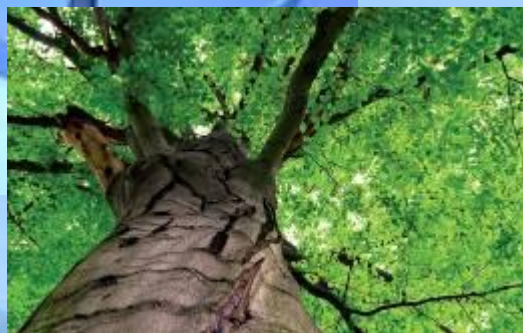


# Chapter 1: Overview of Environment Statistics – Characteristics and Challenges



**Workshop on Environment Statistics in support of the  
implementation of the Framework for the Development of  
Environment Statistics (FDES 2013)  
(Lomé, Togo, 19-23 October 2015)**



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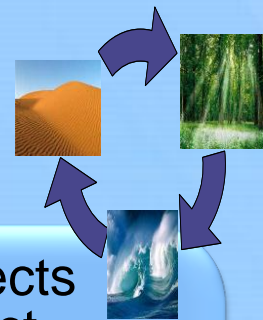
# 1. Objective of environment statistics

To:

- improve knowledge of the environment;
- support evidence-based policy and decision making; and
- provide information for the general public and specific user groups about the state of the environment and the main factors that influence it.



## 2. Scope of environment statistics



- Covers biophysical aspects of the environment and those aspects of the socio-economic system that directly influence and interact with the environment.
- The scope of environment, social and economic statistics overlap and it is not easy – or necessary – to draw a clear line dividing these areas.
  - Social and economic statistics that describe processes or activities with a direct impact on, or direct interaction with, the environment are used widely in environment statistics. They are within the scope of the FDES.
- Other relevant social and economic statistics, which are not part of environment statistics, are also required to place environmental issues in context and facilitate the integrated analysis of environmental, social and economic processes.
  - The use of consistent definitions and classifications among these fields supports their integration.





### 3. Main users of environment statistics

The type, the level of thematic, spatial and temporal aggregation, and the format of environment statistics depend on the type of user **and** the intended use.

<b>Users</b>	<b>Main Types of Environment Statistics</b>
<b>Policy and Decision Makers</b>	<b>Environmental indicators and more aggregated statistics</b>
<b>General Public (including media and civil society)</b>	<b>Environmental indicators and more aggregated statistics</b>
<b>Analysts, Researchers, and Academia</b>	<b>Extensive and detailed environment statistics</b>
<b>International Agencies</b>	<b>Detailed environment statistics, indicators and their metadata</b>



# Products of Environment Statistics

The main products of environment statistics are:

- Detailed descriptive environment statistics series
- Environmental indicators

Both can be:

- Stored in multi-purpose databases
- Disseminated in the form of
  - Online databases
  - Publications (e.g., compendia, yearbooks, thematic reports)
  - Analytical publications (e.g., state of the environment reports)





## 4. Environmental information, data, statistics and indicators



### Examples of quantitative environmental information

Environmental data

Environment statistics

Environmental indicators

Environmental indices

Environmental-economic accounts



## 4. Environmental information, data, statistics and indicators

### Environmental information

- Environmental information includes quantitative and qualitative facts describing the state of the environment and its changes.
  - **Quantitative environmental information**
    - **Consists of data, statistics and indicators and is generally disseminated through databases, spreadsheets, compendia and yearbooks.**
  - **Qualitative environmental information**
    - Consists of descriptions (e.g., textual or pictorial) of the environment or its constituent parts that cannot be adequately represented by accurate quantitative descriptors.

Geographically referenced environmental information provides facts on the environment and its components using digital maps, satellite imagery and other sources linked to a location or map feature.







## 4. Environmental information, data, statistics and indicators

### Environmental data

- Environmental data are large amounts of unprocessed observations and measurements about the environment and related processes.
- They may be collected or compiled by:
  - national statistical offices, environmental ministries, sectoral authorities (e.g., water, forest, mining)
  - using different types of sources:
    - statistical surveys (censuses or sample surveys)
    - administrative records, geographic databases, registers and inventories
    - monitoring networks, thematic mapping, remote sensing, scientific research, and field studies.



