The SDGs Geospatial Roadmap

Prepared by the Inter-agency and Expert Group on the Sustainable Development Goals Indicators

THE
SDGs
GEOSPATIAL
ROADMAP

SUSTAINABLE
DEVELOPMENT
GOALS

UN-GGIM
UNITED NATIONS
COMMITTEE OF EXPERTS ON
GLOBAL GEOSPATIAL
INFORMATION MANAGEMENT

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2020 was intended to be a milestone for global sustainable development. Twenty years from the inception of the Millennium Development Goals and five years into the Sustainable Development Goals (SDGs), regardless of the present global situation, the transformational vision and new data requirements called for to realise the 2030 Agenda have not been fully realised. The extent of this challenge has been underestimated. It is further amplified by gaps and unequal distribution of the foundational geospatial data, leadership, knowledge, and innovation which all countries need.

This **SDGs Geospatial Roadmap** has been collaboratively developed as a strategic information and communications mechanism to 'build the bridge' and understanding between the statistical and geospatial actors working within the global indicator framework. The SDGs Geospatial Roadmap provides simple and actionable guidance to the Inter-agency and Expert Group on Sustainable Development Goal Indicators' (IAEG-SDGs), SDGs Custodian Agencies and National Statistical Offices, National Geospatial Information Agencies and others working within the national SDG ecosystem. Implementing the SDGs Geospatial Roadmap will help guide national institutions to collaborate and realise the immense innovative potential that geospatial information and its associated technologies can bring to the SDGs, and other global development agendas such as Sendai Framework for Disaster Risk Reduction 2015-2030, the response to COVID-19, and broader national priorities.

The vision of the SDG Geospatial Roadmap is to see **geospatial and location-based information being recognised and accepted as official data for the SDGs and their global indicators.** This vision expands on the recommendation of the IAEG-SDGs' Working Group on Geospatial Information (WGGI) that, while official statistics are the foundation on which the SDGs are built, the SDGs cannot be fully realised using official statistics alone, particularly when they are not produced in sufficient quality, detail and frequency. In fact, the SDGs are highly dependent on the understanding of geographic location, necessitating the inclusion and use of geospatial information, Earth Observations and other forms of location-based data.

Therefore, **the SDGs Geospatial Roadmap is a living resource that helps communicate, guide and enhance the awareness of geospatial information, Earth Observations, and related data sources, tools and methods, to inform and support the implementation, measurement and monitoring of the SDGs, according to national circumstances.** It achieves this through **three phases** that detail how and why geospatial information is needed and how it can be applied to support countries in their national implementations of the SDGs. In highlighting available resources, existing global geospatial frameworks and novel, innovative approaches, the SDGs Geospatial Roadmap is supported by a series of **Key Actions, Case Studies and supporting guidance** for each phase that recommend the unique value proposition and opportunity that geospatial information can and does provide, and identifies what needs to be done, when, why, and by whom.

In July 2017, in its resolution 71/313, the General Assembly adopted the Global Indicator Framework for the 17 SDGs and 169 targets of the 2030 Agenda for Sustainable Development, as developed by the IAEG-SDGs. The Statistical Commission agreed upon the Global Indicator Framework at its forty-eighth session, held in March 2017. The resolution stressed that official statistics and data from national statistical systems constitute the basis needed for the Global Indicator Framework and recommended that national statistical systems explore ways to integrate new data sources into their systems to satisfy new data needs of the 2030 Agenda.

The requirements of the 2030 Agenda imply that the SDG indicators should be disaggregated, where possible, by income, sex, age, ethnicity, migratory status, disability and geographic location, or other characteristics, following the Fundamental Principles of Official Statistics.

Yet, we have not achieved the transformation progress needed to attain the SDGs. Further, the reporting requirements of the 2030 Agenda add an extra layer of work to National Statistical Offices (NSOs), at a time when many are already facing ever higher pressures caused by national and global reporting frameworks and the recovery from COVID-19. Moreover, while official statistics are the foundation on which the SDGs are built, the SDGs cannot be fully realised using official statistics alone. The SDGs are highly dependent on geospatial information and Earth Observations (EO) as the primary data for relating people, economy and the environment to a location and place, and to measure 'where' progress is, or is not being made, particularly at 'disaggregated' sub-national and local levels. The Working Group on Geospatial Information (WGGI) of the Inter-Agency and Expert Group of the SDGs indicators was established to directly support and complement the ongoing work of the IAEG-SDGs and the implementation of the Global Indicator Framework, where the geospatial data acquisition, integration and statistical disaggregation is most needed.

The SDGs Geospatial Roadmap aims to communicate the value of the support already provided to the IAEG-SDGs, UN custodian agencies, and Member States, provides practical guidance for the use of geospatial information for the production, measurement, and monitoring, and elaborates on the vision to see geospatial and location-based information being recognised and accepted as official data for the SDGs and their global indicators, providing practical guidance which enables the mainstreaming of the SDGs at any level of development. It achieves this by demonstrating how to 'build the bridge' between the statistical and geospatial actors working within the Global Indicator Framework, through three phases:

PHASE 1	PHASE 2	PHASE 3
Prepare and Plan	Design, Development and Testing	Producing, measuring, monitoring and reporting geospatially enabled SDG indicators

The SDGs Geospatial Roadmap is addressed to NSOs and national actors primarily responsible for providing the underlying data for the SDGs. This ecosystem can include the National Geospatial Information Agency (NGIA), the national (or regional) space agency, custodian agencies of the United Nations System and other stakeholders within the broader data community. Significantly, innovations within the geospatial information and EO communities, and their enabling technologies, can be leveraged and shared to help countries transform how they produce, measure and monitor SDG indicators.

