Supporting UN Sustainable Development Goal Assessments through Satellite Earth Observations

Agriculture production in Spain Source: Sentinel 2A, Credits: ESA

CEOS-hosted meeting
(Embassy of Australia, Washington DC) - 9th March 2017

Two main EO international organisations

(Committee on Earth Observation Satellites)

(*Group on Earth Observations*)

CEOS background

- Established in **1984** under auspices of G-7 Economic Summit of Industrialized Nations: to be the **focal point for international coordination of space-related Earth Observation (EO) activities**
- **Operates through best efforts** of Members and Associates via voluntary contributions
- **60 agencies**: 32 Members (Space Agencies) and 28 Associates (UN Agencies, and other organizations)

30th CEOS Plenary in Brisbane, Nov 2016 (CSIRO Chair in 2016)

Mission and Objectives

CEOS' role is to:

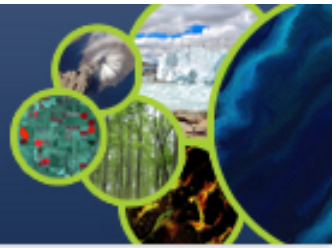
- **ensure international coordination** of civil space-based EO programs,

- **promotes exchange of data, policy and technical information** to **optimize societal benefit** and to inform decision makers

=> for securing a sustainable future for humankind

Access CEOS website here

CEOS work: ceos.org/ourwork/



5 Working Groups (WG):

to enhance technical cooperation among CEOS Agencies in specific topical areas with broad international benefit

7 Virtual Constellations (VC):

coordinated set of space and/or ground segment capabilities from different partners that focuses on observing a particular parameter or set of parameters of the Earth system

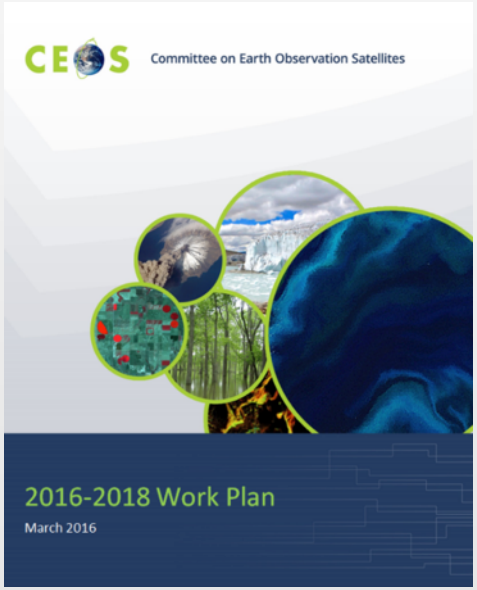
4 Ad hoc teams (AHT):

Particular activity (or temporary) – including a new one for the UN SDGs (Sustainable Development Goals) to be officially endorsed at the next Plenary (with Terms of Reference, work plan)

Thematic areas in CEOS

The main outcomes of CEOS Work Plan (3-year plan) are described for the following thematic areas:

- **Climate** Monitoring, Research, and Services
- **Carbon** Observations, Including Forested Regions
- Observations for **Agriculture**
- Observations for **Disasters**
- Observations for **Water**
- **Capacity Building**
- **Data Access, Availability and Quality**
- Advancement of the CEOS Virtual Constellations
- Support to Other Key Stakeholder Initiatives
- Outreach to Key Stakeholders
- Organizational Issues



Analysis Ready Data (ARD)

Why is ARD critical for end-users?

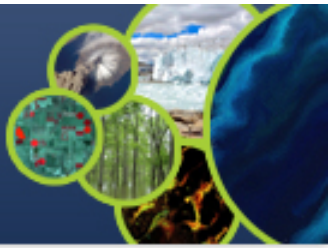
- Enable automated analysis
- Support sensor interoperability
- Less effort on preprocessing – more time to generate higher level products

CEOS definition through the LSI-VC (Land Surface Imaging – Virtual Constellation):

"ARD: satellite data that have been processed to a minimum set of requirements and organized into a form that allows immediate analysis with a minimum of additional user effort and interoperability both through time and with other datasets"

CEOS will now demonstrate the application of it (CARD4L can be downloaded from here) in support of pilot projects including the CEOS Data Cube (see Alexis's presentation)

Publications



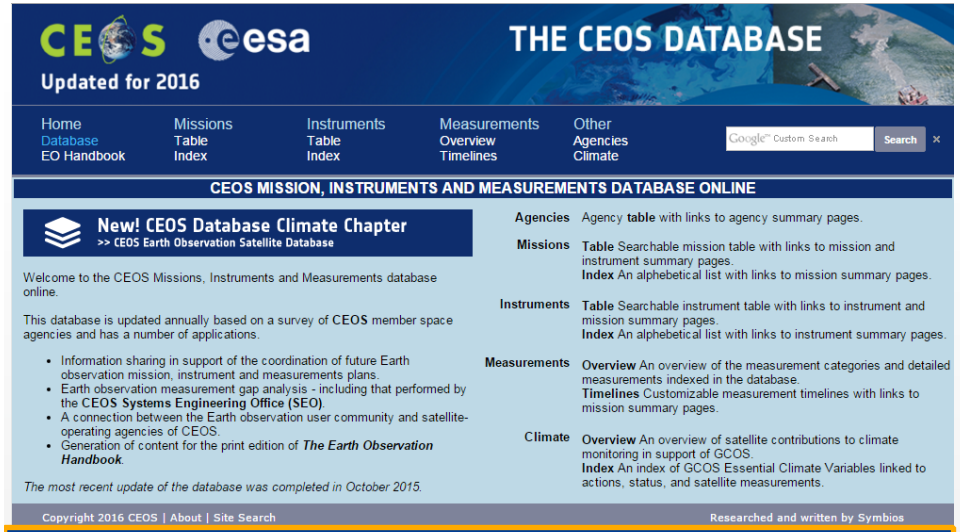
Multimedia eBooks

[Access here]

[Access here]

Highlighting the relevance and value of satellite Earth observation to topics of global significance

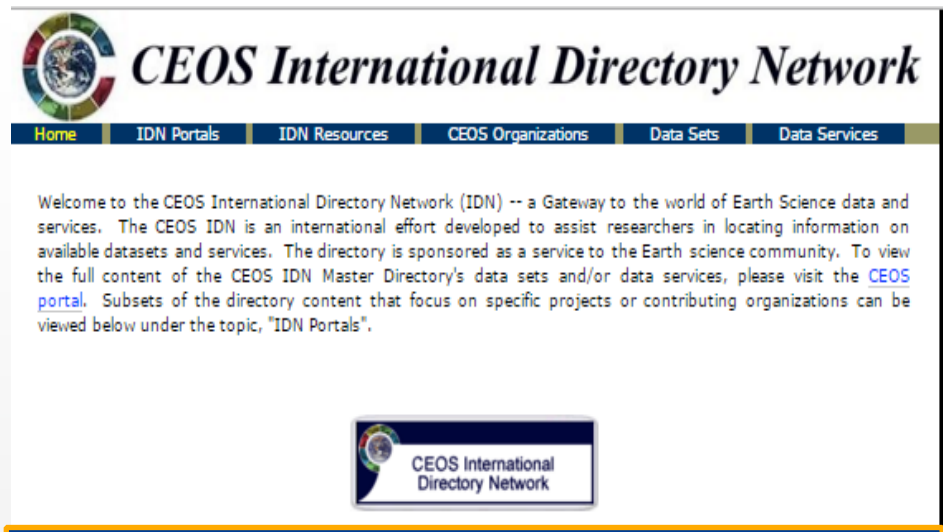
Online Resources



CEOS Database

The official source of information on CEOS satellites and sensors

Access here



CEOS IDN

Connecting you to CEOS data

Access here

CEOS and UNSDGs

CEOS actively supports the UNSDGs , via

- Creation of an **Ad hoc team** in late 2016, with objectives:
- - coordinate and communicate CEOS activities related to SDGs, including/ especially ones aligned with GEO
- - generate use cases and examples
- - provide a forum for sharing/communicating effective practices
- - analyze opportunities for satellite-based EObs to support SDGs (goals, targets, indicators, methods, metadata

CEOS communications activities

- Set up of a dedicated webpage on CEOS website: http://ceos.org/ourwork/ad-hoc-teams/sustainable-development-goals/

- **Collect applications** inputs from CEOS agencies, how they support individually the UNSDGs


CEOS Agency Support to the United Nations Sustainable Development Goal Process

At the 31st Meeting of the CEOS Strategic Implementation Team (SIT-31), CEOS emphasized its role in supporting the United Nations Sustainable Development Goals (UNSDG) process:

Decision 3: The CEOS way forward on the UNSDGs will be undertaken in conjunction with GEO & UN-GGIM, supplemented by a top-down dialogue with relevant UN Agencies and with individual CEOS Agencies making connections within their governments;

CEOS also discussed the creation of communications materials and content that could help communicate that role.