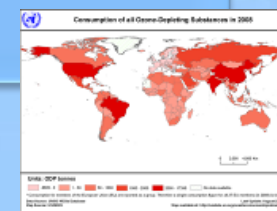


## 4. Environmental information, data, statistics and indicators

### Environment statistics

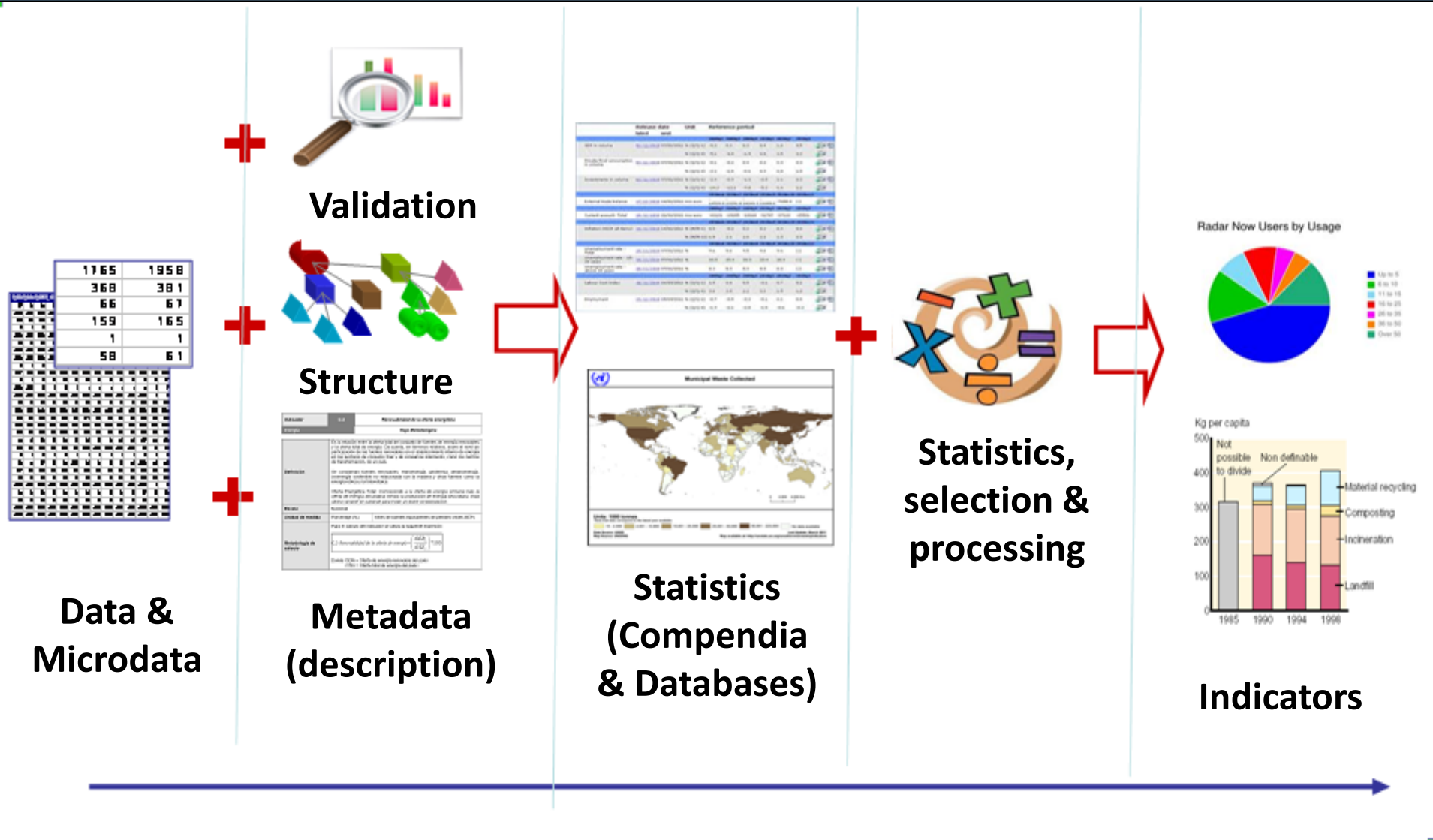
- Environment statistics are environmental data that have been structured, synthesized and aggregated according to statistical methods, standards and procedures.
- Environment statistics process environmental and other data into meaningful statistics describing the state of and trends in the environment and the main processes affecting them.
- Not all environmental data are used to produce environment statistics.
  - The FDES provides a framework that identifies environmental and other data that fall within its scope
  - The FDES contributes to structuring, synthesizing and aggregating the data into statistical series and indicators