This Roadmap was collaboratively developed by the WGGI, following a broad process of qualitative consultation with NSOs and NGIAs representatives of both the IAEG-SDGs and WGGI. Many of the challenges recognised in the Roadmap do not have an obvious and immediate solution, particularly in the area of governance. The SDGs Geospatial Roadmap aims to be an interactive living resource, which invites the statistical, data and geospatial information communities to contribute with new resources, services and examples of best practices, as they emerge, which will be added to the Roadmap's web document as an expanded version of this present document.
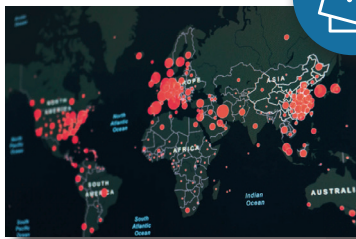
What is Geospatial Information?

Geospatial information describes the physical location of geographic features and their relationship to other features and associated statistical information. Geospatial information is presented in many forms and mediums, including maps, EO, and aerial photography.

Geospatial information is a critical component of the national infrastructure and knowledge economy; a blueprint of what happens where and when, and the means to integrate a wide variety of government services. It is a nation's 'digital currency' for evidence-based decision-making and a critical component of its national infrastructure and knowledge economy that provides a nation's blueprint of what happens where and the means to integrate a wide variety of government services and functions, inclusive of economic growth, national security, sustainable and equitable social development, environmental sustainability and general national prosperity. A geospatially-enabled nation shares, integrates and uses a wide range of data to achieve social, economic and environmental benefits. This use and associated benefits extend across governments, businesses and citizens, and from national to the city and small community levels.

Reference: **Integrated Geospatial Information Framework - Part 1: Overarching Strategic Framework**
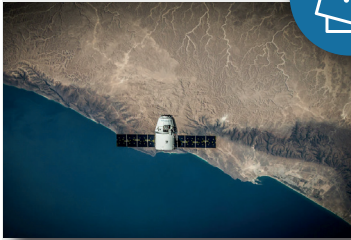
What are Earth Observations?

As a subset of geospatial information, Earth Observations (EO) is an all-encompassing term for data and information collected about our planet, whether atmospheric, oceanic or terrestrial. These EO includes space-based or remotely-sensed data, as well as ground-based or in situ data. EO data is borderless, impartial and inclusive for all. They are an innovative data source for many SDG indicators and essential for describing environmental aspects of our planet. Designed for planetary-scale coverage, EO's characteristics make it an indispensable direct source of data for several SDG indicators and a supporting source of data for many others. Today, many EO data sources are freely available, many with consistent and timely global coverage. However, there are significant demands for the consummate skills and resources, a gap to be bridged so that EO can fully realise its potential for the SDGs.
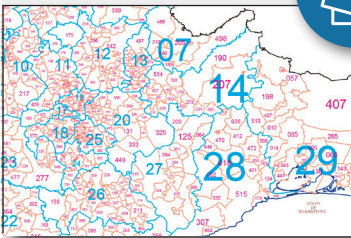
What is Disaggregation by Geographic Location?

Disaggregation by geographic location is the breakdown of data to smaller geographic areas. These geographic areas could be Administrative (ie. from a national level to a local level) or could be grids, urban/rural areas or basins/sub-basins). Disaggregation by geographic location is necessary to generate a dataset at a relevant geographic scale. As the SDGs are relevant for a nation, not just nationally, their relevance and actionability at the local level is a crucial step towards ensuring that "no one is left behind".

The initial development of the Global Indicator Framework largely constituted a statistical data approach. Today, the need for 'disaggregation by geographic location' is now well recognised to ensure that no one is left behind. Depending on the SDG indicator being measured, a mix of statistical and geospatial techniques can be adopted to attain the required scale and resolution. For example, for indicators which require data collection at the local level (such as defining urban and rural areas) and reporting at the national level (such as through the aggregation of locally collected values), representative spatial sampling using statistically sound techniques can be adopted, and continuous monitoring recorded based on the sample.

Through establishing an SDG environment where differing disaggregation by geographic location can be accomplished, the opportunity arises to conduct comparability and other forms of geostatistical analysis. Development is no longer only knowing about 'people' as national aggregations, but also people (inclusive of age, gender, economic status, and income) are understood within their specific 'place' and environment.

Reference: **Principle 3 - Common Geographies. The Global Statistical Geospatial Framework**

How to use the SDGs Geospatial Roadmap

The SDGs Geospatial Roadmap draws on case studies and national examples, specific resources and tools, and highlights further considerations for geospatial information to address our global challenges. The three Phases are structured by an introduction, **Key Actions,** and a Summary.

The **Key Actions** provide simple actions and resources that can establish/strengthen national capacity in using geospatial information for the SDGs. They are also intended to be milestones for 'checking in'. Each Key Action Details:

1. **Context and description of the challenges that the Key Action aims to overcome**
2. **A table of Key Actions**
3. **References to external resources**

Depending on the status of your country, some of the resources will already be assimilated, others will be appropriate in the present, and others could be considered useful for future phases.

