

GEO: Unleashing the Power of Earth Observations

to Address Global Challenges

In November 2015, the intergovernmental Group on Earth Observations (GEO) adopted the *GEO Strategic Plan 2016-2025: Implementing GEOSS*, which lays out the organization's agenda for its second decade. GEO is built on a foundation of advocating broad, open data policies, convening multiple stakeholders, and building human and technological capacity to enable better informed decision-making around major societal challenges through the use of timely, accurate and sustained Earth observations.

Global Challenges

Society today is facing unprecedented challenges in terms of food, water and energy security; resilience to natural hazards; population growth; pandemics of infectious diseases; sustainability of ecosystem services; poverty and the development of a sustainable economy. Climate change cuts across all of these challenges with the potential to greatly exacerbate them. Moreover, in this inter-connected world, the impact of a single event can immediately cross borders and bring cascading consequences to locations further away.

Concerted, global action is needed to respond to societal challenges in order to improve living conditions for all people, especially the world's poorest citizens. Sustainable and equitable solutions require humankind to make intelligent, evidenced-based decisions that

recognize the linkages between behaviour and impact on the planet. At the same time, these challenges point to opportunities for creating sustainable economies that can provide secure environmental and social conditions, while ensuring these conditions remain optimal for future generations.

Unleashing the Power of Earth Observations

Earth observations from diverse sources, including satellite, airborne, *in situ* platforms, and citizen observatories, when integrated together, provide powerful tools for understanding the past and present conditions of Earth systems, as well as the interplay among them. These tools, and the improved knowledge they provide, together with socio-economic data describing the human dimension in the global environment, can help solve problems, address and mitigate risks, and deliver skillful predictions of the future behaviour of Earth systems. The outcome of this information chain is that the potential consequences of human activities on the planet can be understood, anticipated and addressed. As such, *Earth observations are an indispensable component to measure and monitor our progress towards addressing societal challenges.*

Member States of the United Nations (UN) have responded to societal challenges by establishing the Sustainable Development Goals (SDGs) to guide global efforts towards a better future. The SDGs include clear benchmarks against which the world can measure progress over the next 15 years. Through the provision of open, timely and reliable data and information, Earth observations are an opportunity to supplement statistical analyses in the assessment of indicators towards the attainment of the SDGs and, thus, have a critical role to play in support of SDG monitoring frameworks.



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A large aquamarine-coloured plankton bloom is shown stretching across the length of Ireland in this image captured by Envisat's Medium Resolution Imaging Spectrometer (MERIS), an ocean colour sensor. The European Space Agency (ESA) uses satellite data to determine seasonal levels of phytoplankton to inform decisions on conservation and fisheries.

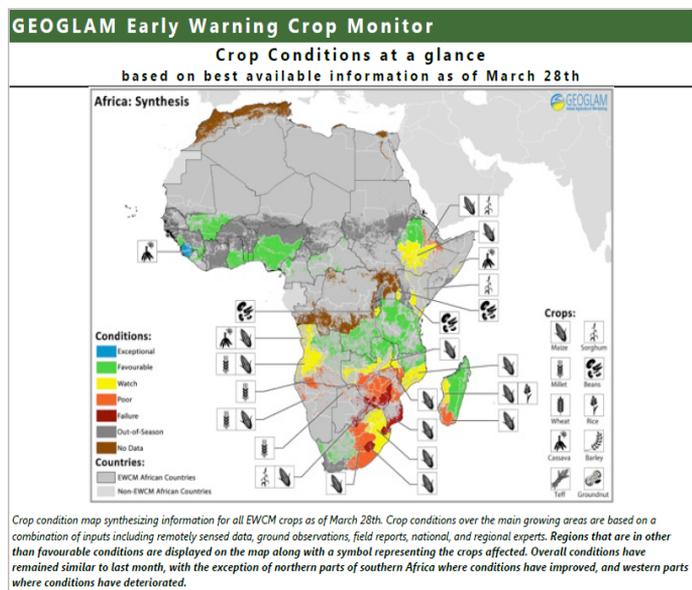
Similarly, Earth observations can be used to strengthen other international treaty and convention follow-up and review frameworks, such as those supporting the Sendai Framework for Disaster Risk Reduction, the United Nations Framework Convention on Climate Change, or the UN Convention on Biological Diversity.

