

DRAFT
Revised Framework for the
Development of Environment Statistics (FDES)

Chapters 1-5

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Acronyms

CEA:	Classification of Environmental Activities
CEPA:	Classification of Environmental Protection Activities
CES:	Conference of European Statisticians
CIESIN:	Centre for International Earth Science Information Network
CITES:	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CPC:	Central Product Classification
CRED EM-DAT:	Centre for Research on the Epidemiology of Disasters Emergency Disasters Database
CReMA:	Classification of Resource Management Activities
DDT:	Dichlorodiphenyltrichloroethane
DPSIR:	Driving forces-Pressure-State-Impact-Response Model
ECE:	Economic Commission for Europe
EEA:	European Environment Agency
EEZ:	Exclusive Economic Zone
EGM:	Expert Group Meeting
EIS:	Environmental Information System
EMEP:	European Monitoring and Evaluation Programme
FAO:	Food and Agriculture Organization of the United Nations
FDES:	Framework for the Development of Environment Statistics
FRA:	Forest Resources Assessment
GHG:	Greenhouse Gases
GIS:	Geographic Information System
GLASOD:	Global Assessment of Human-induced Soil Degradation
GPS:	Global Positioning System
IEMO:	International Emergency Management Organization
IIASA:	International Institute for Applied Systems Analysis
IISD:	International Institute for Sustainable Development
IPCC:	Inter-governmental Panel on Climate Change
IRES:	International Recommendations for Energy Statistics
IRWS:	International Recommendations for Water Statistics
ISCAAP:	International Standard Classification for Aquatic Animals and Plants
ISIC:	International Standard Industrial Classification of all Economic Activities
ISRIC:	International Soil Reference and Information Centre
IUCN:	International Union for Conservation of Nature
MAR:	Monitoring, assessment and reporting
MDG:	Millennium Development Goal
MEA:	Multilateral Environmental Agreement
NASA:	National Aeronautics and Space Administration
NOAA:	National Oceanic and Atmospheric Administration
NSO:	National Statistical Office
ODS:	Ozone Depleting Substances
OECD:	Organization for Economic Co-operation and Development
PCB:	Polychlorinated Biphenyl
PM:	Particulate Matter (also known as Suspended Particulate Matter)
PSR:	Pressure-State-Response Framework

SDI:	UN Commission for Sustainable Development’s Sustainable Development Indicators
SEEA:	System of Environmental-Economic Accounting
SIDS:	Small Island Developing States
SIEC:	Standard International Energy Product Classification
SNA:	System of National Accounts
SPM:	Suspended Particulate Matter (also known as Particulate Matter)
S-RESS:	Stress Response Environment Statistics System
UNCCD:	United Nations Convention to Combat Desertification
UNCLOS:	United Nations Convention on the Law of the Sea
UNECLAC:	Economic Commission for Latin America and the Caribbean
UNEP GEMS:	Environment Programme Global Environment Monitoring System
UNEP-WCMC:	United Nations Environment Programme – World Conservation Monitoring Centre
UNFC:	United Nations Framework Classification for Energy and Mineral Resources
UNFCCC:	UN Framework Convention on Climate Change
UNFF:	UN Forum on Forests
UNFPA:	Population Fund
UNSD:	United Nations Statistics Division
UV:	Ultraviolet
WHO:	World Health Organization
WMO:	World Meteorological Organization

Introduction

- 1.1. Though environment statistics is still a relatively new statistical domain, the demand for such statistics is increasing in step with continued environmental degradation and the challenges associated with better management of the environment. The recognition that human wellbeing depends on the environment has led to a growing list of environmental issues on which decisions must be taken, such as climate change, biodiversity loss and natural resource management. Given the need for governments, businesses, households and other decision makers to deal effectively with these issues, the environment statistics informing them must be of the highest quality possible.
- 1.2. Environment statistics describe the state and changes of environmental conditions, the quality and availability of environmental resources, the impact of human activities and natural events on the environment, the impact of changing environmental conditions, as well as the social actions and economic measures taken by societies to avoid or mitigate these impacts and to restore and maintain the capacity of the environment to provide the services that are essential for life and human wellbeing.
- 1.3. Environment statistics cover a wide range of information and are interdisciplinary in nature. Their sources are dispersed over a variety of data collecting institutions, and similarly numerous methods are applied in their compilation. The field of environment statistics requires a proper framework to guide its development, coordination and organization.
- 1.4. An environment statistics framework should: (i) facilitate a synthesized presentation of data from various subject areas and sources; (ii) suitably simplify the complexity of the environment so as to render its measurement tractable; (iii) help identify the range of statistics relevant to societal decision-making regarding the environment; (iv) be coherent to the fullest extent possible with frameworks for statistics already used in other domains in order to facilitate the integration of environment statistics; and (v) be conceptually based.
- 1.5. The Framework for the Development of Environment Statistics (FDES) was first published in 1984 by the United Nations Statistics Division (UNSD), along with its subsequent publications, *Concepts and Methods of Environment Statistics: Human*

*Settlements Statistics*¹ (1988) and *Concepts and Methods of Environment Statistics: Statistics of the Natural Environment*² (1991). The 1984 FDES and subsequent publications have been a useful framework for guiding countries in the development their environment statistics programmes. During the time since its publication there have been a number of scientific, political, technological, statistical and experience-based developments which suggested that the FDES was ready for revision.

- 1.6. As a consequence, the United Nations Statistical Commission, at its 41st session (23-26 February 2010), endorsed a work programme and the establishment of an Expert Group for the revision of the FDES. The members of the Expert Group represented producers and users of environment statistics of countries from all regions and at different stages of development, as well as international organizations, specialized agencies and non-governmental organizations.

The revision process

- 1.7. The revision was based on an agreed set of criteria and has been supported by extensive international expert consultation. The 1984 FDES was used as the starting point. It was revised taking into account the lessons learned during its application in different countries as well as improved scientific knowledge about the environment and new requirements created by emerging environmental concerns and policy issues including major multilateral environmental agreements (MEAs). The revision has also taken into account the increasing prominence of environmental sustainability and sustainable development issues and concepts. Existing environment statistics and indicator frameworks were analyzed, including major developments in the field of environmental-economic accounting and selected thematic developments pertinent to environment statistics. (For more information on developments since 1984 and on MEAs please see Annex A: Developments since 1984; and Annex B: Multilateral environmental agreements).

The revised FDES

- 1.8. The FDES is relevant to, and recommended for use by, countries at any stage of development. However, its primary objective is to guide the formulation of environment statistics programmes in countries at early stages in the development of environment statistics by: (i) identifying the scope and constituent components, sub-components and statistical topics; (ii) contributing to the assessment of data requirements, sources, availability and gaps; (iii) guiding the development of multipurpose data collection

¹ http://unstats.un.org/unsd/publication/SeriesF/SeriesF_51e.pdf

² http://unstats.un.org/unsd/publication/SeriesF/SeriesF_57E.pdf

processes and databases; and (iv) assisting in the co-ordination and organization of environment statistics, given the inter-institutional nature of the domain.