The rapid pace of innovation within the global geospatial information community means that the data we have today, in terms of quality, resolution and other attributes, will be better tomorrow. Accordingly, the Roadmap can be used as a tool to help countries identify what they need to start to use geospatial information, or for strengthening existing capacities, in their view of future innovations. Regardless of whether a country is challenged through sustaining skills and knowledge or is pushing the technological frontier, this Roadmap aims to provide an equal level of guidance to strengthen the use of geospatial in-formation for the SDGs. In alignment with the three main areas of influence of the Integrated Geospatial Information Framework (IGIF), the Roadmap contextualises along the interconnected areas of influence: Governance, Technology, and People.

The Roadmap Navigator identifies the relationships between the Key Actions and the IGIF's areas of influence to help support the implementation of Key Actions.

Phase	Key Action		People	Technology	Governance
PHASE 1	1	Establish governance structures to coordinate SDGs at the national level			●
	2	Identify national data capacity and highlight potential data gaps			●
	3	Identify and assess relevant frameworks and standards			●
	4	Assess available skills and technological capacity	●	●	
PHASE 2	1	Identify relevant data and appropriate methodologies to develop indicators			●
	2	Prioritise and identify what data is needed at the national level.		●	●
	3	Convene workshops - sharing of knowledge and experiences	●		
	4	Identify appropriate data, develop methods and coordinate development support	●		●
	5	Collaborate with national and global entities to leverage available capacity	●		
PHASE 3	1	Produce indicators	●	●	●
	2	Implement a suitable data management and dissemination platform, identifying technological capacities and gaps.			●
	3	Promote a culture of storytelling with existing data and highlight existing data gaps	●		
	4	Establish a publication calendar, identify institutional areas responsible for managing the production, monitoring, measurement and dissemination process	●		
	5	Publish metadata and continually update the list of prioritised indicators, including sources of information used	●	●	●

PHASE 1: **PREPARE AND PLAN**

The 2030 Agenda, its Goals, Targets and the actual Global Indicator Framework are built upon recog-nising that **future sustainable development strategies must be inclusive, with universal respect for equality and non-discrimination, transformative for people and the planet, and important-ly, are evidence-based and data-driven.** The acquisition and maintenance of the data needed to fulfill these objectives are often conducted at a national level by various agencies, primarily NSOs and NGIAs, but also many other stakeholders within a national data ecosystem. This will require countries to si-multaneously enact the production, measurement, and monitoring of SDG indicators and disaggregate these indicators by geographic location and other relevant disaggregations spotlighted by the global indicator framework.

The availability of new technologies and approaches can be a positive driver or increase perceived com-plexity. However, geospatial information and its associated enabling technologies offer one of the best ways to innovate in the domain of statistics and data science, strengthening the national statistical sys-tem. Geospatially enabling the existing national data ecosystem will help countries to more comprehen-sively meet the requirements for producing, measuring, monitoring and reporting the SDGs. But there is a consummate lack of geospatial information management skills, analysis, and methodologies, which in itself limits countries to identify needs and solutions, in addition to a lack of access, coordination and sharing of data within the national data ecosystem, missing data, incomplete coverage, inconsistent reference system, inaccurate or a lack of authoritative data, and absence of updating policy, among many other issues. So, where to start?

The starting point is to recognise that the needs of the SDGs are not to be considered in isolation from national development monitoring. The data needs of the SDGs are the same data needs that empower national decision-making. Yet, while each country makes progress towards the SDGs, it is crucial to articulate and recognise the value that all elements of the national ecosystem can bring to the SDGs and vice-versa. To make this progress, bring together NGIAs, Cadastral and National Space Agencies, Urban Development, and other national institutions that are the knowledge centres and geospatial infor-mation producers with NSOs and others within the National SDG ecosystem.

Phase 1 - Key Actions

1. Establish governance to coordinate SDGs on national level
2. Identify national data capacity and gaps using the Global Fundamental Geospatial Data Themes
3. Implement guiding frameworks like the IGIF, GSGF and GSBPM
4. Assess skills and technological capacity, establish partnerships

[Key Action 1] Establish governance structures to coordinate SDGs at the national level

Form a National SDGs Committee to holistically consider the SDGs and help coordinate their SDG data resources. In this National Committee, a subcommittee may focus solely on the coordination and use of geospatial information. This National SDGs Committee, additionally to the coordination for the SDGs, will strengthen interlinkages of national agencies and stakeholders at the national level. This Committee should be led by a high-level and effective communicator, ultimately, ensuring that all decision-makers are aware that the needs of the SDGs are the needs of national development. In a case study, Ireland and Colombia detail how they have established governance arrangements according to their national circumstances. The composition of this Committee would be anchored by both the NSO and NGIA, augmented by other relevant agencies (such as the Land Registry, Space Agency, etc).

Reference**: IGIF Strategic Pathway 1: Governance and Institutions.**

[Key Action 2] Identify national data capacity and highlight potential data gaps

Almost all countries will have data gaps and national data ecosystems can be fragmented, regardless of the underlying reasons. All the national ecosystems simultaneously challenge and emphasise the need for the integration of data. A useful foundation is the "14 Global Fundamental Geospatial Data Themes". **The 14 Themes offer a basis for understanding the various data needed for the production, measurement, monitoring and disaggregation by geographic location of the global indicator framework.** Especially in countries where access to technology, software and skills is complex, the themes offer a simple template to evaluate national data capacity and availability, as a basis that will enable the development of a strategy, prioritization, and baseline for indicators production.