L24K Transaction Volumes (millions)					
Month	2007	2008	2009	2010	2011
Jan	208.00	214.00	224.90	224.00	232.90
Feb	204.50	224.00	216.40	224.20	229.90
Mar	236.10	234.00	245.20	253.90	259.79
Apr	226.30	232.00	241.06	252.20	259.70
May	237.90	251.50	255.19	262.00	262.20
Jun	233.80	235.90	246.00	255.00	257.48
Jul	231.60	244.70	251.30	266.70	268.04
Aug	236.00	244.21	247.60	256.30	259.24
Sep	229.00	237.22	244.00	253.30	260.52
Oct	239.00	250.40	260.20	263.10	268.06
Nov	234.00	236.70	241.00	246.60	
Dec	230.00	237.20	244.00	242.00	
Total	2,746.20	2,841.83	2,916.85	2,999.30	2,557.83





# Environment statistics units compile, collect, validate, describe and structure environmental data to produce environment statistics series



## Statistical process: from raw data to statistics and indicators



## 4. Environmental information, data, statistics and indicators

# Environmental indicators



- Environmental indicators:
  - are environment statistics that have been selected for their ability to depict important phenomena or dynamics and are used to synthesize and present complex environment and other statistics in a simple, direct, clear and relevant way;
  - are generated because environment statistics are usually too numerous and detailed to meet the needs of policy makers and the general public, and often require further processing and interpretation to be meaningful;
  - may take various forms such as rates, ratios or proportions, and be constructed at different levels of aggregation; and
  - can be used to assess present and future directions with respect to goals and targets, evaluate and determine the impact of specific programmes, monitor progress, measure changes in a specific condition or situation over time, and convey messages.
- Policy frameworks such as the Millennium Development Goal (MDG) and Sustainable Development Goal (SDG) frameworks, the Driving force – Pressure – State – Impact – Response (DPSIR) framework and national environment/sustainable development indicator sets, are typically used to identify and structure indicators.





## 4. Environmental information, data, statistics and indicators

### Environmental indices



- Environmental indices:
  - are composite or more complex measures that combine and synthesize more than one environmental indicator or statistic and are weighted according to different methods.
- Benefit:
  - an index can provide a valuable summary measure to communicate important messages in an accessible way and, thus, raise awareness.
- Possible limitation:
  - often raise questions regarding their proper interpretation, methodological soundness, subjectivity of the weighting, and the quality of the underlying statistics.



## 5. Sources of environment statistics

- Environment statistics synthesize data originating from various types of sources.
- Data used to produce environment statistics are not only compiled by many different collection techniques, but also by many different institutions.
- Understanding the pros and cons of each source is key in the production of environment statistics.





## 5. Sources of environment statistics

### Types of sources

1. **Statistical surveys** (e.g., censuses or sample surveys of population, housing, agriculture, enterprises, households, employment, and different aspects of environment management)
2. **Administrative records** of government and non-government agencies responsible for natural resources, as well as other ministries and authorities
3. **Remote sensing and thematic mapping** (e.g., satellite imaging and mapping of land use and land cover, water bodies or forest cover)
4. **Monitoring systems** (e.g., field-monitoring stations for water quality, air pollution or climate)
5. **Scientific research and special projects undertaken to fulfill domestic or international demand**



## 5. Sources of environment statistics

### Statistical Surveys



- a) **Census:** a survey that collects data from the entire population of interest
- b) **Sample Survey:** a survey carried out using a sampling method, in which data are collected from a representative portion of the population of interest and not the whole population

#### Environment statistics can be collected from surveys by:

- I. adding environment-related questions to surveys intended primarily to collect data on other topics;
- II. using surveys intended primarily to collect environment statistics.
  - When environmental data are collected through environment statistics surveys, the survey design reflects the objective of producing environment statistics.
- Environment statistics surveys are not always economically feasible with restricted budgets.
- Data are frequently obtained from other existing statistical surveys (e.g., social, economic and sectoral) whose primary objective differs from the production of environment statistics.