- 1.9. The revised FDES is a multipurpose conceptual and statistical framework that is comprehensive and integrative in nature. It provides an organizing structure to guide the collection and compilation of environment statistics and to synthesize data from various subject areas and sources. It is broad and holistic in nature, covering the issues and aspects of the environment that are relevant for analysis, policy and decision making.
- 1.10. The FDES is structured in a way that allows links to economic and social domains. It seeks to be compatible with other frameworks and systems, both statistical and analytical, such as for instance the System of Environmental-Economic Accounting (SEEA), the Driving force – Pressure – State – Impact – Response (DPSIR) framework, and the Millennium Development Goals (MDGs) indicator framework. As such, the FDES facilitates data integration within environment statistics and with economic and social statistics.
- 1.11. The FDES organizes environment statistics into a structure of six components, each of them broken down into sub-components and statistical topics. The six components cover environmental conditions and quality; the availability and use of environmental resources and related human activities; the use of the environment as a sink for wastes and residuals and related human activities; extreme events and disasters; human habitat and environmental health; and social and economic measures for the protection and management of the environment.
- 1.12. The statistical topics represent the quantifiable aspects of the components and they are grouped into sub-components, taking into account the types and sources of the statistics needed to describe them.
- 1.13. The FDES sets out, arranged in three tiers, a comprehensive (though not exhaustive) list of statistics (the Basic Set of Environment Statistics) that describe the statistical topics. Within this scope, a Core Set of Environment Statistics has been identified as Tier 1. The objective of the Core Set is to serve as an agreed limited set of environment statistics that are relevant to all countries. Harmonized international definitions, classifications and data collection methods for these statistics will be provided in subsequent methodological handbooks to facilitate their production in an internationally comparable manner.

1.14. The FDES targets a wide user community including environmental statisticians in national statistical offices (NSOs), environmental administration and management as well as other producers of environment statistics. It helps to mark out the roles of the different data producers, thus facilitating coordination.

Structure of the document

1.15. Chapter 1 of the FDES gives an overview of the main characteristics of environment statistics. Chapter 2 presents the conceptual foundation of the FDES and introduces the six components that provide the organizational structure for environment statistics. Chapter 3 provides an expanded discussion of the components, sub-components and statistical topics of the FDES. Chapter 4 presents the statistics underlying the topics of the FDES (the Basic Set of Environment Statistics), and introduces the Core Set of Environment Statistics, describing the criteria and process for their selection. Chapter 5 gives examples of the application of the FDES to selected cross-cutting environmental issues and specific analytical needs.

Chapter 1: Overview of Environment Statistics

- 1.16. This chapter describes the domain of environment statistics, introduces its main characteristics, and discusses some of the methodological and institutional challenges that need to be considered when working in this field. The FDES, as a tool to organize the contents and the production of environment statistics, will be described in depth in Chapter 2.
- 1.17. Like social and economic statistics, environment statistics is a domain composed of different substantive themes and components where, besides the NSOs and Environmental Ministries, several other institutions are key players. Within this relatively new statistical domain, the necessary methodological resources, tools and good practices are being developed and systematized progressively. Ongoing development and organization of environment statistics at national and international levels can also be observed, noting that countries have progressed, and are progressing, in a heterogeneous way.
- 1.18. Environment statistics are multidisciplinary and cross-cutting, involving numerous sources and stakeholders. To effectively produce environment statistics, specific statistical and environmental expertise, institutional development capabilities, and adequate resources are equally necessary. Many countries still require substantial technical assistance and capacity building in developing national environment statistics programmes.

1.1 Objective of environment statistics

- 1.19. The objective of environment statistics is to provide information about the environment, its most important changes over time and across locations, and the main factors that influence them. Ultimately, environment statistics aim at providing high quality statistical information to improve knowledge of the environment, to support evidence-based policy and decision making, and to provide information for the general public, as well as for specific user groups.

1.2 Scope of environment statistics

- 1.20. The scope of environment statistics covers biophysical aspects of the environment and those aspects of the human sub-system that directly influence and interact with the environment.
- 1.21. Within this scope, environment statistics describe the state and changes of environmental conditions, the quality and availability of environmental resources, the impact of human activities and natural events on the environment, the impact of changing environmental conditions, as well as the social actions and economic measures taken by societies to avoid or mitigate these impacts and to restore and maintain the capacity of the environment to provide the services that are essential for life and human wellbeing (see Paragraph 1.3).

1.22. The scope of environment, social and economic statistics overlap and it is not easy (and not necessary) to draw a fine dividing line between these statistical areas. Social and economic statistics describing processes or activities that have a direct impact on, or interact directly with, the environment are widely used in environment statistics and they are within the scope of the FDES. Beyond that, other relevant social and economic statistics are also required to put environmental issues in context and to facilitate the integrated analysis of environmental, social and economic processes. The use of consistent definitions and classifications among these fields helps their integration. When properly integrated, data and other inputs from these domains enrich the analysis of environment statistics.

1.3 Main uses and user groups of environment statistics

1.23. Environment statistics serve a variety of users, including but not restricted to:

- i. Policy and decision makers at all levels;
- ii. The general public, including media and civil society;
- iii. Analysts and researchers;
- iv. Academia; and
- v. International agencies.

1.24. Different users need environment statistics at different levels of aggregation and depths of information. They may need cross-cutting environment statistics data sets, for instance regarding climate change. In other cases they may only be interested in particular topics and themes pertaining to specific sectoral analysis and policy making. Policy and decision makers, and the general public would tend to use environmental indicators, whereas researchers, analysts, and experts may be more inclined to look at extensive and detailed environment statistics.

1.25. Environment statistics support evidence based policy making by enabling the identification of environmental policy issues and the objective quantification of measures and impacts of policy initiatives. They strengthen assessments through quantitative metrics, making analyses more robust through the use of timely and comparable data. The type, the level of thematic, spatial and temporal aggregation and the format of environment statistics depend on the type of the user and the intended purpose of use. The main products of environment statistics are detailed tabulated environment statistics series, environmental accounts and environmental indicators.