Additionally, at the global level and also aligned with the 14 Themes, are the WGGI's reports on **"Global and Complementary Geospatial Data for SDGs"** and **"Land Cover Datasets for SDGs"**. These resources identify specific sources of geospatial data, often open-data, that is available at no-cost at the point of delivery. These offer an entry point for countries to access the data, technology and skills shared outside the national context.

In this context, EO offers the largest opportunity to transform and augment national efforts to use geo-spatial information for the SDGs. Moreover, when data remains insufficient, methods that use non-con-ventional data or analysis can be employed to complement traditional approaches. This case study on **embracing non-conventional methods and data** provides further context on how to establish a framework to introduce non-conventional data and methods within the measurement strategy.

[Key Action 3] Identify and assess relevant frameworks and standards

Determine the availability of the 14 Themes at the national level, when the data baseline to produce indicators is being established. Part of the gaps at the national level could be resolved at the regional level (discussed in Phase 2). Other resources are also available to help with elevating national capacity for using geospatial information for the SDGs, like these **three guiding frameworks: the IGIF, the Global Statistical Geospatial Framework (GSGF) and Generic Statistical Business Process Model (GSBPM).**

The three guiding frameworks individually and collectively support the NSOs (GSBPM), the NGIAs (IGIF), and the bridge between them (GSGF). The outputs and inputs to each of these frameworks are the data of the Global Fundamental Geospatial Data Themes. Crucially, these frameworks are not prescriptive and serve to support and augment established national frameworks.

[Key Action 4] Assess available skills and technological capacity

Assess the existing capacities and establish an enabling environment for geospatial information to empower the SDGs, as the primary outcome of implementing global geospatial frameworks like the IGIF, GSGF and the Global Fundamental Geospatial Data Themes for the elaboration of these frameworks. These frameworks help strengthen the national capacity to use geospatial information, yet, their strategic pathways, principles or themes cannot be realised unless there is a consummate level of development in the capacity for integration of statistical and geospatial information, technology and people.

The needs for developing technological capacity for using geospatial information will differ widely across countries, from access to basic computing, internet connectivity and software, low capacity in using geospatial information for producing, measuring and monitoring SDGs, or structural difficulties, including lack of institutions needed to coordinate across diverse data producers.

There are several technological platforms available for the management of SDG data. These platforms can be nationally built, or developed by an open-source community, or taken 'off the shelf' from a software vendor. Each country will choose its platform based on its prevailing national circumstances.

The **Federated Information System for the SDGs (FIS4SDGs)** is recommended by both the Statistical Commission and the Committee of Experts on Global Geospatial Information Management (UN-GGIM). The FIS4SDGs provides a complete enabling environment for national and international reporting for the integration of SDGs. It offers countries a basis from which to establish capability and readiness. Moreover, while nationally owned and implemented, it gives guidance on dissemination, interoperably within the national and global SDGs ecosystem. Despite significant investments to develop skills in countries that lag furthest behind, inherent fragility exists in the sustainment of capacity, knowledge and skills in many countries, in spite of regional and global cooperation, events and workshops that initially help to build local teams of experts. Therefore, the Roadmap recommends that the National SDGs Committee establishes a baseline of technical/skills capacity needed. **Strategic Pathway 8: "Capacity and Education" of the IGIF** is accompanied by a detailed Annex, containing tools which enable countries to conduct a Capacity Needs Assessment, highlights common components of a 'capacity development and education strategy', and other assessment tools.

Strengthening the application of technology is not the only component of this Key Action, concurrent to assessing technological capacity is the need to assess and develop skills of the people working in the SDG domain. Alongside regional workshops (Phase 2 - Key Action 3) online knowledge resources (e.g., **Earth Observations Toolkit for Sustainable Cities and Human Settlements),** partnerships with academia and the private sector are all mechanisms that can help build skills and capacity.

Key Technology

The FIS4SDGs, is an initiative led by DESA's Statistics Division, in partnership with Esri, that leverages **state-of-the-art web technologies and services to improve the inte-gration, accessibility and usability of official statistics, geospatial information, and other sources of data,** including from outside the official statistical system, to support de-cision makers at the local, national, regional and global levels in achieving the 2030 Agenda.

The FIS4SDGs creates an **enabling environment** for the national and international report-ing and the integration and analysis of SDG data and statistics across a system of federated data hubs, thus strengthening the capacity of national statistical and geospatial information systems to respond to the data needs of decision and policy makers, and their international partners, at the country level.

It's based on the principle of **national ownership,** where the National Statistical System im-plements internationally agreed standards around the production and dissemination of data and statistics, in line with country-specific priorities and ongoing capacity building efforts. The **federated architecture** supports an interoperable data ecosystem enabling independent global and national SDG Data Hubs that can publish and share, authoritative SDG data and information on a common platform, enabling users to not only access the data they need when they need it, but also ensure the traceability and accountability of the data, which is maintained at its source.