## 5. Sources of environment statistics

### Administrative records



- Administrative data kept by government agencies or NGOs may be used for the production of environment statistics

#### Advantage:

- Cost of collecting such data is significantly less than creating and conducting a survey
- Level of response burden is minimized
- Complete coverage of units under administration is assured

#### Possible Limitations:

- Differences between administrative and statistical terms and definitions
- Deliberate misreporting may occur
- Data may not be checked or validated for statistical purposes;
- Restrictions may be placed on access to data
- Coverage, though complete for administrative purposes, might not match statistical requirements



## 5. Sources of environment statistics

# Remote Sensing and Thematic Mapping



- Remote sensing is the science of obtaining information about objects or areas from a distance, typically from aircraft or satellites.
- Remote sensing makes it possible to:
  - Collect data on dangerous or inaccessible areas
  - Replace costly and slow data collection on the ground, thus ensuring that areas or objects are not disturbed
- Uses: satellite, aircraft, spacecraft, buoy, ship, balloon and helicopter images
- Result can be: mapped, imaged, tracked and observed
- Example:

Remote sensing data can be captured and analyzed to measure forest cover, compare the impact of natural disasters, changes in the area of soil erosion, the extent of pollution, changes in land cover or population estimates of animal species.

**Remote sensing, combined with thematic mapping data and sufficient validation using actual measurements in the field, usually provides consistent and high quality data for environment statistics.**



## 5. Sources of environment statistics

# Monitoring systems

- Typically comprised of **field-monitoring stations** which are used to describe the qualitative and quantitative aspects of the environmental media (e.g., air, water or soil quality, or hydrological or meteorological characteristics).

### Main advantages:

- i. Usually collected using verifiable scientific methods
- ii. Usually validated
- iii. Often available as time series
- iv. Frequently use models to improve data quality



### Possible limitations:

- Field monitoring stations are usually located in “hot-spot” areas with
  - i. high levels of pollution;
  - ii. high sensitivity; or
  - iii. large numbers of the population being affected

**Therefore, the measurements will be location-specific and more difficult to aggregate over space to produce measures of quality over larger territories**



## 5. Sources of environment statistics

# Scientific Research and Special Projects

Main advantages of using data from scientific research and special projects are that they:

- i. are usually available at no or low cost
- ii. minimize the response burden
- iii. can be used to address data gaps
- iv. are useful for developing coefficients for models



Possible limitations of using these sources include that:

- i. they often use terms and definitions that differ from those used in statistics
- ii. access to microdata may be limited
- iii. metadata may be missing
- iv. data are often available only for case examples (i.e. limited areas or industries)
- v. data are often available on a one-time basis only

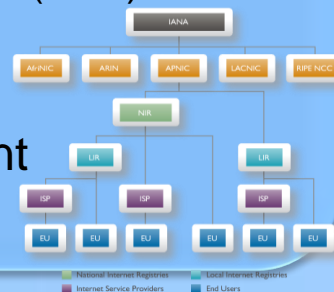






## 6. Classifications and other groupings relevant to environment statistics

- There is no single overarching, internationally agreed classification of the environment for statistical purposes, such as ISIC. There are coexisting and emerging classifications and categorizations for specific subject areas, which include standardized statistical classifications as well as less formalized groupings or categories.
  - Environment statistics uses specific classifications, e.g., FAO Land Cover Classification System, UN Framework Classification for Fossil Energy and Mineral Reserves and Resources (UNFC), Classification of Environmental Activities (CEA)
  - Also, environment statistics uses classifications, categories and groupings, e.g., the classification of natural and technological disasters (CRED-EMDAT), the classification of protected areas and of threatened species (UNEP-WCMC and IUCN), or the source categories for GHGs from the IPCC, that were not developed for statistical purposes.
- Environment statistics also uses economic and social-demographic classifications:
  - International Standard Industrial Classification of All Economic Activities (ISIC)
  - Central Product Classification (CPC)
  - International Classification of Diseases (ICD)
- The use of these classifications facilitates integration of environment statistics with economic and social-demographic statistics.