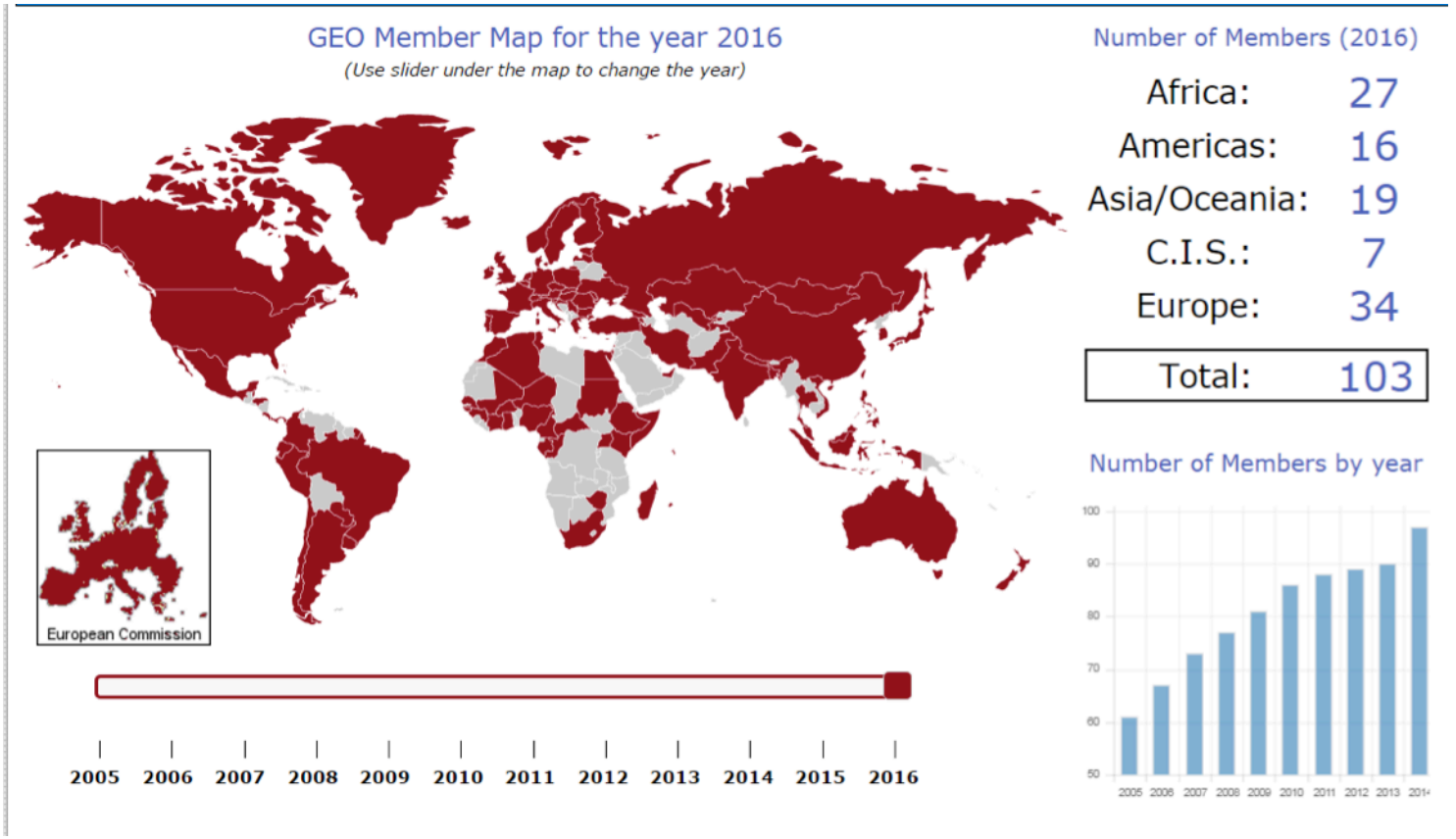
To facilitate this process, we are asking CEOS Agencies to provide a non-technical snapshot of the ways you currently are or plan to support the UNSDG process, specifically (i.e. the nature of the project(s), pertaining to which goals/targets/indicators, in what country/region, etc).

CEOS Internal Document – Prepared by CSIRO Chair, SEO, & CEO Teams – June, 2016 1

GROUP ON EARTH OBSERVATIONS

103 GEO Members (countries) in 2016

+ 95 participating organizations



GROUP ON EARTH OBSERVATIONS

CEOS, GEO and GEOSS

32 Space Agencies

28 Associates

Space Arm Of GEO

103 governments & EC

GEO

95 organizations

GEO UN SDG Side Event 10th Nov 2015, Mexico City

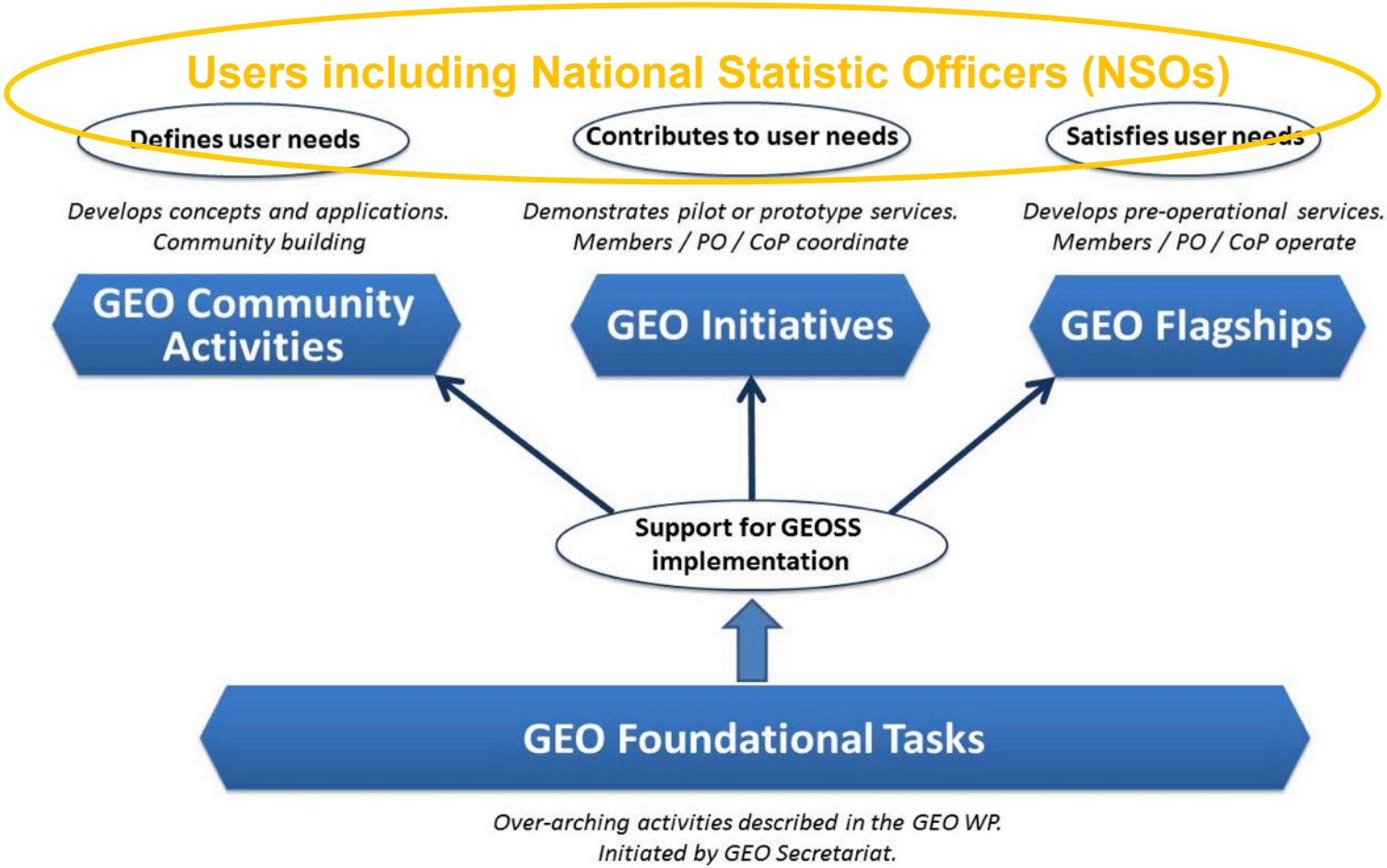
CEOS has aligned much of its resources and capacity in support of GEO's commitments to the international community, supporting a wide range of its activities, including the UNSDGs.