Phase 2 identifies resources that help with assessing and deciding on which data, methods, gaps, is-sues, and actions, to use geospatial information in the SDGs process. With 17 Goals, 169 Targets and 231 unique Indicators, and need to measure progress for those who are vulnerable, the overarching data needs, means of production, methodologies of measurement, and mechanisms of dissemination are not yet fully matured. Successive decisions of the Statistical Commission on the need to 'develop the necessary statistical standards and tools and build capacity on disaggregated data', include using geospatial location[1]. Supporting the construction of the indicators are **531 data series,** which includes time series data and data disaggregated by various characteristics, including by sex, age, and other relevant demographics.

Key Actions

1. Identify key resources to prioritize data needs
2. Prioritise focus indicators based on National priorities
3. Convene workshops to promote sharing knowledge
4. Convene workshops to confirm appropriate data and methods, and coordinate development support
5. Leverage available capacity with regional and global entities

The interconnected nature of the SDGs means the involvement of agencies from across the natio-nal ecosystem, including environmental, agricultural, and cadastral agencies. Therefore, **the roadmap recommends high-level commitment to an open discussion across the national ecosystem** that supports the sharing of institutional challenges in the management of geospatial information for the SDGs, identifies indicators based on national priorities, and then seeks to bridge these gaps and then select indicators that are of specific focus to the national context.

[Key Action 1] Identify relevant data and appropriate methodologies to develop indicators.

While some indicators need local data all the way down to street and address level, others could benefit from a more regional/global data approach, or a combination of these two approaches. As there still extensive work ongoing by the SDGs Custodian Agencies to define the metadata and methodological needs of the SDGs, combined with the need for national capacity development to produce indicators, geospatial information has the potential to enable transformational at all levels, supporting not just the SDGs, but other developmental priorities within the national ecosystem, including the ambition of the 2030 Agenda of leaving no one behind.

To highlight **how geospatial information can be used, the "Short List" and "List of Indicators"** are invaluable for supporting the design and development of what sources of geospatial information are needed. Specifically, the "List of Indicators" **identifies which indicators are capable of being pro-duced, measured or monitored using geospatial information, and the various dimensions of**

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1   See Statistical Commission decisions 47/101, 48/101, 49/101, 50/101, 51/101, and 52/101.

disaggregation. In the supporting material UN Women as a custodian agency elaborates on how to identify and prioritise using Disaggregation by Geographic Location and other characteristics, further contextualising how and why the **IGIF Strategic Pathway 4: Data** should be implemented, providing several resources, including how to conduct Gap Analyses and establish Data Governance Roles and Responsibilities.

[Key Action 2] Prioritise and identify what data is needed at the national level.

Following the prioritisation of indicators, geospatial information can be evaluated and provided by the stakeholders of the National SDGs Committee. The "SDGs Assessment Matrix" is a practical tool for countries to identify responsibilities, needed data and metadata, and agreed modalities of production.

Assessment Tool

The **SDGs Assessment Matrix** is a questionnaire, set up by the Regional UN-GGIM Committee for Europe, supports the identification of needs and prioritisation for the creation and analysis of SDG indicators. Each line of the matrix is one indicator contained in the "Short List" or in the "List of Indicators".The assessment is question-based to:

→ Understand if a Country is reporting and how on specific indicators
→ Identify actual and expected level of usage of geospatial information
→ Evaluate the availability of national methodologies
→ Identify Country level of interest on the indicators

While prioritizing the focus indicators, countries are urged to keep in mind that the SDGs are interlinked to various other national and multilateral agreements. Therefore, fulfilling the data requirement for SDGs may, in turn, fulfill the data needs of other national and international commitments too.

[Key Action 3] Convene workshops - sharing of knowledge and experiences

As countries in the same region often have similar arrangements and levels of capacity, there is a high potential for sharing data, lessons learned and collaborative development of methodologies. Other countries with particular gaps will benefit even more from being able to learn about the experiences of neighbors with similar national problems. Given the global nature and availability of data sources, countries could also explore ways to work collaboratively to procure tools and platforms that might otherwise be unattainable in isolation. Accordingly, alongside dialogue in the national context, countries are urged to coordinate their national workshops in collaboration with UN Regional Commissions, UN Regional Coordination Offices, the regional committees of UN-GGIM, and other regional organisations. Simultaneously, these stakeholders are urged to coordinate with countries to strengthen collaboration and coherence in the provision of development support.

Exemplifying the potential support available at the regional level is the support provided by **Digital Earth Africa and the United Nations Food and Agriculture Organisation (FAO)**. Digital Earth Africa offers countries with an operational data infrastructure which makes current and historical, analysis-ready satellite data freely available and openly accessible for the continent, with FAO collaborating to produce land cover and crop type maps.

Digital Earth Africa

Digital Earth Africa aims to provide a routine, reliable and operational service, using EO to deliver decision-ready products enabling policy makers, scientists, the private sector and civil society to address social, environmental and economic changes on the continent and develop an eco-system for innovation across sectors. It achieves this by processing openly accessible and freely available data to produce decision-ready products.

www.digitalearthafrica.org

Given the replicability and open source of this service, Digital Earth Americas and Digital Earth Pacific have seen value and are now being implemented.

National land cover and crop type maps by FAO

FAO is building capacity in countries in producing national land cover and crop type maps, in-line with the Global Fun-damental Geospatial Data Themes to underpin the computation of several land based SDG indicators. The Land Cover Classification System (LCCS) provides a consistent framework for the classification and mapping of land cover. Its main objectives were to overcome the rigidity of *a priori* land cover existing classifications, which in many cases difficult the assign-ment of classes and the resulting mapping. Many materials are developed with the aim of making the process easy to understand and apply.