## 7. Temporal considerations



- Different time scales or longer or shorter time periods must be used to aggregate environmental data over time.
  - For example air pollution daily... forest cover every 5 years
- Determining the appropriate temporal aggregation of environment statistics involves a variety of considerations depending on the nature of the measured phenomena
- Even when environmental data are produced at irregular intervals, environment statistics based on these data can still be produced at regular intervals if there are enough data points in each period to do so.



# Examples of frequency, periodicity, temporal aggregation



Primary data collection

Primary production-compilation

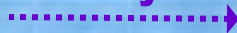
Compilation/elaboration of environment statistics/indicators

NSO: Environmental Surveys



Periodicity of primary production

**Yearly**



Periodicity of transfer to Department of Environment Statistics

**Yearly**



Department of Environment Statistics / Indicators

Dissemination periodicity

Dissemination compendia, databases

Air Quality Monitoring Station



**Daily**



**Monthly**



NSO and/or Environmental Ministry

**Annual**



Remote sensing - Forest Cover



**Every 5-years**



**Every 5-years**



Energy providers



**Monthly**



**Quarterly**





## 7. Temporal considerations (cont.)



### Example:

- **Fluid environmental phenomena** call for careful consideration of the temporal dimension because ebbs and flows, droughts and floods, snow and runoffs can occur, which all influence measurements.
- Variations may be daily and, at other times, seasonal depending on what is being measured.
  - Seasonal variations may be seen in the fluctuations in certain types of fish biomass, surface water levels, ice cap surface or the incidence of fires. In such cases, monitoring must focus more on certain months than others.





## 8. Spatial considerations



- The occurrence and impacts of environmental phenomena are distributed spatially without regard for political-administrative boundaries.
- **Meaningful spatial units for environment statistics are**
  - natural units, e.g., watersheds, ecosystems, eco-zones, landscape or land cover units; or
  - management and planning units based on natural units, i.e.: protected areas, coastal areas or river basin districts.
- Economic and social statistics are aggregated traditionally according to administrative units.
  - This difference can complicate the collection and analysis of environment statistics particularly when they must be combined with data originating from social and economic statistics.
  - However, there is a trend towards producing more geo-referenced data, which would overcome some of the spatial complications of analysis.



## 9. Geospatial information and environment statistics

- Geospatial information:
  - presents the location and characteristics of different attributes of the atmosphere, surface and sub-surface.
  - is used to describe, display and analyse data with discernible spatial aspects, such as land use, water resources and natural disasters.
  - allows for the visual display of different statistics in a map-based layout which can make it easier for users to work with and understand the data.
- The ability to overlay multiple data sets using software, for instance on population, environmental quality, and environmental health, allows for a deeper analysis of the relationship among these phenomena.





## 9. Geospatial information and environment statistics

# GIS, Remote Sensing, satellite images

- Remote sensing data from satellites are obtained digitally and communicated to central facilities for processing and analysis in GIS.
- Digital satellite images can be analysed in GIS to produce land cover and land use maps. When different types of geospatial data are combined in GIS (e.g., by combining satellite remote sensing land use information with aerial photographic data on housing development growth) the data are transformed so that they are coincident and fit the same coordinates.
- GIS uses the processing power of a computer, together with geographic mapping techniques (cartography), to transform data from different sources onto one projection and one scale so that the data can be analysed and modelled together.



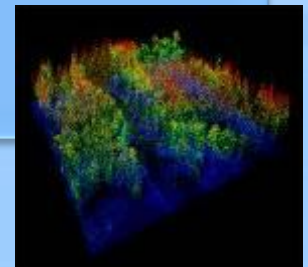


## 9. Geospatial information and environment statistics

# Geographic information system (GIS)

A GIS is an integrating technology that helps to capture, manage, analyse, visualize and model a wide range of data with a spatial or locational component.

- Geospatial data may be obtained using a variety of technologies such as:
  - Global Positioning System (GPS) and remote sensing satellites.
- The attributes of the collected data can be entered:
  - Manually (land-use information, demographics, landscape features)
  - Digitized from a map to a digital format by electronic scanning (land survey map)
- The final representation of the data is constructed by superimposing different layers of information as required by the analytical and/or policy requirements.