GROUP ON EARTH OBSERVATIONS

Societal Benefit Areas

GROUP ON EARTH OBSERVATIONS

Four types of GEO activities



CEOS/GEO and the UNSDGs

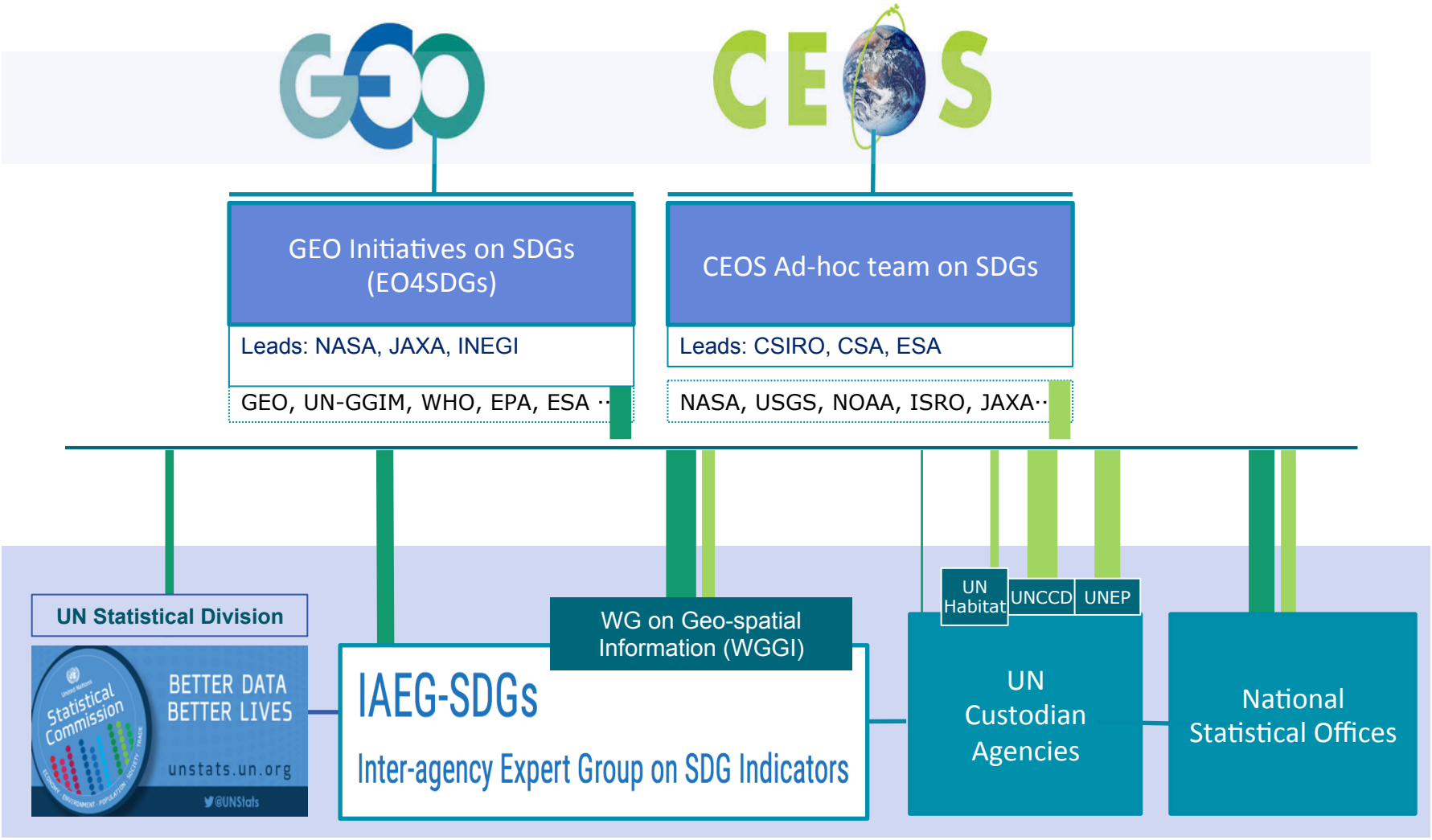
The 2030 Agenda for Sustainable Development (or 17 'SDGs', the UN Sustainable Development Goals):

a concrete application of EO data to be used by official statistics

GEO and CEOS role: to identify where EO data can be useful to monitor AND/OR help achieve UNSDGs

Target *Contribute to progress on the Target yet not the Indicator per se*								*Goal*	*Indicator* *Direct measure or indirect support*				
							1.5	1 NO POVERTY					
					2.3	2.4	2.c	2 ZERO HUNGER	2.4.1				
				3.3	3.4	3.9	3.d	3 GOOD HEALTH AND WELL-BEING	3.9.1				
								4 QUALITY EDUCATION					
								5 GENDER EQUALITY	5.9.1				
		6.3	6.4	6.5	6.6	6.a	6.b	6 CLEAN WATER AND SANITATION	6.3.2	6.4.2	6.5.1	6.6.1	
				7.2	7.3	7.a	7.b	7 AFFORDABLE AND CLEAN ENERGY	7.1.1				
							8.4	8 DECENT WORK AND ECONOMIC GROWTH					
				9.1	9.4	9.5	9.a	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	9.1.1				
								10 REDUCED INEQUALITIES					
	11.3	11.4	11.5	11.6	11.7	11.b	11.c	11 SUSTAINABLE CITIES AND COMMUNITIES	11.3.1	11.6.2	11.7.1		
					12.2	12.a	12.b	12 RESPONSIBLE CONSUMPTION AND PRODUCTION					
					13.1	13.3	13.b	13 CLIMATE ACTION	13.1.1				
	14.1	14.2	14.3	14.4	14.6	14.7	14.a	14 LIFE BELOW WATER	14.3.1				
15.1	15.2	15.3	15.4	15.5	15.7	15.8	15.9	15 LIFE ON LAND	15.1.1	15.2.1	15.3.1	15.4.1	15.4.2
								16 PEACE, JUSTICE AND STRONG INSTITUTIONS					
			17.6	17.7	17.9	17.16	17.17	17 PARTNERSHIPS FOR THE GOALS					