Globally, there are numerous data sources available providing topographic maps, EO, Digital Elevation Models (DEMs) and sources of geospatial information available for the SDGs. To help chart a path and demystify what sources of (global) data can be used, two key resources can be used, the "Global and Complementary (Non-authoritative) Geospatial Data for SDGs" and "Specifications of land cover data-sets for SDG indicator monitoring". Alongside engagement at the regional level, **commit to workshops with SDG Custodian Agencies**. These may focus on confirming appropriate data, methods and the coordination of development support.

Regardless of where the geospatial information originates, irrespective of whether data is drawn from the national, regional or global level, the actions to enable its use for the SDGs are broadly similar. By transforming raw data into decision-ready products, the ability to inform policy and action can be realised while the barriers of capability and cost are reduced.

[Key Action 4] Identify appropriate data, develop methods and coordinate development support

To identify appropriate methodologies to develop indicators following the prioritisation of indicators and the identification of suitable data, **workshops with SDG Custodian Agencies are a useful first step.** Liaising with other countries in the region in a systematic manner is another mechanism that can help confirm appropriate data, methods and coordinate development support. These similar efforts should be articulated into national discussions on how to further establish the technical environment around the SDGs.

From establishing geospatial and location-based information as official data for the SDGs and their global indicators, technological change is the sole constant. As a trend, as we develop new technologies new data and methods opportunities will become available, by embracing a forward-looking approach to using geospatial information for the SDGs, countries can take advantage of these novel data sources, regardless of whether these data sources are considered innovative.

For example, the Landsat programme, initiated in 1972, has consistently evolved and improved its sensors and ability to deliver better data. Now, both privately-owned or state-run constellations provide a variety of data including orthoimagery. Another example is the global Demographic and Health Surveys (DHS) Pro-gram. First initiated in 1984, it has been used for decades to collect, analyze, and disseminate data on the well-being of women and children, and is often used as the primary source of data for the global indicator framework. In recent years the DHS has added geographic information in all surveyed countries, which has enabled researchers and policy makers to assess the impact of location on health and other well-be-ing outcomes and is increasingly being used to improve accessibility of health services, including family planning interventions. UN Women provide a **case study of how these data can be used to monitor the SDGs from the gender perspective.** With the guiding notion of the SDGs being one where pro-gress towards the SDGs is "country-owned and country-led", it is advised that **the ability of a country to transform decision-making is limited, when the country does not wish to, or cannot commit to using geospatial information, regardless of how technically mature it may seem.**

[Key Action 5] Collaborate with national and global entities to leverage available capacity

The encompassing nature of the SDGs, should not be placed on the shoulders of the few within the national context. By promoting the participation of staff at all levels, the ability for sharing knowledge and socialising innovation can be realised. The SDGs are reported nationally but the challenge of developing appropriate methodologies is a global problem. Through dialogue, nationally and globally, highlighting resources that assist with the Design, Development and Testing of geospatial information for the SDGs, gaps can be identified and barriers overcome.

Selecting geospatial information and methodologies to produce, measure and monitor indicators

1.

USE GEOSPATIAL INFORMATION WHEN AVAILABLE

Where the recommended data sources are available, **geospatial information should be used.** If not, it can complement other data sources, bridge gaps, or add information and coverage. Time series with data of EO can be useful when matching data to reporting timeframes. When data is presented in an intuitive manner, contexts are better understood, this will lead to more informed decision-making. The List of Indicators is a useful resource to identify how geospatial information can be used.

2.

DEFINE SOURSES AND DETERMINE CORRECT INTEGRA-TION METHOD

It is generally preferable to utilise **national data,** where it can suit the national context better, providing greater and more relevant thematic detail, and has been produced and validated by experts with accurate local knowledge. **Global datasets** can also be advantageous, as they can provide an almost immediate assessment of an indicator's status and provide guidance and case studies for its correct use and integration for national estimation and reporting.

3.

IDENTIFY THE APPROPRIATE ATTRIBUTES OF A DATASET

Several attributes factors should be considered when selecting geospatial information. For example, when wanting to develop a Digital Earth Model, a cadastral database may not be the first place to start. Similarly, to conduct analysis in a specific time-frame, data will be needed for that time period. Aspects to consider include: Thematic match with the indicator methodology; Spatial resolution; Temporal coverage; Temporal extent; Availability of accuracy information.

4.

IDENTIFY RELEVANT ACTIONS ON THE DATA SELECTED

Where possible, geospatial information should be validated at the geographic level in which it is being used. Local ground or reference data should be of a higher quality than the dataset itself. Harmonising data will also be required where geospatial data is replacing or complimenting another data source; however, extensive methodological guidance is available (e.g. for Land Cover). National campaigns may be required to acquire, process, and analyze geospatial information.

Phase 3 identifies key actions that support the end-to-end process of producing to disseminating and reporting indicators. Through building on the foundation established in the previous Phases, the ability to produce, report, measure and monitor SDG indicators will be realised. Once data, attributes and methodologies are gathered and selected, and indicators are prioritized, the structure in charge of technical development should be established depending on the institutional ecosystem, to guarantee the best conditions for the continuous access to inputs and the analysis, and to achieve the continuity and appropriate frequency for the reporting effort.