1.4 Environmental data, statistics and indicators

- 1.26. Environmental information is the broadest term used to describe the qualitative and quantitative aspects of the environment. Environmental information encompasses (but is not limited to) different levels of detail such as environmental data, environment statistics (including environmental accounts), and indicators.
- 1.27. Environmental data are large amounts of unprocessed observations and measurements about the environment and related processes. They can be collected or compiled by statistical data collection methods such as censuses or sample surveys, by NSOs or other parts of the national statistical system; or they may originate from administrative records, registers, inventories, monitoring networks, remote sensing, scientific research, and field studies.
- 1.28. Environment statistics aggregate, synthesize and structure environmental and other data according to statistical methods, standards and procedures. It is the role of environment statistics to process environmental data into meaningful statistics that describe the state and trends of the environment and the main processes affecting them. Not all environmental data are used in the production of environment statistics. The FDES provides a framework that marks out environmental data that fall within its scope and then structures, synthesizes and aggregates them into meaningful statistics.
- 1.29. For specific analytical purposes, environment statistics may be reorganized and restructured according to different analytical frameworks such as for instance the Driving force – Pressure – State – Impact - Response framework, or issue-based frameworks which focus on specific environmental problems (e.g., air pollution, land degradation, etc.); policy based frameworks such as sustainable development strategies, or assessment frameworks such as those used in state of the environment reports.
- 1.30. Accounting frameworks, such as the SEEA, reorganize the relevant environment statistics according to stocks and flows within and between the environment and the economy based on national accounting principles, thus linking environment statistics with the System of National Accounts (SNA) and facilitating the analysis of relationships between the economy and the environment.
- 1.31. Environment statistics are usually too numerous and detailed to satisfy the needs of policy makers and the general public. They often require further processing and interpretation, resulting in environmental indicators. Indicators are used to synthesize and

present complex statistics. They are measures that summarize, simplify and communicate information.

- 1.32. Environmental indicators require a careful selection of statistical inputs in order to calculate ratios or proportions which depict key aspects or processes of the environment. Sometimes the terms indicators and statistics are used interchangeably, and indeed some statistics are indicators in and of themselves, but typically indicators incorporate more than one statistic. Environmental indicators have the purpose of defining objectives, assessing present and future direction with respect to goals and values, evaluating specific programmes, demonstrating progress, measuring changes in a specific condition or situation over time, determining impact of programmes and conveying messages. Frameworks such as the DPSIR, or policy frameworks such as the Millennium Development Goals Indicators framework are typically used for the identification and structuring of indicators.
- 1.33. Environmental indices, a special type of indicator, are composite or more complex measures that combine and synthesize more than one indicator or statistic that are weighted according to different methods. The Environmental Vulnerability Index (EVI) and the Environmental Performance Index (EPI) are examples of commonly compiled indices. An index can provide a valuable summary measure for communicating important messages in a popular way and thus raising awareness; however, they often raise questions related to their proper interpretation, methodological soundness and the quality of the underlying statistics.
- 1.34. These types of quantitative information about the environment are all important and interdependent. They all feed back into each other to produce diverse and complementary products that can be used for different purposes and that fit specific user needs and resources of countries or agencies. Ideally, information about the environment can be produced and used as an integrated system which would increase synergy and consistency, as well as efficiency in the use of limited financial resources.

1.5 Sources of environment statistics

- 1.35. Environment statistics synthesize data originating from a wide range of source types, including:
- i. Statistical surveys (censuses or sample surveys of e.g., population, housing, agriculture, enterprises, households, employment, or different aspects of environment management);
 - ii. Administrative records (of government agencies in charge of natural resources and other ministries and authorities);
 - iii. Estimates and modelling;
 - iv. Monitoring systems (of water quality, air pollution, climate, soils, and so on);
 - v. Remote sensing (e.g., satellite imaging of land use, water bodies or forest cover);

- vi. Scientific research (e.g., glacier retraction, global CO₂ concentration, biological assays); and
- vii. Projects and special studies undertaken to fulfil domestic or international demand.

1.36. The list above is meant to illustrate some common sources for environment statistics. In practice, these sources are usually used in combination. For instance, statistical surveys, modelling, scientific research and remote sensing are all involved in the estimation of some types of emissions to the air. The source types under i-iii are commonly used in all areas of statistics (economic, social and environment) whereas those under iv-vii are mostly specific to production of environment statistics.

1.37. Environmental data are typically dispersed over numerous agencies, departments or institutes, requiring considerable effort to attain compatibility and accuracy. In practice, this means that the data used for the production of environment statistics are not only compiled by many different collection techniques but also by many different institutions.

1.38. When environmental data are collected through environment statistics surveys, the survey is designed according to its objective of producing environment statistics. However, environment statistics surveys are not always feasible or economical, therefore data are frequently obtained from other existing (e.g., social, economic, sectoral) statistical surveys which have a primary objective different from the production of environment statistics. Therefore, in many cases, the data may need to be reorganized or reclassified for them to be used in environment statistics. As compared to economic statistics, environment statistics face an additional difficulty, namely, that in many cases the data needed are not built into any kind of business accounting or recording system.

1.39. The use of administrative records is a cost and resource-effective way of obtaining data for environment statistics. However, as there are usually differences between administrative and statistical terms and definitions, the data may need reconsiliation with the terms and classifications used in statistics.

1.40. Using data from other sources (such as satellite data for land use statistics, or measurements of pollutants from monitoring stations) for the production of environment statistics, can pose challenges as these data have often been collected and compiled for specific purposes and do not necessarily satisfy the quality requirements of statistics. However, environment statistics, being multi- and interdisciplinary in nature, need to rely on these data and sources and to the extent possible integrate them into official statistics by appropriate methods. The use of this type of information in environment statistics needs special knowledge and expertise that is rarely available at NSOs, therefore close collaboration with the relevant experts is necessary.

1.41. Environment statistics bring together data from different disciplines with different terms, definitions and classifications in the relevant subject areas. NSOs have a prominent role in developing and promoting the use of statistical classifications as well in harmonizing or bridging different classifications among the producers of environmental data. The FDES is a tool that facilitates this process.

1.42. For more information on sources of environment statistics please see Annex C: Sources of environment statistics.

1.6 Temporal and spatial considerations

1.43. Environment statistics require the simultaneous consideration of a number of temporal and spatial issues.

Temporal considerations

1.44. A uniform calendar or fiscal year does not fit the diversity of natural phenomena, therefore longer or shorter time periods may be much more appropriate for the aggregation of environmental data over time.

1.45. With respect to periodicity, certain features of natural growth of biomass (e.g., in a natural, slow growing forest that is not subject to logging) do not justify or require assiduous monitoring of their status, since the most relevant changes can be observed on an annual or even less frequent basis. Other environmental processes, however, change so quickly that measurements are needed hourly or even more frequently. One example of frequent monitoring is air quality³ in urban settings.

