaska-Fairbanks (UAF) use small aircraft such as the Havilland DHC-3 Otter. Credit: UAF

Space-based Satellites

Airborne

Ground-based

In Situ
How can the Earth observation community contribute toward achieving the SDGs?

- Method development
- Capacity building
- Analysis-ready data, tools, platforms
- Scalability of applications & methods
Earth Observations in Service of the 2030 Agenda (EO4SDG)

Purpose:
Organize and enable the potential of Earth observations and geospatial information within GEO to advance the 2030 Agenda and enable societal benefits through achievement of the SDGs.

Key Emphasis:
Collaborations with global statistical community, NSOs, line ministries, custodian agencies. Also, communication role in a federated approach with GEO & broader EO community.

http://eo4sdg.org

Ad-Hoc Team on Sustainable Development Goals

Purpose:
Assess, showcase and promote satellite-based Earth observation contributions for the full realization of the SDGs.

Key Emphasis:
Collaborations with GEO and global statistical community, NSOs, line ministries, custodian agencies. Also, analysis of new opportunities for satellite observations to support SDGs.

http://ceos.org/
End hunger, achieve food security and improved nutrition and promote sustainable agriculture

Condition Synthesis Maps Covering All AMIS Crops

Crop conditions and drivers are shown as of February 28. Crops that are in other than favorable conditions are displayed on the map with their crop symbol & driver.

https://cropmonitor.org/

Market Monitor:
Operational monthly bulletin for primary crop types for 49 countries
Four main crops: Rice, Wheat, Maize, Soybeans

EO Data Use
- Satellite baseline datasets - GEOGLAM Crop Calendars and Crop Masks
- Satellite observations of land - NASA & USGS (MODIS, Landsat, SMAP), ESA (Sentinel-1, Sentinel-2, Sentinel-3), CSA (Radarsat-2, RCM), JAXA (GCOM-C, ALOS-2), DLR (TerraSAR-X, TanDEM-X), CNES (Pleiades)
- In-situ & agrometeorological data sets
- Novel crowd-sourced information – GEO WIKI
Earth observations for water-related ecosystem monitoring

High quality Global Data Set on spatial extent of inland water bodies
(1984-2015, full Landsat archive, 30m, Joint Research Center supported by Google Earth Engine)

Water-related Community Portal
- Wetland-related datasets freely available
- EO best case practices & guidelines
- Portal customization for SDG 6 monitoring & reporting
Earth observations for water-related ecosystem monitoring

**Analysis of water-quality indicators (Chl-a, TSS)**
- Water Anomaly detection using Landsat (NASA-USGS) & Sentinel 2 (ESA)
- Spatial Resolution: 20-30 m
- NASA’s SeaWiFS Data Analysis System (SeaDAS)
- Forthcoming work with UN Environment & countries to build capacity for algorithm development/validation and support SDG monitoring & reporting

Concentrations of chlorophyll-a (Chl), which is the primary pigment in phytoplankton, and the total suspended solids (TSS) can be used as proxies to infer other important parameters like oxygen level, nutrients, or chemicals. Chl and TSS are both listed as parameters under SDG indicator 6.6.1.
15.3.1. Proportion of land that is degraded over total land area

- Good Practice Guidance produced by UNCCD
- National official data sources, complemented by EO.
- EO Data: Land Cover – NASA (Landsat, MODIS), USGS (Landsat), ESA (Land Cover CCI); Land Productivity Dynamics (LPD) – JRC; Soil Organic Carbon (SOC) - International Soil Reference and Information Centre
- UNCCD - GEO regional capacity building workshops & federated collaborative platforms

Out of the 113 countries that have committed to set LDN targets, 64 countries have already established a baseline.
15.3.1 – Land Degradation Monitoring Tool

- GEF-funded project.
- Focus on: Senegal, Tanzania, Uganda, Kenya
- EO Data: AVHRR, MODIS (NDVI), GOME-2 (chlorophyll fluorescence), MERRA-2 (soil moisture), Landsat 8, Sentinel 2A & 2B, 50 cm commercial satellite data
- Open source platform, qGIS, GEE
- SDG Monitoring & Reporting

*Above:* A screenshot of the Trends.Earth tool in use. Provided by Tristan Schnader, Vital Signs Senior Project Manager at CI.

**Pilot Country Workshops & Lessons Learned**
Guidelines on dataset standardization to allow for valid comparisons • Request for finer spatial res. EO, preprocessed and ready for analysis • Need for further capacity building around indicators & tools • Internet access could limit usefulness of fully online platforms
Building capacity around SDGs and EO data and tools

Past Webinar Series (June 2017)
Learning Objectives:
- Acquire satellite observations of land cover used to assess SDG indicators 15.1.1 and 15.3.1
- Develop a basic understanding of image classification and change detection

Impact
445 individuals from 79 countries, 27 U.S. (states, territories, and D.C.), and 350 organizations

“[I] hope to combine skills accessing & using this data along with higher resolution data to produce better derivative synthetic populations w/ estimated demographic attributes.” - U.S. Attendee

“It will help me create map of species distribution coupled with habitat characteristics” - Malaysian Attendee

http://arset.gsfc.nasa.gov

CAPACITY BUILDING:
Support institutions and individuals in the ideation, development, and implementation of methods, building capabilities directly with the SDG methods and more broadly with accessing and applying Earth observations.
EO4SDG

EARTH OBSERVATIONS FOR THE SUSTAINABLE DEVELOPMENT GOALS

http://eo4sdg.org
Twitter: @EO4SDG
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Thank you!
EXTRA SLIDES
Data Cubes - Application Products

- Cloud-free Mosaics
- Land Change Detection
- Water Detection
- Water Quality
- Fractional Cover
- Vegetation Anomaly
- Coastal Change
- Urbanization

Country Example: Australian, Colombian, and Swiss national Data Cubes
- Reduced data preparation burden ... uses ARD
  - Enables data interoperability
  - Efficient time series analyses
- Open source software and free access
Combining Earth observations to support informed decision-making

- Land Temperature
- Sea Surface Temperature
- Vegetation
- Sea Surface Salinity
- Total Rainfall
- Aerosols
- Fires & Thermal Anomalies
- Chlorophyll
- Sea Surface Height
### Earth Observations in Service of the 2030 Agenda

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**Key Emphasis:**
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<tr>
<th>Target</th>
<th>Goal</th>
<th>Indicator</th>
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<td>17. Partnerships for the goals</td>
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## Alignments of the Goals with types of Earth observations and geospatial information

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<th>Sustainable Development Goals</th>
<th>Population distribution</th>
<th>Cities and infrastructure mapping</th>
<th>Elevation and topography</th>
<th>Land cover and use mapping</th>
<th>Oceanographic observations</th>
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