## 10. Institutional dimension of environment statistics

### Resolving institutional concerns



- Identifying the primary institutional obstacles that impede the production of environment statistics and developing a strategy to overcome these is essential for countries that seek to develop or strengthen their environment statistics programmes.
- Key elements pertaining to the institutional dimension that should be considered and dealt with simultaneously while developing environment statistics include:
  - The legal framework
  - Institutional development
  - Inter-institutional collaboration
  - Institutional cooperation among national, regional and global bodies



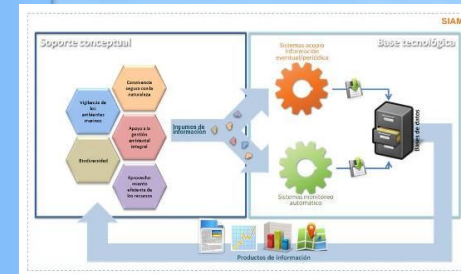
## 10. Institutional dimension of environment statistics

### Legal Framework

Relevant for production of environment statistics commonly consists of statistical, environmental and other relevant sectoral legislation, such as for water, energy and agriculture.

- National statistical legislation: NSO is usually the authority responsible for creating and coordinating the national statistical system.

- Laws do not explicitly refer to environment statistics (relatively new statistical domain). Insufficient guidelines for statistical coordination among the relevant statistical parties in the country.



National Statistics Office  
National Statistics Office



## 10. Institutional dimension of environment statistics

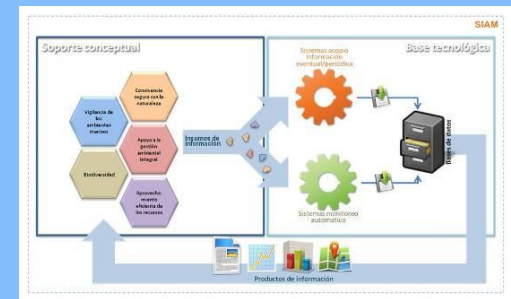
### Legal Framework (cont.)

Nevertheless, since the environment is becoming increasingly important in the development agenda, NSOs have included the production of environment statistics in their programmes, though sometimes without clarifying the supporting institutional arrangements.

Challenges of complex institutional context:

- Overlapping mandates
- Duplication of efforts
- Other coordination difficulties

It is often difficult to determine the official figures for a specific statistic when different agencies produce the same or similar statistics, but with different values.







## 10. Institutional dimension of environment statistics

### Institutional development



- A well-defined mandate and the designation of a specific unit responsible for producing environment statistics is critical for the successful organization of a national environment statistics programme within the official institutions that are responsible for producing statistics.
- This unit requires a regular operations budget and a minimum number of trained personnel for the tasks involved.

***Environment statistics units thus need a capacity-building programme for staff, together with the financial resources to implement it.***



## 10. Institutional dimension of environment statistics

### Inter-institutional collaboration

Institutions  
and people



- Environment statistics cover several topics for which the data are generated by NSOs, specialized agencies, ministries, provincial and municipal governments and scientific institutions.
- This requires these stakeholders to collaborate, both at the strategic and technical level.



## 10. Institutional dimension of environment statistics

### Inter-institutional collaboration (cont.)



- Collaboration of national and sub-national institutions can take the form of a multi-stakeholder or interagency platform tasked with coordinating the strategic development and production of environment statistics.
- Interagency platforms bring together users and producers of environment statistics to identify users' needs and ensure the coordinated production of the necessary environment statistics from a variety of data sources.
- One of the tasks of the platform is to ensure that a common statistical methodology or protocol is used to ensure comparability and statistical soundness. Another relevant function is to preserve continuity over time, despite significant turnover of staff in the partner institutions.
- If tasked with overseeing the national statistical system and coordinating these platforms, the NSO must have adequate authority, resources or capacities to lead the multi-stakeholder processes.
- Depending on the institutional arrangement, the environmental ministry or equivalent institution in many developing countries coordinates such platforms.





## 10. Institutional dimension of environment statistics

### **Institutional cooperation: national/regional/global**

- International organizations that produce environmental data and statistics also face the same institutional challenges as countries.
- It is very important to consider the operational aspects that can improve coordination and resource utilization among the national, regional and global levels, with the understanding that all potential partners have different mandates, work programmes and deadlines.
- Reporting requirements for certain international agreements and treaties, which are an important dimension of environment statistics, should be included in national environment statistics programmes.





# Thank you for your attention!

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