1.46. Determining the appropriate frequency for updating environment statistics often involves different considerations. For example, in fluid environmental phenomena, careful consideration of the temporal dimension is needed since there can be ebbs and flows, droughts and floods, snow and runoffs which all influence measurements. Sometimes there may be daily variations and at other times variations may be seasonal depending on what is being measured. Seasonal variations can 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 needs to be focused more during some months than others. Given these temporal aspects, statistics often point out the maximum, the minimum and/or other ways of describing the relevant phenomenon and its levels below or above certain benchmarks, and not be restricted to a sum or an average for a period. In addition, it should be noted that even when environmental data are produced at irregular intervals, environment statistics based on

³ Air quality is measured by the concentrations of particulate matter (PM₁₀, PM_{2.5}) also known as suspended particulate matter (SPM), ground level ozone (O₃) or other pollutants depending on the specific city.

these data can still be produced at regular intervals if there are enough data points in each period to do so.

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Spatial considerations

1.47. The occurrence and impacts of environmental phenomena are distributed through space without regard for political-administrative boundaries. For example, some aquifers, rivers, ecosystems, and most certainly oceans, are shared by different regions and countries. Yet, national statistical systems are usually organized using administrative boundaries. This difference can complicate the collection and analysis of environment statistics especially when there is a need to combine them with social and economic statistics. There is however a trend towards producing more geo-referenced data, which would overcome some of the spatial complications of analysis. Methods are being developed that allow for more geospatial information to be published which may enable better integration of information in the future.

1.48. Also, some environment statistics fluctuate considerably depending on their geographic location. Different geographic locations can be associated with different climatic and ecosystem conditions and anthropogenic pressures. Consequently location-specific information can often times be more useful than national aggregates or averages. To cite an example of such a case, the maximum level of a pollutant at a specific geographic location may exceed maximum authorized values even when the national average pollution indicators remain at low levels. Location-specific information is also useful for identifying sources of environmental pressures.

1.7 Geospatial information and environment statistics

1.49. Geospatial information describes the location and names of features beneath, on or above the earth's surface. At its simplest this can mean the basic topographical information found on a map, but also includes different location-related datasets combined into complex layers that show information such as land use, forest cover and population density⁴.

1.50. Geospatial information adds significant value and utility to environment statistics. Ideally, geographic aspects of data should always be collected, represented and analyzed at the most detailed scale possible, dependent on national capacities and priorities. Geospatial information enables better analysis of environmental issues as environmental, social and economic statistics can be aggregated or disaggregated according to a wide range of scales and zones meeting diverse analytical and policy demands, such as:

- i. Natural units (e.g., watersheds, ecosystems, etc.)
- ii. Administrative units (e.g., municipalities, districts, counties, regions, etc.);

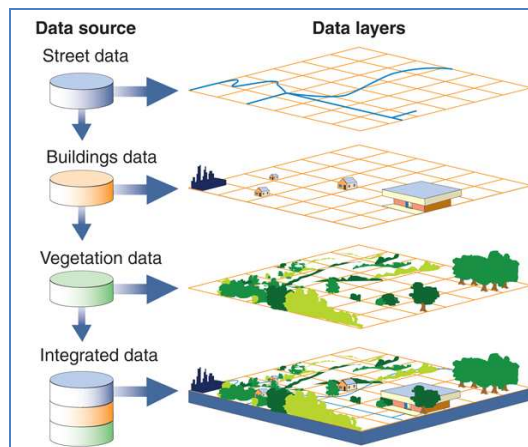
⁴ Land Information, New Zealand <http://www.linz.govt.nz/geospatial-office/what-is-geospatial-info/>

- iii. Management units (e.g., protected areas, river basin districts, etc.);
- iv. Planning units (e.g., coastal zones, urban areas, etc.);
- v. Legal property units (e.g., cadastral units, etc.); and
- vi. Analytical units (e.g., land cover units, socio-ecological landscape units, eco-complexes, geo-systems, eco-zones, etc.).

1.51. The complexity of current environmental issues (e.g., climate change, biodiversity loss, ecosystem health, natural disaster frequency and intensity, population growth, food and water shortages, etc.) increasingly calls for the integration of geospatial information, statistics and sectoral data for more effective and efficient monitoring of progress in the environmental pillar of sustainable development. Geographic Information Systems (GIS) can help establish the links between different types and layers of data by providing powerful tools for storage and analysis of spatial data and by integrating databases from different sectors in the same format and structure.

1.52. A GIS is a computer system capable of capturing, storing, analyzing, and displaying geographically referenced information⁵. Geospatial data can be acquired using a variety of technologies such as Global Positioning System (GPS) and Remote Sensing satellites. Land surveyors, census takers, aerial photographers, police, and even average citizens with a GPS-enabled cell phone can collect geospatial data using GPS or street addresses that can be entered into GIS. The attributes of the collected data, such as land-use information, demographics, landscape features, or crime scene observations, can be entered manually or, in the case of a land survey map, digitized from a map format to a digital format by electronic scanning. The final representation of the data is constructed by superimposing different layers of information as required by the analytical and/or policy requirements.

Figure 1.1 Example of GIS Data Layers or Themes



Source: GAO (2005). P5, cited by Folger (2009)

⁵ Folger, P (2009), Geospatial Information and Geographic Information Systems (GIS) <http://www.fas.org/sgp/crs/misc/R40625.pdf>

- 1.53. Remote sensing is a technique for gathering information about an object without coming into physical contact with it. It is the quantitative analysis of digital information where measurements can be made from ground, aircrafts or satellites. The information is carried by electromagnetic radiation. With remote sensing, skills are needed in digital image analysis where computer programming, image display tools and statistics, etc., are required for interdisciplinary work that might involve scientists and experts in various fields - biology, climatology, geology, atmospheric science, chemistry, oceanography, and more. With satellite remote sensing, global issues can be addressed by monitoring regional and global changes ⁶.
- 1.54. Earth observation⁷, through measuring and monitoring, provides an insight and understanding into Earth's complex processes and changes. Earth observation includes measurements that can be made directly or by sensors in-situ or remotely (i.e., satellite remote sensing, aerial surveys, land or ocean-based monitoring systems to provide key information to models or other tools to support decision making processes. Earth observation assists governments and civil society to identify and shape corrective and new measures to achieve sustainable development through original, scientifically valid assessments and early warning information on the recent and potential long-term consequences of human activities on the biosphere.
- 1.55. Remote sensing data from satellites are acquired digitally and communicated to central facilities for processing and analysis in GIS. Digital satellite images, for example, can be analyzed in GIS to produce maps of land cover and land use. When different types of geospatial data are combined in GIS (e.g., through combining satellite remote sensing land use information with aerial photographic data on housing development growth), the data must be transformed so they 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 analyzed together. A useful synthesis on the GIS and geospatial terminology is presented in Annex D.
- 1.56. The need for more national level capacity building for collecting, processing and analyzing geospatial information is therefore an important priority, especially for developing countries. In addition to technical expertise, the knowledge of the analyst using the geospatial information about the local area is also important, for instance for ground-truthing⁸. Field checking and calibrating a sample of the areas being reported on adds value

⁶ REMOTE SENSING OF THE ENVIRONMENT, GEOG 4093/5093 – 4, Spring 2006 (<http://cires.colorado.edu/steffen/classes/geog5093/rs.pdf>)

⁷ UNEP 2012, Available at http://na.unep.net/siouxfalls/publications/Early_Warning.pdf

⁸ Field check

to the validation of geospatial information since different areas can appear to be similar or the same from remote sensing images.