Key Actions

1. Develop and enact an SDGs dissemination strategy
2. Implement a suitable data management and dissemination platform, identifying techno-logical capacities and gaps
3. Promote a culture of storytelling with existing data and highlight existing data gaps
4. Establish a publication calendar, identify areas responsible for monitoring
5. Publish metadata and continually update the list of prioritised indicators, including sources of information used

[Key Action 1] Develop and enact an SDGs production and dissemination strategy

Develop and publish an **SDG production and dissemination strategy, focused on the national environment and its decision-making needs,** after establishing a National SDGs Committee and developing an inclusive environment for design, development and testing of geospatial information for the SDGs. The development of this strategy should be led by the National SDGs Committee, and linked to national issues and development priorities. This will further emphasise that developing capacity to attain the goals and targets of the SDGs are the same needs for national development.

[Key Action 2] Implement a suitable data management and dissemination platform, identi-fying technological capacities and gaps

Once the challenge of accessibility to equipment and internet connectivity are resolved, there are several technologies available including open-source softwares and codes, many which are focused solely on the needs of the SDGs dissemination while others can be adapted. The challenge of accessibility to data and technology can be resolved through **dialog with regional and global actors, with the provision of technical assistance and capacity development** that ensue: workshops and meetings during the entire process, bringing together peers, SDGs Custodian Agencies, the IAEG-SDGs and other capacity development stakeholders, can help foster dialogue on developing strategic action and support the coordination of resources to mitigate these gaps.

Tools such as the **FIS4SDGs,** as well as National SDG Data Hubs, help with bridging the technology, divide, not only for the dissemination of results associated with the SDGs, but also to **guarantee a standardized management of geospatial information, and geospatially enabled indicators in general.** Further, the potential to reflect information at different levels of disaggregation, global and local, means that these tools and platforms are oriented to different types of users and facilitate both decision-making and focused actions that guarantee compliance with the targets and Goals of the 2030 Agenda.

Ultimately, while the ability of countries to use geospatial information for the SDGs is underpinned, **the full mainstream and transformation depend on the ability to communicate, develop and skill the people within the relevant agencies and ministries.** Indicators should be reported and dissemiinated at the smallest level geography possible, consistent with prevailing national guidelines related to the disclosure of geospatially integrated statistical data. By enabling disaggregation by geographic location, this helps provide data at both the national and local levels; the SDGs have a great local relevance to help improve decision-making at all levels of a country's decision-making process.

Reference: **The IGIF Strategic Pathway 9: Communication and Engagement**.

[Key Action 3] Promote a culture of storytelling with existing data and highlight existing data gaps

Storytelling is a vital method used to communicate to various stakeholders, whether national or global, the public or national agencies the importance of the 2030 Agenda, and the importance of integrating indicators into local policy. Telling stories generates an attractive shared understanding, at national, re-gional and global levels, and thus lays the foundation for a constructive dialogue and collaboration in the different stages of implementing the SDGs Geospatial Roadmap.

Storymaps are an efficient, pervasive interactive communication tool which integrates text, in-teractive maps, and other mechanisms to interactively visualise data, triggered and animated as the reader navigates through the Storymap. In embedding interactive maps and features, the user can interact with the underlying data and what the data represents in a relatively spontaneous manner. This interaction can include both simple and advanced analytics, such as zonal statistics or proximity analysis, yet would help inform decision-making. In the supporting material the **case study on Storymaps** communicates indicative principles and (both proprietary and open) technologies. In helping further entrenching the use of geospatial information within the national context, communicating the "how" and "why", it can also help other countries within our global community.

[Key Action 4] Establish a publication calendar, identify institutional areas responsible for managing the production, monitoring, measurement and dissemination process

From the landscape established by the SDGs Assessment Matrix, the agencies responsible for the underlying data, methodologies and producing the indicators should have been identified, along with a timeline for the release and dissemination of SDG indicators. Within this national statistical system, the national ministries and agencies should also have the ability to 'action' the data; informed policy and

decision-making is the ultimate aim of the SDGs. Through the constant production and dissemination of indicators, the ability to monitor and measure progress, identify where progress is, and is not being made can be realised. This will help further promote the trust and uptake of data. Accordingly, it is recommended **to incorporate information pertaining to the use of geospatial information within the National Data Publication Calendar, indicating the source(s) of geospatial information, levels of geographic disaggregation, national custodian institution(s) responsible for the indicator's production, institutions who will consume the emanating data, and other relevant pieces of information** based on national priorities.

[Key Action 5] Publish metadata and continually update the list of prioritised indicators, including sources of information used

Proactive steps are needed to ensure metadata and information relating to the prioritisation of indicators is published. This will help further enfranchise and socialise decisions made regarding the production and dissemination of indicators, but also their measurement and monitoring. This requires a broad agreement to use geospatial information in producing, measuring, monitoring and reporting geospatially enabled SDG indicators. But also, it is not just the origin of the data that is important, the metadata and methodologies of how data is transformed into an indicator have to be described.