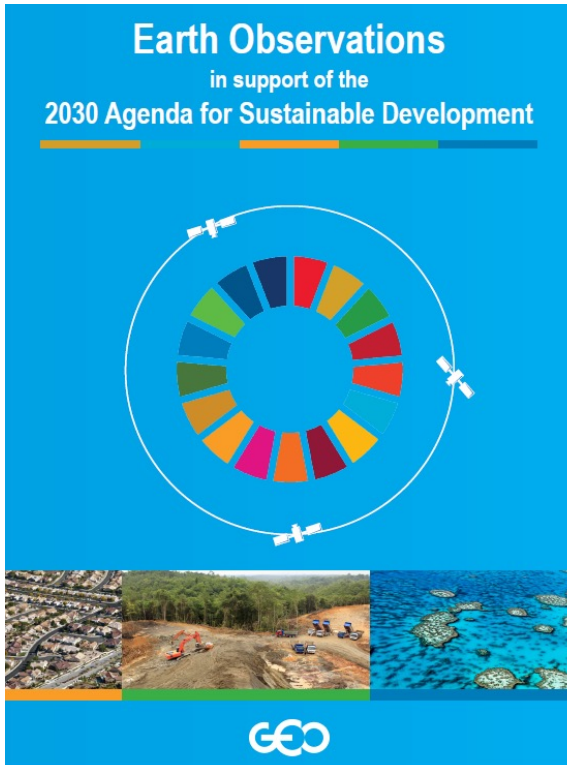
GEO/CEOS/ESA Involvement in the SDG Process



GEO and the SDGs

- **Initiative on the SDGs "Earth Observations in Service of the 2030 Agenda for Sustainable Development" (EO4SDGS):**
  - Elaborate case studies at country level to showcase the value of EO data:
    - Report distributed earlier this week in NY at the 48th UN Statistical Commission
  - Participate in the new "Working Group on Geospatial Information" (WGGI) within IAEG-SDG (Inter-Agency Expert Group on SDGs):
    - another report to be available soon
  - Explore further partnerships with SDGs (eg Data4SDGs toolbox - modules to be developed)
  - Other capacity building activities

  CEOS is a member of this initiative and actively supports it



- **Programme Board: SDGs, one of the top 3 priorities:**
  - creation of a subgroup dedicated to SDGs (new),
  - Terms of Reference being developed

EO support to SDG implementation

GROUP ON EARTH OBSERVATIONS

Global Datasets	Methodological Guidelines	Country Support	Capacity Building	EO Software Toolboxes	EO knowledge Hub & platforms

Custodian Agencies

- Access to global / regional datasets.
- in the absence of or to complement and enhance, national data sources.
- countries which face major difficulties in collecting national data

- Support custodian agencies to develop method. guidelines to countries.
- EO Best Practices.
- Scientifically sound approaches.
- Product validation.
- Show Cases.

NSOs and governments / agencies

- Targeted activities to support NSOs and ministries to report on SDG indicators.
- Support country level efforts to apply EO to track, monitor and achieve SDGs.

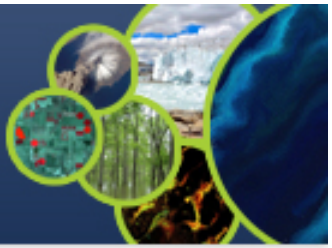
- Build capacity to exploit EO
- Training courses
- Training material on EO best practices
- Mainly in developing and emerging economies
- Critical mass of technical centers

Key Stakeholders

- Free of charge
- Open source
- Easy to use
- EO Processing Toolboxes (ESA SNAP)
- Thematic Toolboxes

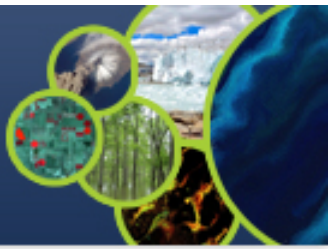
- Knowledge sharing
- Facilitate access to satellite data
- Access to global / regional datasets
- EO Best practices
- Method. guidelines
- Visualisation and Analysis tools
- On-line processing
- Toolboxes

Value of EO data for Official Statistics



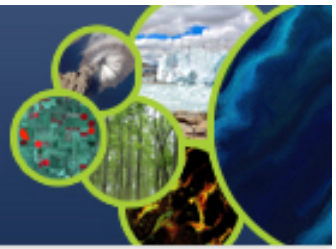
A. Significant opportunities for complementing and enhancing official statistics:

- **Several sources** of available satellite imagery data, free or commercial, from different EO satellites
- **Various measurements collected** about the land and land cover, water and atmosphere;
- **Complement traditional sources** (ground or socio-economic data) when there is a lack of data;
- **Provide spatially and temporally denser information** (on multiple scales, up to global);
- Improve **frequency** or **richness** of data;
- **Save money** on traditional methods (survey methods can be time-consuming and expensive);
- Allow **consistent and comparable measurements** across different countries and regions