- 1.57. Considerations regarding institutional mandates and coordination are also relevant to geospatial information and environment statistics, since often national geographic and statistical institutions are separated and have different institutional traditions embedded in their staff, directives and outputs. Few cases around the world can showcase national official statistical and geographic functions in one single institution (e.g., INEGI in Mexico and IBGE in Brazil). In such cases, the national institutions are able to take advantage of enormous opportunities in the production and dissemination of statistics created from the synergy between the two fields. Some NSOs, which have their own cartography or GIS unit, can be of much help to environment statistics in this regard.
- 1.58. The UN initiative on Global Geospatial Information Management (GGIM)⁹ provides a forum for liaison and coordination among Member States, and between Member States and international organizations. It aims at playing a leading role in setting the agenda for the development of global geospatial information and for promoting its use to address key global challenges. Environment statistics can benefit much from this initiative where a number of its topics are covered and where data sharing is facilitated.

1.8 Classifications, categories and other groupings relevant to environment statistics

- 1.59. Statistical classifications are sets of discrete categories which may be assigned to a specific variable in a statistical survey or an administrative file and used in the production and presentation of statistics.¹⁰
- 1.60. The field of environment statistics has no single, overarching, internationally agreed classification of the environment for statistical purposes. Instead, there are a number of co-existing and emerging classifications and categorizations for specific subject areas in environment statistics. These include standardized statistical classifications as well as less formalized groupings or categories. Some of the classifications and categories that have been used in the environmental field have not been developed specifically for statistical purposes, and therefore have to be linked to statistical classifications.
- 1.61. Standard economic statistical classifications, such as the International Standard Industrial Classification of all Economic Activities (ISIC) and the Central Product Classification (CPC) among others, are relevant and used in environment statistics. The use of these classifications facilitates the integration of environment statistics with economic statistics.

⁹ UN Global Geospatial Information Management (UN GGIM): <http://ggim.un.org/>

¹⁰ <http://unstats.un.org/unsd/class/family/bestprac.pdf>

- 1.62. The pioneering environment statistics classifications adopted by the Conference of European Statisticians (CES) between 1989 and 1996 have been used extensively for international data collection. These environment statistics classifications developed by the Economic Commission for Europe (ECE) are heterogeneous and most of them include more than one single hierarchical classification. They also include recommendations for definitions, measurement methods and tabulations. The ECE classifications for environment statistics include classifications of Water Use (1989), Land Use (1989), Wastes (1989), Ambient Air Quality (1990), Freshwater Quality for the Maintenance of Aquatic Life (1992), Marine Water Quality (1992), Environment Protection Activities and Facilities (1994), and Flora, Fauna and Biotopes (1996).
- 1.63. More recent statistical classifications as well as less-formalized categorizations which pertain to specific sub-domains of environment statistics do exist and are in use. They are classifications and categorizations developed by different international organizations and specialized agencies, intergovernmental organizations or non-governmental organizations. Examples are the FAO Land Cover Classification System; the UN Framework Classification for Energy and Mineral Resources; or the groupings and classifications developed for water statistics or for energy products in the relevant UN international recommendations.
- 1.64. Many of the aforementioned classifications have been revised, adapted and used in the SEEA Central Framework, including the Classification of Environmental Activities (CEA) which covers the classes of activities that are considered to be environment protection and resource management activities, mostly used for producing statistics of environmental protection and resource management expenditure. Other examples are the categories of solid waste or the interim classifications of land use and land cover. More work on classifications regarding ecosystems and ecosystem services is being carried out as part of the development of the experimental ecosystem accounts of the SEEA.
- 1.65. Additionally, there are classifications and lists of categories which do not originate in the statistical community but are used in environment statistics, such as classifications of both natural and technological disasters produced by the Centre for Research on the Epidemiology of Disasters Emergency Disasters Database (CRED – EM-DAT); classifications for protected areas and threatened species by United Nations Environment Programme’s World Conservation Monitoring Centre (UNEP-WCMC) and the International Union for the Conservation of Nature (IUCN); the ecosystem reporting categories used by the Millennium Ecosystem Assessment; or the source categories for greenhouse gas emissions (GHGs) from the Inter-governmental Panel on Climate Change (IPCC).
- 1.66. These classifications have been widely used by the UN ECE, the Organization for Economic Co-operation and Development (OECD), Eurostat, UNSD, and various regional

and national bodies for international data collection. Ensuring harmonization of the different classifications, and building bridges among them, are among the most important roles of environmental statisticians.

1.67. For more information on classifications used in environment statistics please see Chapter 4: The Core Set of Environment Statistics which includes a column that lists commonly used classifications and categorization. Annex E also contains relevant classifications and groupings in the field of environment statistics.

1.9 Institutional dimension of environment statistics

1.68. The institutional dimension of environment statistics is as important as technical capacity when developing environment statistics at the national level. Given that environment statistics are multi-disciplinary, cross-cutting, and involve numerous stakeholders, actors and producers, problems of insufficient institutional development, overlapping mandates and functions, inadequate interagency coordination and other institutional issues are very common in most countries. The problems of coordination and heterogeneous development can also escalate to the regional and global levels, where a multiplicity of partner agencies operate with different mandates, work programmes, and production timetables.

1.69. Identifying the primary institutional obstacles that impede the production of environment statistics and developing a strategy to overcome these is vital for countries keen on developing or strengthening their environment statistics programmes. In general, countries face the following institutional challenges in the production of national environment statistics:

- i. In many countries, a coherent and explicit institutional framework to govern the production of environment statistics is missing or incomplete. Often it is not clear which agency or agencies are responsible for the production of various environment statistics. In addition, in many developing nations, environment statistics, even when collected, are not digitized and disseminated.
- ii. The various institutions involved in the production of environment statistics (e.g., NSOs, Environmental Ministries and other sectoral agencies – Water, Air, Forest, Agriculture, etc.) frequently do not coordinate or share data, often resulting in duplication of efforts.
- iii. There is insufficient communication and coordination among the producer and user communities of environment statistics at all levels.
- iv. There are insufficient operational guidelines available in the languages of the practitioners regarding the institutional dimension of the production of environment statistics, thus often NSOs and Environmental Ministries do not have a clear idea of the minimum requirements necessary for creating a national environment statistics programme.