GEO's Vision and Mission

The Group on Earth Observations (GEO), is a global partnership of 102 governments and 95 scientific and technical organizations that envisions a future wherein decisions and actions for the benefit of humankind are informed by coordinated, comprehensive and sustained Earth observations. The extraordinary monitoring capabilities of the countries and organizations that participate in GEO afford decision makers an unprecedented opportunity to gain foresight about critical factors that impact our future – from ongoing food and public health security, to real-time events like natural disasters, to next season's crop outlook, to the state of the oceans in ten years.

To realize its vision, GEO works to connect the demand for sound and timely environmental information with the supply of data and information about the Earth that is collected through observing systems and made available by the GEO community. In doing so, GEO works to unleash the power of Earth observations by facilitating their accessibility and application to global decision-making within and across many different domains.

A central part of GEO's Mission is to build the Global Earth Observation System of Systems (GEOSS). GEOSS is a set of coordinated, independent Earth observation, information and processing systems that interact and provide access to diverse information for a broad range of users in both public and private sectors. GEOSS links these systems to strengthen the monitoring of the state of the Earth. It facilitates the sharing of environmental data and information collected from the large array of observing systems contributed by countries and organizations within GEO. Further, GEOSS ensures that these data are accessible, of identified quality and provenance, and interoperable to support the development of tools and the delivery of information services. Thus, GEOSS increases our understanding of Earth processes and enhances predictive capabilities that underpin sound decision-making.



The Early Warning Crop Monitor is a monthly tool synthesizing national and regional crop analyst inputs along with Earth observation data to visualize crop conditions in countries at risk of food insecurity. The Early Warning Crop Monitor is conducted by GEOGLAM, a GEO Global initiative, with inputs from the following partners, FEWS NET, JRC, WFP, ARC and UMD. For more information go to: www.geoglam-crop-monitoring.org



GEO's Convening Power

Because of its broad intergovernmental membership and diversity of contributing organizations, GEO is able to assemble and coordinate expertise from across different disciplines and communities. GEO uses this *convening power* to bring together the unique combinations of partners required to address societal challenges faced by communities across the globe at every scale, from individuals to countries to continents, drawing on comprehensive, coordinated and sustained Earth observations.

Decision-making relies, and will continue to rely, on the ability of expert communities to utilize complex data from Earth observations and combine these with social and economic analyses. Sound, evidence-based decision-making will encourage sustainable behaviour by humankind in relation to Earth's resources, leading to economic benefits for all of society. Capitalizing on its strengths, GEO will work during the next decade to ensure that decision-making is increasingly informed by Earth observations, provided through, and as a result of, the contributions of its Members and Participating Organizations.

Through engagement with user communities, GEO will play a key role in systematically: identifying data needs while advocating the provision of, and access to, multiple sources of data; delivering tools, skills and services to allow the intelligent exploitation of the data by the user communities; and showcasing the value of Earth observation data in order to expand interest in, and use of, those observations, as well as demonstrate their benefits to society. This end-to-end process of identifying needs, ensuring the availability of data with which to develop information to address societal challenges, and transforming that information into knowledge through the generation of products and services for end-users, defines the scope of GEO.

Strategic Objectives

To realize its Vision and maximise the benefits that GEO can bring to users, through 2025, GEO defines three spheres of activity focusing on “advocacy” for the value of Earth observations as a fundamental component of timely information; “engagement” with stakeholder communities to address societal challenges; and “delivery” of critical data, information and knowledge to inform decision-making. Accordingly, three Strategic Objectives – Advocate, Engage and Deliver - will guide GEO activities through 2025. (See: Strategic Objectives Text Box)

GEO’s Strategic Objectives

Strategic Objective 1:

To **Advocate** the importance of Earth observations as irreplaceable resources that must be protected, rendered fully and openly accessible (including through contribution to GEOSS), and integrated to provide maximum value in support of achieving national and international calls for resilient societies, sustainable economic growth, and a healthy environment worldwide.