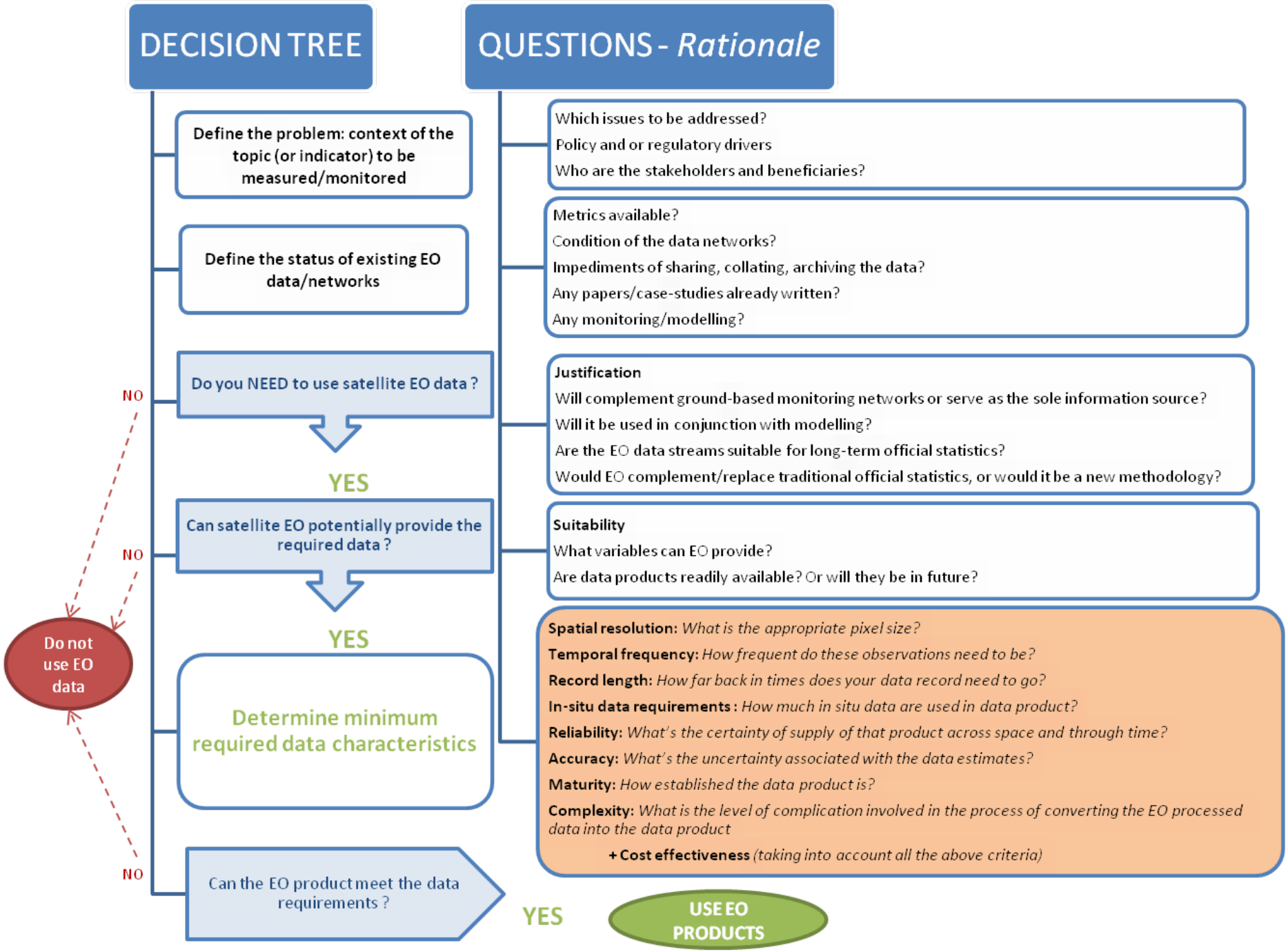
B. Still, a few challenges …

- **Large and complex** data: necessary expertise, infrastructure and internet bandwidth;
- New statistical **methods** to be implemented;
- Capacity Building: NSOs to develop the **capacity to select, access, process and apply the required data sources;**
- **Data continuity** (long-term investment in countries frameworks);
- Only **spatial, spectral, and temporal information** which can be then related to indicators;
  - Identify the **best algorithmic approach** and **statistical applications** that are most suited to the use of EO data,
  - Criteria: organisational **benefits**, methods' **feasibility**, and **cost** savings probability

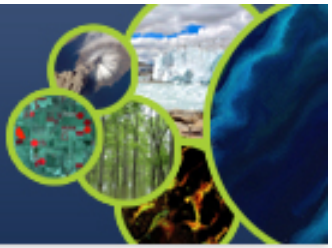


How to determine minimum EO data requirements ?

Justification	*Do you need to use EO?*
Suitability	*Can EO provide the required data products?*
Spatial resolution	*What is the appropriate size of pixel?*
Temporal frequency	*How frequent do these EO need to be done?*
Record length	*How far back in time does your data record to go?*
Reliability	*Do you need guaranteed continuation of data supply into the future?*
Accuracy	*What degree of accuracy is needed in the data product?*
Maturity	*Do you want to use only data products that common in use?*
Complexity	*What data management and analysis capacity is available?*


DECISION TREE
QUESTIONS - Rationale
Define the problem: context of the topic (or indicator) to be measured/monitored
Which issues to be addressed?
Policy and or regulatory drivers
Who are the stakeholders and beneficiaries?
Define the status of existing EO data/networks
Metrics available?
Condition of the data networks?
Impediments of sharing, collating, archiving the data?
Any papers/case-studies already written?
Any monitoring/modelling?
Do you NEED to use satellite EO data ?
NO
YES
Justification
Will complement ground-based monitoring networks or serve as the sole information source?
Will it be used in conjunction with modelling?
Are the EO data streams suitable for long-term official statistics?
Would EO complement/replace traditional official statistics, or would it be a new methodology?
Can satellite EO potentially provide the required data ?
NO
YES
Suitability
What variables can EO provide?
Are data products readily available? Or will they be in future?
Do not use EO data
Determine minimum required data characteristics
Spatial resolution: What is the appropriate pixel size?
Temporal frequency: How frequent do these observations need to be?
Record length: How far back in times does your data record need to go?
In-situ data requirements : How much in situ data are used in data product?
Reliability: What's the certainty of supply of that product across space and through time?
Accuracy: What's the uncertainty associated with the data estimates?
Maturity: How established the data product is?
Complexity: What is the level of complication involved in the process of converting the EO processed data into the data product
+ Cost effectiveness (taking into account all the above criteria)
NO
Can the EO product meet the data requirements ?
YES
USE EO PRODUCTS

Global rising interest in the UNSDGs



Opportunity for space agencies and official statistics to work together

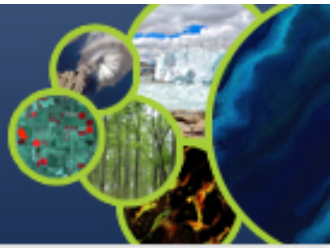
- CEOS and GEO strongly support the UNSDGs
- Increased engagement of UN Agencies to develop specific ‘indicators’ and monitoring guidelines (under UN Statistics) – eg CSIRO/UNCCD
- A few CEOS Space & technical agencies being approached by their NSOs for advice to use EO in SDGs monitoring (Australia, South Africa, Japan, European countries…)

Australian Bureau of Statistics

Statistics South Africa

eurostat

Other international WG or initiatives using EO data



1. United Nations system

IAEG-SDGs: Inter-agency Expert Group on SDG Indicators (http://unstats.un.org/sdgs/iaeg-sdgs/)

WGGI (sub-group of IAEG-SDGs): Working Group of Geospatial Information

UN-GGIM: United Nations United Nations Committee of experts on Global Geospatial Information Management (http://ggim.un.org/)

2. Other global initiatives (GEO)

GEOGLAM: Group on Earth Observations Global Agricultural Monitoring Initiative (geoglam.org)

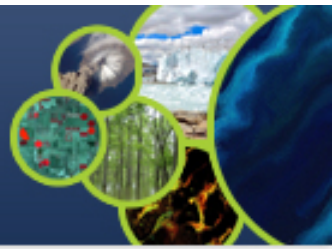
GEOGLAM RAPP: a CSIRO-led initiative on Global Rangelands and Pasture Productivity (geo-rapp.org)

GEO DARMA: addressing priorities of the Sendai Framework for Disaster Risk Reduction 2015-2030 using Earth observations (https://www.earthobservations.org/activity.php?id=49)

GFOI: Global Forest Observations Initiative (www.gfoi.org)

AquaWatch: the GEO Water Quality Community of Practice (http://www.geo-water-quality.org/aquawatch_3

Other emerging working groups to collaborate with



1. IAEG-SDGs: Inter-agency Expert Group on SDG Indicators

Created by the UN Statistical Commission

- Organizations are encouraged to talk to **relevant Agencies**, the **"SDG indicators' custodian agencies"** as identified in the document of the IAEG-SDG from their 3rd meeting: **"Provisional Proposed Tiers for Global SDG"**: http://unstats.un.org/sdgs/files/meetings/iaeg-sdgs-meeting-03/Provisional-Proposed-Tiers-for-SDG-Indicators-24-03-16.pdf

- 3 different "tiers" levels according to the availability and maturity of data/ methodologies

CEOS Agencies to contribute to the development of these methodologies (for the most relevant indicators) through GEO or with relevant 'custodian' agencies

Examples of how EO can support SDGs (applications)

GOAL 6
"Ensure availability and sustainable management of water and sanitation for all"