- 1.70. To address the above mentioned challenges and assist countries in developing national environment statistics programmes, it is important to consider capacity building not only as it relates to technical and statistical issues, but also to the institutional dimension of the production of environment statistics.
- 1.71. The following are four key elements pertaining to the institutional dimension that need to be considered and dealt with simultaneously while developing environment statistics.
- 1.72. The legal framework. In most countries, the legal framework for the production of environment statistics commonly consists of statistical, environmental and other relevant sectoral legislation such as water, energy and agriculture. Each of these laws defines the mandate and competencies of the institutions in charge of each sector.
- 1.73. Under national statistical legislation, commonly the NSO is the responsible authority for creating and coordinating the national statistical system. However, in most cases, the law does not explicitly refer to environment statistics, as this is a relatively new statistical domain. Moreover, in many cases it does not explicitly provide guidelines for statistical coordination among the relevant statistical parties at the national level nor spell out responsibilities and obligations. 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 clarity on the supporting institutional arrangements.
- 1.74. In this complex institutional context there may be overlapping mandates, duplication of efforts, and other coordination difficulties. In fact, it is often difficult to know what the official figures are on a specific statistics because different agencies are producing the same or similar statistics.
- 1.75. Countries need to review their statistical and environmental legislation to provide clarity regarding the authorities responsible for producing environment statistics along with guidelines for statistical governance and coordination. Equally important, the production of environment statistics needs to be included in the NSO mandates and programs of work, as this can significantly improve issues arising from fragmented mandates (e.g., mandates to collect water statistics alone, as opposed to a more holistic and wide-ranging set of environment statistics).
- 1.76. Institutional development. Successful organization of a national environment statistics programme, with a well defined mandate and a specific unit in charge or carrying out the production of environment statistics is critical within the official institutions responsible for

the production of statistics. These units require a regular budget for operations and a minimum number of trained personnel for the tasks entailed. Hence, it is important for environment statistics units to have a capacity building programme for their staff along with the financial resources to carry it out.

- 1.77. Inter-institutional collaboration. The multi-disciplinary and cross-cutting nature of environment statistics requires that several actors collaborate in their production. Environment statistics cover several topics for which the data, whether in the form of administrative records, remote sensing, scientific measurements or survey results, are being generated by specialized agencies, ministries, provincial and municipal governments. To compile and process these data into environment statistics requires the collaboration of key stakeholders.
- 1.78. Although this is not a simple task, the majority of countries around the world are in various stages of a process of modernizing their government institutions and management styles with more participation, collaboration, transparency and accountability. This trend can favour and foster collaboration among the different institutions and levels (e.g., national, provincial, municipal) to work collaboratively towards shared goals and programmes. These challenges and opportunities among institutions within countries can be thought of as the first interface of coordination at the national level.
- 1.79. The collaboration of national and sub-national institutions can take the form of data sharing agreements between key institutions and often requires the establishment of a multi-stakeholder or inter-agency platform tasked with coordinating the production of environment statistics. These inter-agency platforms usually bring together all relevant agencies to collaborate in jointly producing environment statistics (and other related products such as environmental indicators) from a variety of data sources. This typically involves establishing work plans and having periodic meetings and workshops to share expertise which benefits the overall quality and availability of the national environment statistics databases and/or compendia. Often times, within the inter-agency group, theme-specific nodes are created and sustained as needed (e.g., energy, water, forest, marine, etc.) in order to develop environment statistics products for these different topics. One of the tasks of the platform is to ensure that a common statistical methodology or protocol is being used to ensure comparability and statistical soundness. Another relevant function is to preserve continuity over time, despite significant turnover of staff in the different partner institutions. In some countries, the data sharing agreements are formalized to explicitly stipulate that government agencies share their data. In other countries, this is done on an informal basis.
- 1.80. Several countries producing environment statistics have established such multi-stakeholder platforms to coordinate the generation of environment statistics. Although these

platforms are established formally, more often than not, in practice they do not operate properly or face great difficulties in doing so. Therefore, it is necessary to develop a strategy, work plan and protocols, and to meet on a regular basis to advance the work. The NSO, if tasked with overseeing the national statistical system and coordinating these platforms, must have adequate authority, resources or capacities to lead the multi-stakeholder processes. Depending on the institutional set up, in many developing countries the coordination role in such platforms lies with the environmental ministry or equivalent institution.

- 1.81. In addition to establishing a platform at the technical level, it is essential to have an executive board or committee to oversee the strategic aspects of the process and to whom the technical platform can report. This will ensure that the technical platform has the necessary authority and institutional backing so that decisions can be taken on important strategic and management issues. Such a high level mechanism can also be called upon to support the work of the technical platform, particularly in terms of allocating resources and mandating the work on the platform as part of the staff's regular work plan.
- 1.82. Institutional cooperation of national, regional and global bodies. The institutional challenges common in countries are also faced by international organizations that are involved in the production of environmental data and statistics. It is very important to consider the institutional arrangements and mechanisms that are conducive to better coordination and resource utilization among the national, regional and global levels, understanding that all potential partners have different mandates, work programmes and deadlines to meet. In addition, reporting requirements for certain international agreements and treaties, which are an important dimension of environment statistics, need to be included in national environment statistics programmes.
- 1.83. For more information on the institutional dimension of environment statistics please see Annex F.

Chapter 2: Framework for the Development of Environment Statistics

2.1. This chapter introduces the conceptual framework of the FDES and the main concepts that have been considered when designing its scope and structure. It ties the conceptual foundation to the main structural components of the FDES, which are further discussed in detail in Chapter 3. It also explains the relationship between the FDES and other commonly used systems and frameworks.

2.1 What is the FDES?

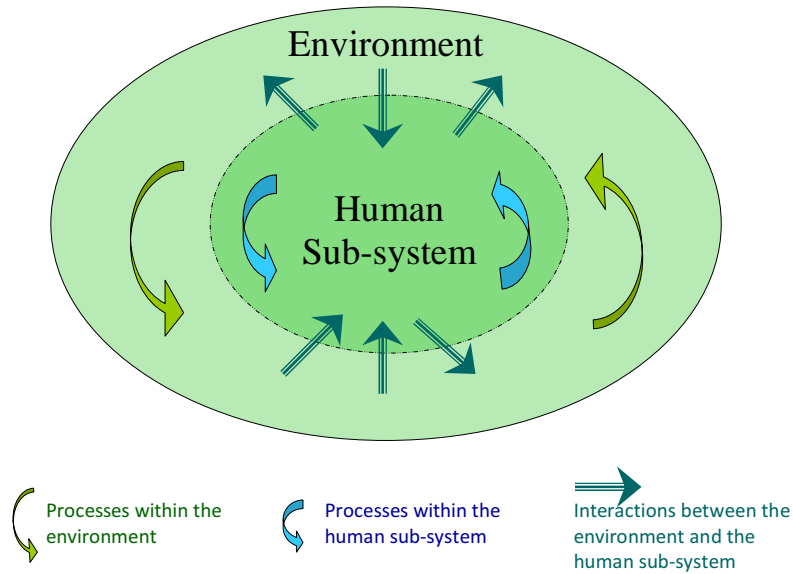
2.2. The FDES is a multipurpose conceptual and statistical framework that is comprehensive and integrative in nature. It provides an organizing structure to guide the collection and compilation of environment statistics and to bring together data from various subject areas and sources. It is broad and holistic in nature, covering the issues and aspects of the environment that are relevant for analysis, policy and decision making.