Strategic Objective 2:

To **Engage** with stakeholder communities and foster strategic partnerships to address global and regional challenges, by increasing the understanding and use of Earth observations available in support of science-based and data-driven decision- and policy-making.

Strategic Objective 3:

To **Deliver** data, information and knowledge enabling stakeholders to improve decision-making processes and inform policy requirements, promote the exchange of best practices, enable the uptake of new technologies, and create new economic opportunities while leveraging public sector investment through standardization, collaboration and innovation.



Societal Benefit Areas

Guided by the Strategic Objectives, the Societal Benefit Areas (SBAs) are the domains in which Earth observations are translated into support for decision-making. GEO will facilitate the development of solutions to societal challenges within these SBAs by mobilizing resources including observations, science, modelling and applications, to enable end-to-end systems and deliver services for users. (See: Societal Benefit Areas Text Box)

Underpinning the SBAs is research pertaining to terrestrial, freshwater, ocean and atmospheric domains, over a range of spatial and

temporal scales that makes use of satellite, airborne and *in situ* Earth observations for monitoring and understanding the current status of Earth systems. This research can also identify potential changes in Earth systems that may result in risks for global society, providing the time and means to respond.

Climate change and its impacts cut across all SBAs. Supporting sustainable development agendas while tackling the effects of climate change, is an example illustrating this inter-linkage. Hence, GEO will supply the requisite Earth observations in support of effective policy responses for climate change adaptation, mitigation and other impacts across the SBAs. GEO will work with its partners, such as the World Meteorological Organization (WMO), the Global Climate Observing System (GCOS) and the UN Food and Agriculture Organization (FAO), to lead national, regional and global efforts to enhance global observation systems, thereby strengthening resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.

GEO Societal Benefit Areas 2016-2025

GEO will advocate the value of Earth observations, engage communities and deliver data and information in support of:

- **Biodiversity and Ecosystem Sustainability:** by bridging multiple types of observation data and knowledge to provide information on the health of Earth’s biological and ecological systems and their services to society; in order to strengthen conservation, restoration and sustainable use of ecosystems and biodiversity, including marine planning and ocean use, and forest management, in response to changes in climate and land use, through science-society collaborations at local, national, regional and global levels.
- **Disaster Resilience:** by increasing capacity to prepare, forecast, mitigate, manage and recover from disasters; in order to achieve a substantial reduction of risk and losses of life and property through an understanding of disaster risk brought by maintaining and strengthening in-situ and remotely-sensed Earth and climate observations while enhancing the access to, and the sharing and use of, data and information obtained through such observations.
- **Energy and Mineral Resources Management:** by enhancing the discovery, development and sustainable production of mineral and renewable energy resources; in order to facilitate substantial increases in the share of renewable energy in the global energy mix, through usable, actionable information on resource assessment, monitoring and forecasting of intermittent energy sources, including solar, wind, ocean, hydropower, geo-thermal power and biomass.
- **Food Security and Sustainable Agriculture:** by underpinning development, management and forecasting of global food and agricultural production on land and in the water; in order to end hunger, achieve food security (including monitoring for quality, safety and correct identification) and promote sustainable agriculture adapted to climate change impacts through strengthening food production monitoring and early warning systems, and providing accurate, timely information on agricultural production status, outlook and forecasts.
- **Infrastructure and Transportation Management:** by providing support for planning, monitoring and management of infrastructure (dams, roads, rail, ports, and pipelines) and transportation (air, land and sea); in order to minimize environmental impacts while moving towards a low-carbon footprint.

- **Public Health Surveillance:** by yielding insight into the threat of vector-borne and environmentally-linked diseases, taking into account impacts of climate change; in order to promote a substantial reduction in the number of fatalities and illnesses from infectious diseases, environmental pollution and health risks, through raising public awareness and supporting policy making and management with accurate monitoring and early warning at local, national, regional and global levels.
- **Sustainable Urban Development:** by assisting in the development of resilient cities and assessment of urban footprints; in order to make cities and human settlements inclusive, safe, resilient and sustainable through identifying economic externalities, managing environmental, climate and disaster risks, and building capacity to participate, plan and manage based on objective information regarding urban development.
- **Water Resources Management:** by supporting management of water resources, including the cryosphere, while fostering and maintaining water quality; in order to ensure the availability and sustainable management of water and sanitation through sound science-based public policies informed by Earth observations, modelling and data integration.