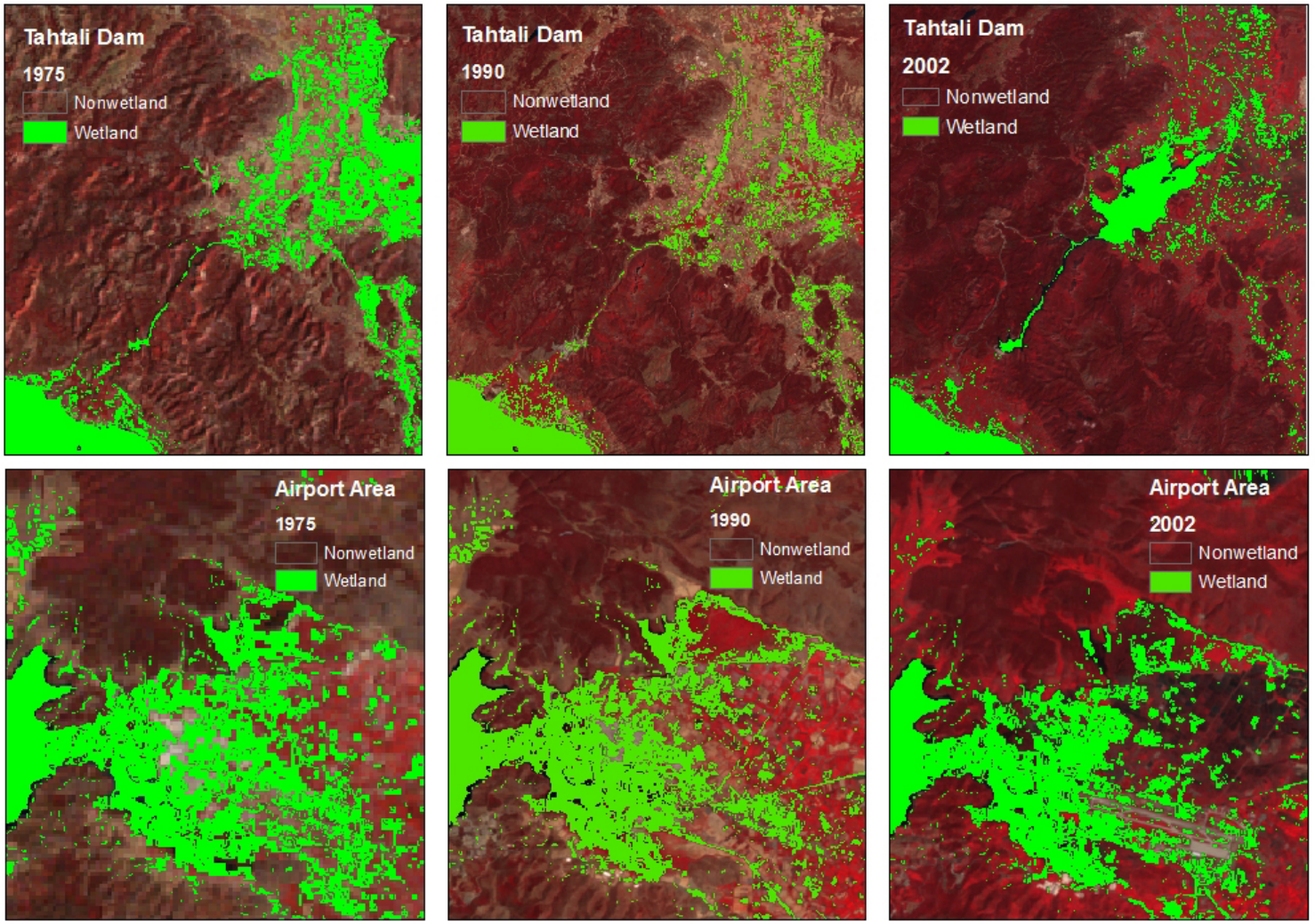
TARGET 6.6
"By 2020, **protect and restore water-related ecosystems**, including mountains, forests wetlands, rivers, aquifers and lakes. "

INDICATOR 6.6.1
Percentage of change in the extent of water-related ecosystems over time

% of change in wetlands extent over time can be measured globally by earth observation based monitoring of wetlands looking at land-use, land-cover, vegetation cover, inundation frequency, biodiversity

Multi-temporal Wetland Identification and Delineation products (Landsat 1975, 1990, and 2002) for exemplary sites between Izmir and Bodrum (upper part: region around Tahtali Dam; lower part: Bodrum airport area).

http://www.earthzine.org/wp-content/uploads/2011/12/Figure-3.jpg

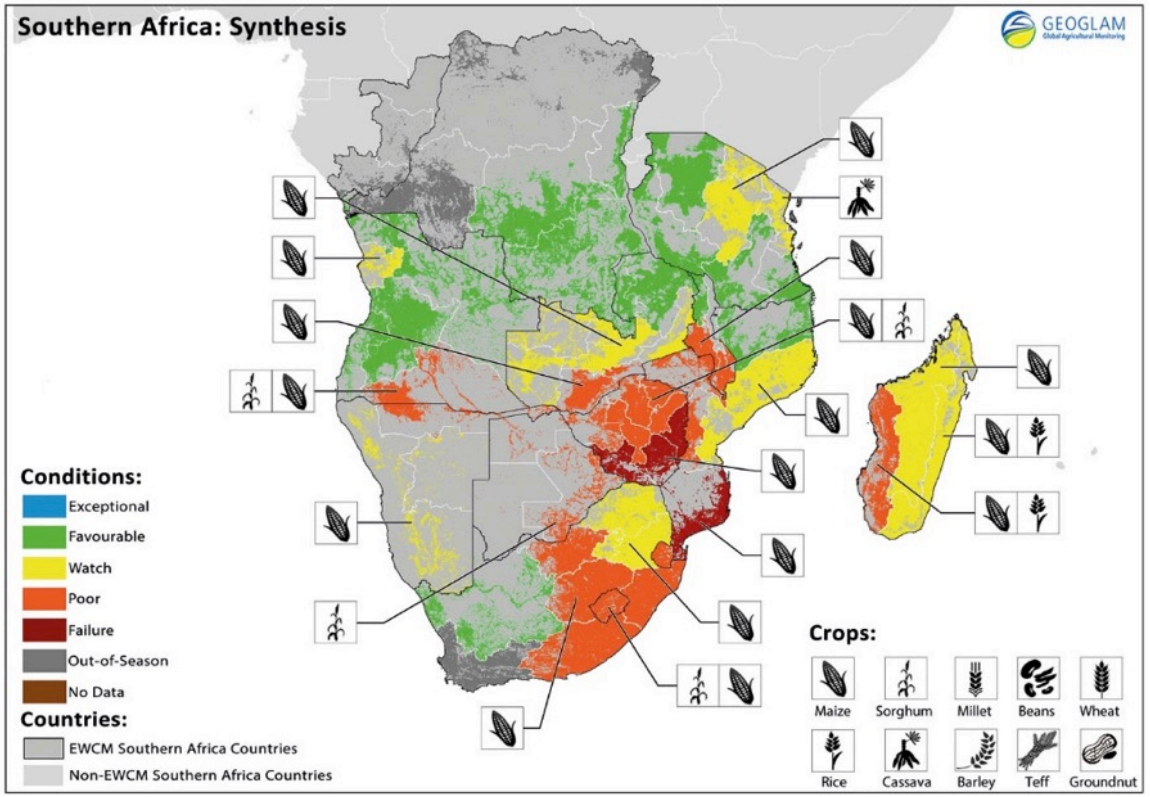


Target 2.c Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility.

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.