2.3. The FDES is relevant to, and recommended for use by, countries at any stage of development. Its primary objective is to guide the formulation of environment statistics programmes by: (i) delineating the scope of environment statistics and identifying its constituents; (ii) contributing to the assessment of data requirements, sources, availability and gaps; (iii) guiding the development of multipurpose data collection processes and databases; and (iv) assisting in the co-ordination and organization of environment statistics, given the inter-institutional nature of the domain.

2.2 Conceptual foundation of the FDES

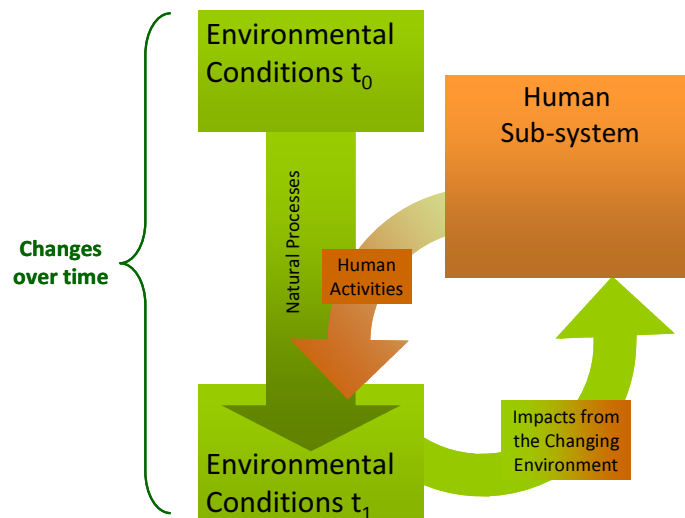
2.4. The FDES is based on a conceptual foundation that considers humans and the human sub-system as integral parts of, and interacting with, the environment. *Figure 2.1* illustrates this concept, with the human sub-system as an integral part of the environment, and the arrows representing a variety of complex natural, social and economic processes and interactions, within and between the environment and the human sub-system.

Figure 2.1: The environment, the human sub-system, and interactions between them



2.5. Human wellbeing depends upon the living and non-living environment and the goods and services they provide. People require the environment for survival and for various social, cultural and economic purposes. The human sub-system uses the environment for habitat, for obtaining important physical resources, and as a recipient or sink for various emissions, residuals and wastes. Human societies and their production and consumption patterns affect the environment that supports them and other life forms in general. Over time, the changing environment affects humans in different ways (see Figure 2.2). Human activities can have both negative and positive impacts on the environment.

Figure 2.2: Environmental conditions and their changes



2.6. Escalating human impacts on environmental systems worldwide have raised concerns about the consequences of environmental changes for the sustainability of human societies and also for human wellbeing. Conditions of the living and non-living environment, natural processes and the capacity of ecosystems to provide goods and services all experience change as a result of human activities. Due to the interconnectivity between the different systems, changes in one part can influence a variety of changes in different parts of the system.

Ecosystems and ecosystem services

2.7. The Millennium Ecosystem Assessment defines an ecosystem as “a dynamic complex of plant, animal and microorganism communities and the nonliving environment interacting as a functional unit.”¹¹ Ecosystems are systems of interacting and interdependent relationships among their elements. They perform specific functions such as biochemical cycling, photosynthesis, including the cycling of energy, water, carbon and nutrients and cleansing of air and water.

2.8. Ecosystems provide a great variety of goods and services that are fundamental to the survival of every species on the planet and upon which people depend. These are commonly known as ecosystem services. Ecosystem services are generated as a result of biophysical, geochemical, and other physical processes and interactions within and between ecosystems. The capacity of ecosystems to provide ecosystem services depends on the extent and the conditions of the ecosystems. The extent and conditions of ecosystem change both as a result of natural processes and human activities.

2.9. Four main types of ecosystem goods and services have been commonly distinguished:

- i. Provisioning services that provide goods and services which humans require to meet the basic necessities like food and raw materials;
- ii. Regulating services that keep the planet habitable like the regulation of climate and hydrological systems;
- iii. Supporting services that arise from the continuous cycling of energy and materials necessary to support all living things like photosynthesis and nutrient cycling; and
- iv. Cultural services that provide wellbeing to humans like scenic views, natural monuments and wildlife.

2.10. A Common International Classification of Ecosystem Services (CICES) is emerging within the frame of the work on the SEEA Experimental Ecosystem Accounts. For accounting purposes, the draft CICES distinguishes three main types of ecosystem services,

¹¹ Millennium Ecosystem Assessment, 2005. *Ecosystems and Human Wellbeing*. <http://www.maweb.org/documents/document.356.aspx.pdf>

namely provisioning, regulating and cultural services. The CICES lists those ecosystem services where a direct connection to humans can be established, therefore supporting services are considered embodied in the provisional, regulating and cultural services that they underpin.¹²

- 2.11. In addition to ecosystem services, people also use many abiotic materials and flows found in the environment (such as underground mineral and energy resources or the capture of energy from solar or wind sources). These are goods and services provided by the environment but they are not considered ecosystem services (with the exception of water) as they are not the result of interactions within ecosystems. However, the extraction, capture and use of these abiotic goods and services significantly affect the extent and conditions of ecosystems.
- 2.12. The underlying principle behind the ecosystems approach is to move away from an emphasis on selected elements that comprise an ecosystem to a perspective that is more comprehensive and holistic.¹³ The systemic view underpinning the ecosystem approach allows an understanding that the ecosystem as a whole is greater and more complex than the sum of its parts, and the interrelations among components are dynamic and as important as the functioning of each individual part. The FDES is based conceptually on this holistic approach.