One such development for the WGGI is to articulate **guidance for countries that enables them to review and validate indicators using geospatial information** - a key point of their forthcoming Work Plan for 2022. While a significant number of indicators can only be produced by geospatial information alone, almost all indicators would benefit from its use in its production, measurement or monitoring. All indicators produced should be geospatially enabled to allow for disaggregation by geographic location at sub-national levels, where possible. In turn, the consistent production will allow for progressive measurement and monitoring at these levels of geography. Further progress can be achieved through leveraging **existing resources, such as the Global and Complementary Geospatial Data for the SDGs report and identifying agreed minimum validation criteria or common parameters that SDG Custodian Agencies could use to validate the effectiveness of EO through its metadata.** In a case study, **Japan and FAO** highlight national and regional examples of the process in using geospatial information and EO data to produce an indicator, specifically SDG indicator 15.4.2 - Mountain Green Cover Index.

We are in a constantly evolving ecosystem, where the advent of new technologies combined with research of novel methodologies offers opportunities not considered last years, let alone during the adoption of the SDGs in 2015. Geospatial information is the missing component that will enable the robust transformation of official statistics and to achieve the shared vision of the 2030 Agenda. Several resources discussed within this Roadmap that can be used to fully understand the role of geospatial information, how to integrate it within the national context, support the transformation within a country's governance, technological capability and staffing capacity and meet the challenge of the SDGs. This will be a constantly moving target, which will be consistently improved by a commensurate development and accessibility to novel technology, methodologies and approaches. The gulf between our current abilities and the future that we want is still large, but proactive steps should be taken to bridge the geospatial digital divide and take the bold and transformative steps which are urgently needed to shift the world onto a sustainable and resilient path.

SUMMARY AND CALL TO ACTION

Implementing the SDGs Geospatial Roadmap will enable countries to better harness geospatial information for the production, measurement, monitoring and reporting of geospatially related indicators. Further, this will help countries disaggregate indicators by geographic location and combine with data disaggregated by income, sex, age and other statistical dimensions to help countries with making decisions informed by data. While it is already recognised that integration of these forms of data is a critical driver that enables the implementation of the SDGs, this cannot be achieved through statistics alone in part due to the interconnected and interrelated nature of the SDGs.

Unfortunately, the call of Goal 17 to "enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts" by 2020 was not met. However, we collectively have the tools and mechanisms that will enable the production and dissemination of high-quality, timely and reliable data within our grasp.

At the foundation of this is geospatial information; from adding value to all other disaggregation to providing the key mechanism which will enable the full realisation of the overarching principle of the 2030 Agenda for Sustainable Development, namely to leave no-one behind and to reach those furthest behind first. Geographic information is the key component that can highlight groups which are currently lagging behind, whether through disaggregation of income, sex, age, race, ethnicity, migratory status, disability or other characteristics relevant in national contexts. In sum, geospatial information provides the basis to integrate and analyse data, inform decision-making, and enable the 'where' needed for action. This Roadmap is the starting point to enable the IAEG-SDGs, custodian agencies and states to fully harness geospatial information for the SDGs, and in turn, this Roadmap calls for geospatial and location-based information to now be recognised and accepted as official data for the SDGs alongside official statistics.

Notes

The designations used and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries. The term "country" as used in this publication also refers, as appropriate, to territories or areas. The designations "developed regions" and "developing regions" are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. The boundaries and names shown and the designations used on the maps on this site do not imply official endorsement or acceptance by the United Nations.

United Nations Statistical Commission

The United Nations Statistical Commission (UNSC), established in 1947, is the highest body of the global statistical system. It brings together the Chief Statisticians from member states from around the world. It is the highest decision-making body for international statistical activities especially the setting of statistical standards, the development of concepts and methods and their implementation at the national and international level. UNSC is a subsidiary body of the UN Economic and Social Council (ECOSOC).

United Nations Committee of Experts on Global Geospatial Information Management

The United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) is the apex intergovernmental body to discuss, enhance and coordinate global geospatial information management activities by involving Member States at the highest level, to work with Governments to make joint decisions and set directions on the use of geospatial information within national and global policy frameworks, and to develop effective strategies to build geospatial capacity in developing coun-tries. UN-GGIM is also a subsidiary body of ECOSOC.

The IAEG-SDGs Working Group on Geospatial Information (WGGI)

In September 2015, Member States adopted the 2030 Agenda for Sustainable Development and tasked the United Nations Statistical Commission to develop the global indicator framework. The overarching principle of the 2030 Agenda for Sustainable Development is that no one should be left behind. At its 46th Session in March 2015, UNSC established the Inter-agency and Expert Group on SDG Indicators (IAEG-SDGs), composed of Member States and including regional and international agencies as observers. The IAEG-SDGs was tasked to develop a global indicator framework for the 17 goals and 169 targets of the 2030 Agenda, and to support its implementation. The IAEG-SDGs, in its report to the UNSC (in March 2016) noted that the integration of statistical data and geospatial information will be key for the production of a number of indicators. As a means to address these issues, and to address specific areas relevant to the production of SDGs indicator, the IAEG-SDGs created the Working Group on Geospatial Information (WGGI) at its third meeting in Mexico City. The WGGI is composed of representatives from the IAEG-SDGs, SDG Custodian Agencies, and experts from the wider geospatial and Earth Observations communities, including from UN-GGIM. Together, the WGGI diligently works to provide expertise and advice to the IAEG-SDGs, custodian agencies and the broader statistical community as to how geospatial data, Earth Observations and other new data sources can reliably and consistently contribute to the production and dissemination of the indicators.

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