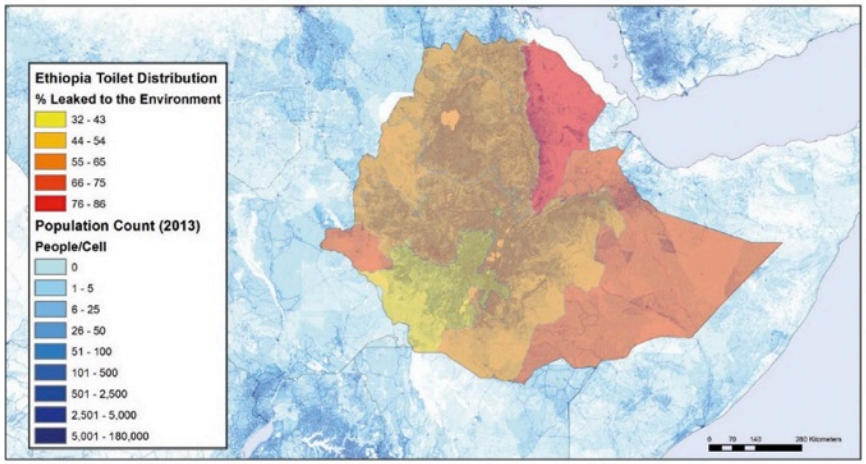
"Development planning and SDG outcomes can be visualized with maps." (CIESIN)

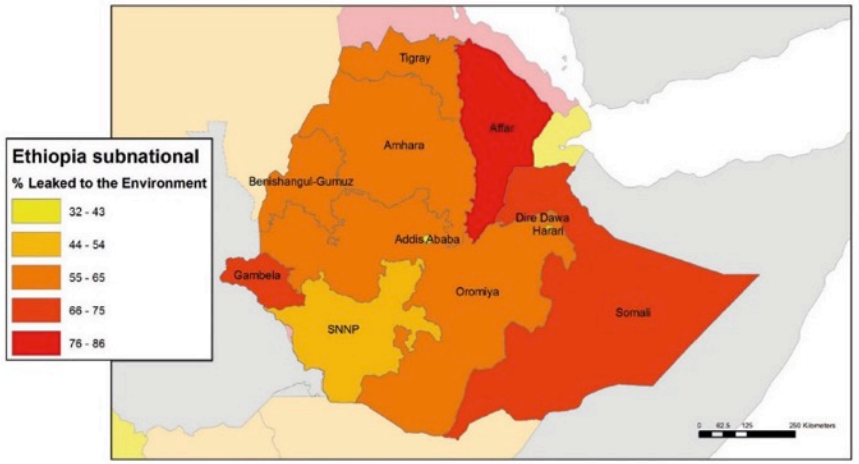


GEOGLAM Early Warning Crop Monitor

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



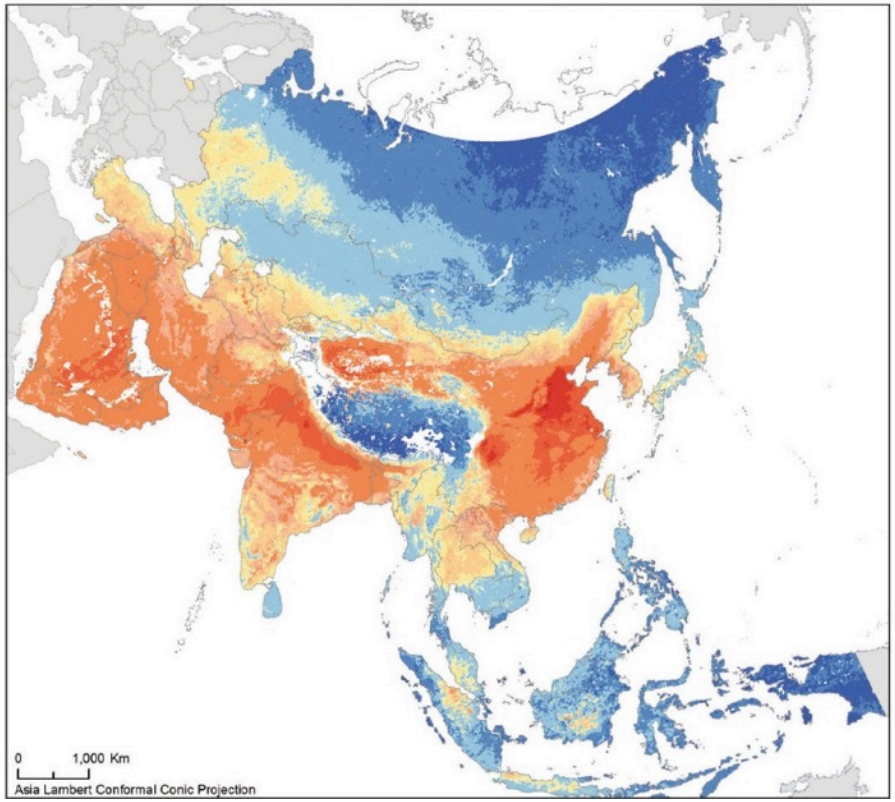


WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation

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.

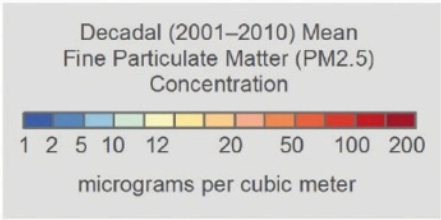
MEASURING AIR QUALITY IN CITIES AND ACROSS REGIONS



CIESIN Columbia University, April 2015

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

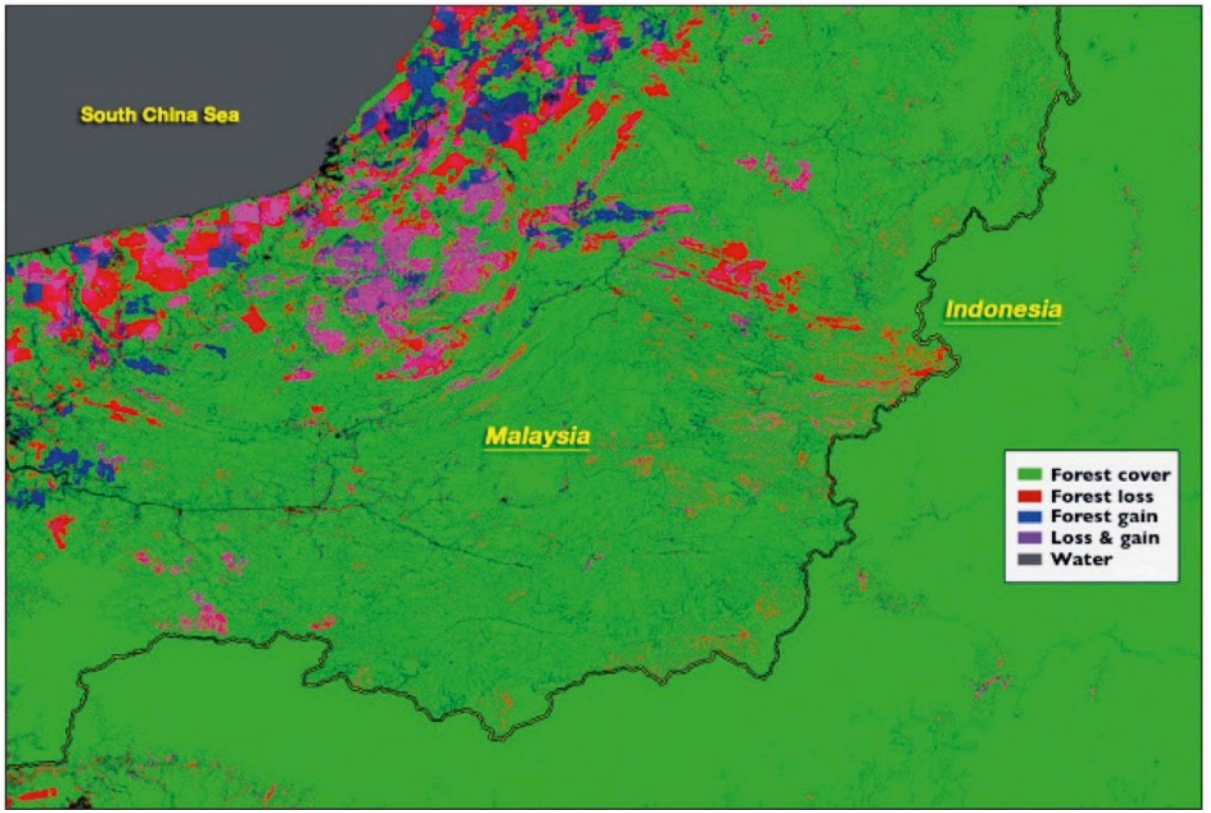
Measurements from satellites provide information on air quality in communities and regions. For example, this map shows baseline data on particulate matter that could be used by statistical agencies, public health organizations, and environmental protection officials to develop more in-depth indicators,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



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.