Data Sharing and Data Management Principles

GEO recognizes that the societal benefits arising from Earth observations can only be fully achieved through the sharing of data, information, knowledge, products and services. GEO has therefore promoted fundamental principles for data sharing, expanding the trend towards open data worldwide. Thus, as it embarks on its second decade, GEO now aims to implement the following GEOSS Data Sharing Principles:

- Data, metadata and products will be shared as Open Data by default, by making them available as part of the GEOSS Data Collection of Open Resources for Everyone (GEOSS Data-CORE) without charge or restrictions on reuse, subject to the conditions of registration and attribution when the data are reused;
- Where international instruments, national policies or legislation preclude the sharing of data as Open Data, data should be made available with minimal restrictions on use and at no more than the cost of reproduction and distribution; and
- All shared data, products and metadata will be made available with minimum time delay.

To further maximize the value and benefits arising from Earth observation data, GEO will continue to work with partners to promote the use of its Data Management Principles¹, which are based on discoverability, accessibility, usability, preservation and curation. These principles address the need for common standards and interoperability arrangements. This will ensure that data and information of different origin and type are comparable and compatible, facilitating their integration into models and the development of applications to derive decision support tools.

Capacity Building

Building capacity, as well as sustaining and enhancing existing capacity, is essential for developing the competencies of GEO Members and Participating Organizations in the effective use of Earth obser-

vations for responding to societal challenges and addressing sustainable development issues. The need for greater capacity to access and use Earth observation data, information, tools and services is particularly strong in developing countries. To integrate their use in the decision-making processes will require collaborations with key government and regional entities and international donor/development organizations to establish and increase awareness about the value of Earth observation information, facilitate the development of national GEO and Spatial Data Infrastructures, as necessary, and assist in the development of technical and human capacity to fully utilize these resources.

Moving Forward into the Second GEO Decade

With the adoption of its Strategic Plan, GEO has re-committed to harnessing the power and potential of Earth observations for the betterment of our global society. We pledge to work in concert with stakeholder communities to serve as a broker, connecting users, data providers, engineers, scientists and other relevant experts to create solutions to global challenges that transcend both national and disciplinary boundaries.

Barbara J. Ryan

Barbara J. Ryan is Secretariat Director of the intergovernmental Group on Earth Observations (GEO) located in Geneva, Switzerland. In this capacity, she leads the Secretariat in coordinating the activities of 101 Member States and the European Commission and 95 Participating Organizations that are integrating Earth observations so that informed decisions can be made across eight Societal Benefit Areas, Biodiversity and Ecosystem Sustainability, Disaster Resilience, Energy and Mineral Resources Management, Food Security, Infrastructure & Transportation Management, Public Health Surveillance, Sustainable Urban Development and Water Resources Management.

Before becoming GEO Director in July 2012, Ryan served as Director of the World Meteorological Organization (WMO) Space Programme with responsibility for coordinating space-based observations to meet the needs of WMO Members in the topical areas of weather, water, climate and related natural disasters.

Before joining WMO in October 2008, she was the Associate Director for Geography at the U.S. Geological Survey (USGS) in Reston, Virginia where she had responsibility for the Landsat, remote sensing, geography and civilian mapping programs of the agency. It was under her leadership that implementation of the Landsat data policy was reformed to release all data over the internet at no additional cost to the user -- an action that has resulted in the global release of more than 25 million Landsat scenes to date, and significant economic returns globally.

Ryan holds a Bachelor's degree in Geology from the State University of New York at Cortland, a Master's degree in Geography from the University of Denver, and a Master's degree in Civil Engineering from Stanford University. She has been awarded an honorary doctorate of science degree from the State University of New York at Cortland.



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¹ See GEO Strategic Plan 2016-2025: Implementing GEOSS Reference Document (see: <http://goo.gl/3OEMNP>)