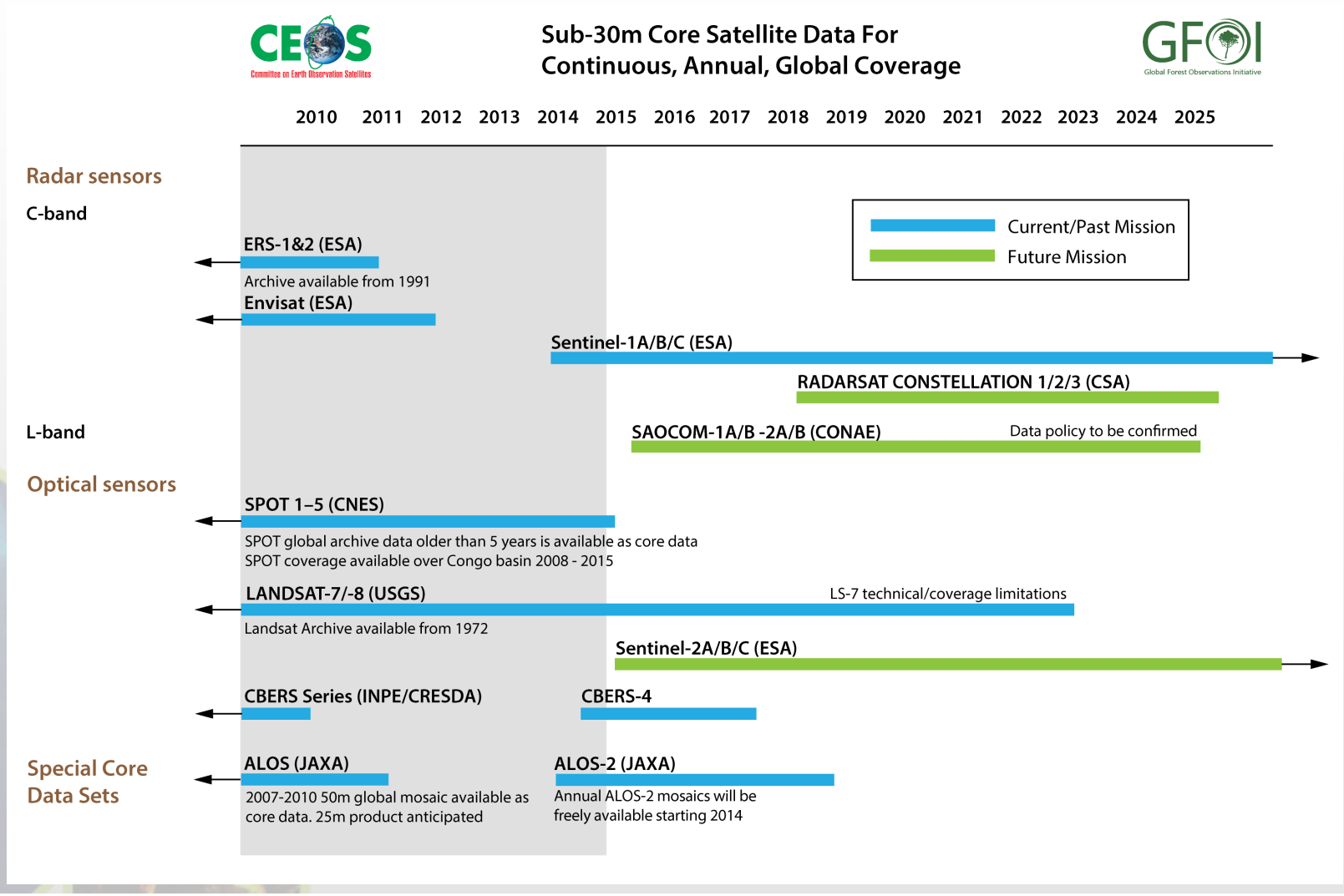


NASA Goddard, based on data from Hansen et al., 2013.

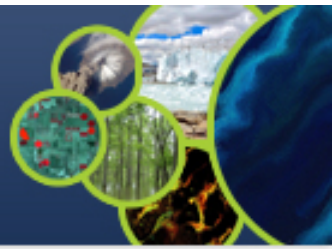
"Mapping SDG-related data will improve measuring and monitoring of progress toward the SDG Indicators."

FOREST CHANGE: example of a Global Baseline Core Satellite Data

GFOI (Global Forest Observations Initiative)



Conclusion



- **CEOS and GEO: international bodies (public)** to **coordinate and centralize** civil-based global EO satellite information, **give access to open & free data** to monitor changes in various sectors for **global and sustainable human benefits** (agriculture, air quality, biodiversity, climate, disasters risk reduction, health, etc.)

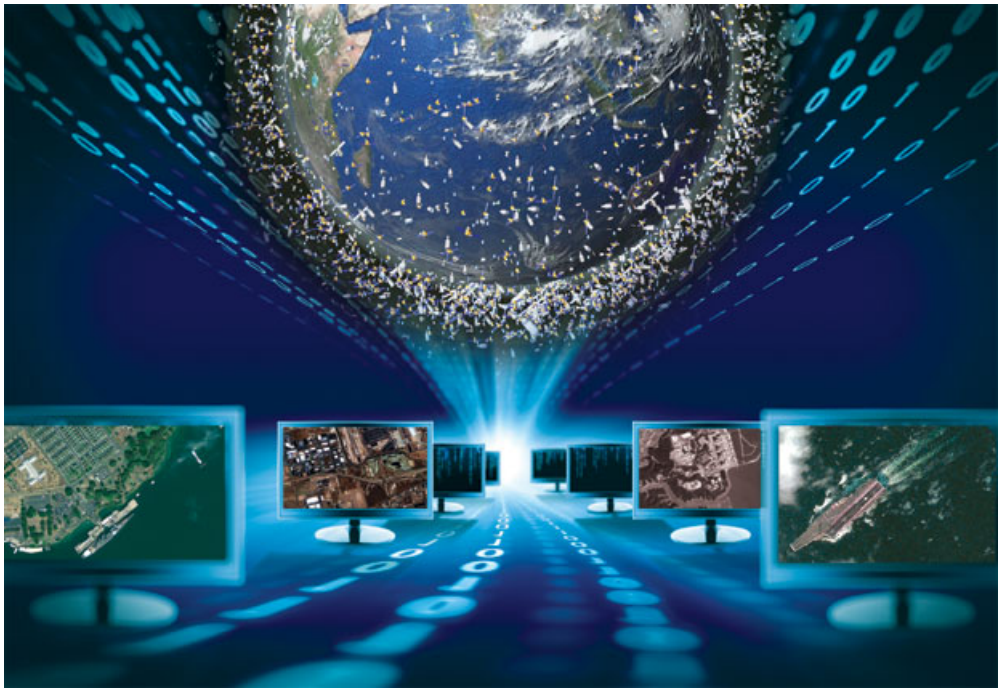
http://www.ceos.org/ https://www.earthobservations.org

- CEOS agencies ensure **validity**, **neutrality**, and **continuity** (one of the main UN requirements for data and indicators used to monitor SDGs) of satellite data

AND….

- Any **ideas** of futures collaborations to maximize our support to the SDGs?
- Any **recommendations** to help us improve our support to the SDGs?
- Any **questions**?

THANK YOU FOR YOUR ATTENTION



For more information – CEOS contacts:

Alex Held (CSIRO, CEOS Chair 2016 & co-lead of the Ad hoc Team SDG) alex.held@csiro.au

Flora Kerblat (AHT SDG) flora.kerblat@csiro.au

Marie-Josee Bourassa (CSA, co-lead of the AHT SDGs) marie-josee.bourassa@canada.ca

Marc Paganini (ESA, co-lead of the AHT SDGs) marc.paganini@esa.int