2.3 Scope of the FDES

- 2.13. The scope of the FDES covers the elements defined in the scope of environment statistics (as described in Section 1.2). The scope of environment statistics covers biophysical aspects of the environment and those aspects of the human sub-system that directly influence the state and quality of the environment. It includes the interactions within the environment, and among the environment, human activities, and natural events.
- 2.14. Following, key concepts covered in the scope of the FDES will be discussed in more detail. These relevant aspects describing concepts and relations among them were helpful while determining the structure and components of the FDES presented in the following section (Section 2.4).

Environmental conditions and quality

- 2.15. The environment is the biophysical, biotic and abiotic, surroundings in which humans live. Changes in the conditions and quality of the environment are in the centre of the FDES. These changes show the balance of the negative and positive impacts of human activities and

¹² SEEA Experimental Ecosystem Accounts. Draft for discussion.

¹³ Environment Canada, Agriculture and Agri-Food Canada, *A National Ecological Framework for Canada*, 1999, Ottawa, <http://sis.agr.gc.ca/cansis/nsdb/ecostrat/intro.html>

natural events. It should be noted that in many cases it is not possible to establish direct cause-effect relationships between changes in environmental quality and the individual human activities or natural events, as the impact is the result of combined and cumulative effects and processes over space and time. Certain environmental conditions are not affected significantly by human activities and natural processes or they change very slowly, while others show more immediate change. The components of the environment that are affected by human use are ecosystems, land, and subsoil resources.

- 2.16. Ecosystems offer provisional, regulating, cultural and supporting services that are essential for life and human wellbeing. If undisturbed, ecosystems have the capacity to provide a continual flow of ecosystem goods and services. Depending on the relation between the scale and persistence of human use of the environment and the carrying capacity and resilience of ecosystems, human activities can exert pressure on and cause significant change in the quality and integrity of ecosystems, affecting its capacity to continue to provide its services.¹⁴
- 2.17. Land provides space for natural ecosystems, human habitats and human activities. As this space is finite, the expansion of human activities can occur by reducing the space occupied by natural ecosystems, thus reducing the capacity of ecosystems to yield ecosystem goods and services for all living beings.
- 2.18. Subsoil resources are underground deposits of various minerals that are important component of ecosystems and also provide raw materials and sources of energy for humans. These subsoil elements, when considered as resources for human use, are fundamentally different from ecosystems in that they are non-renewable, therefore their use results in permanent depletion.

Factors directly affecting the environment

- 2.19. The factors affecting the conditions and quality of the environment can be both natural and anthropogenic.
- 2.20. Natural processes help to sustain the functioning of ecosystems and the generation of renewable resources, yet they are also responsible for normal or extreme natural losses. On a human timescale, these natural processes do not affect non-renewable resources except in the form of natural disasters.

¹⁴ (i) Humans have made unprecedented changes to ecosystems in recent decades to meet growing demands for food, fresh water, fibre, and energy; (ii) These changes have helped to improve the lives of billions, but at the same time they weakened nature's ability to deliver other key services such as purification of air and water, protection from disasters, and the provision of medicines; and (iii) The pressures on ecosystems will increase globally in coming decades unless human attitudes and actions change.

2.21. Human activities that directly affect the environment are related to the use of non-renewable and renewable resources, land use, and the discharge of residuals to the environment from production and consumption processes. These activities often lead to environmental changes in the form of resource depletion and environmental degradation, which in turn have a negative impact on human wellbeing. On the other hand, human activities aimed at the protection of the environment and management of its resources can reduce such negative impacts on the environment.

Human habitat and environmental health

2.22. People and many of their activities which have a direct impact on the environment are concentrated within and around human settlements. Human settlements also constitute the immediate environment where the population is directly exposed to environmental effects. Human settlements represent a special category in the measurement of environmental conditions and quality as well as their impacts on human health and wellbeing.

Environment protection, management and engagement

2.23. Protection of the environment and the management of environmental resources may be advocated, facilitated, supported or mandated by different policies, economic measures, instruments and actions. These policies, instruments and actions are aimed at managing, mitigating and restoring the environment's state and quality so that it can continue to support life and human activities in a sustainable manner.

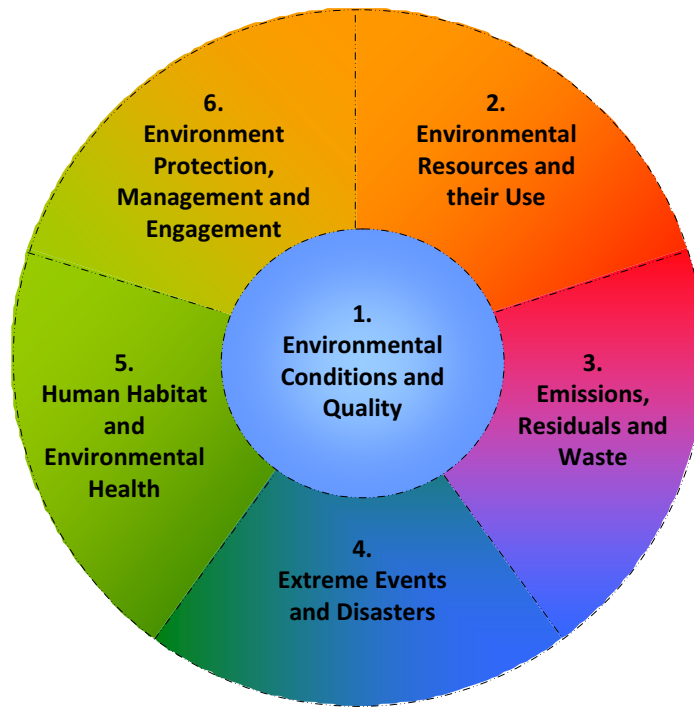
2.4 From the conceptual foundation to the FDES structure

2.24. The FDES organizes environment statistics into a structure consisting of components, sub-components and statistical topics, using a multi-level approach. The first level of the structure consists of six fundamental components that follow the FDES conceptual framework.

2.25. The first component brings together statistics related to the conditions and quality of the environment and their change. The second component groups together statistics related to environmental resources (ecosystem provisioning services, land and subsoil resources) and their use. The third component includes statistics related to the use of regulating services of the environment for the discharge of residuals from production and consumption processes. Statistics related to extreme events and disasters (both natural and anthropogenic) and their impacts are covered by the fourth component. The fifth component brings together statistics related to environmental conditions and impacts within human settlements. The sixth component groups statistics relevant to societal responses and economic measures aimed at protecting the environment and managing environmental resources.

2.26. *Figure 2.3* shows the six components of the FDES. The dotted lines separating the components are an indication of the continuous interactions among them. These interactions are between and among all the components of the FDES. It should be noted that a two dimensional diagram can only provide a limited visualisation of the complex and interrelated nature of the relationships between humans and the environment. However, this diagram can be a useful visual tool to keep in mind when discussing the different components of the FDES in more detail.

Figure 2.3: The components of the FDES



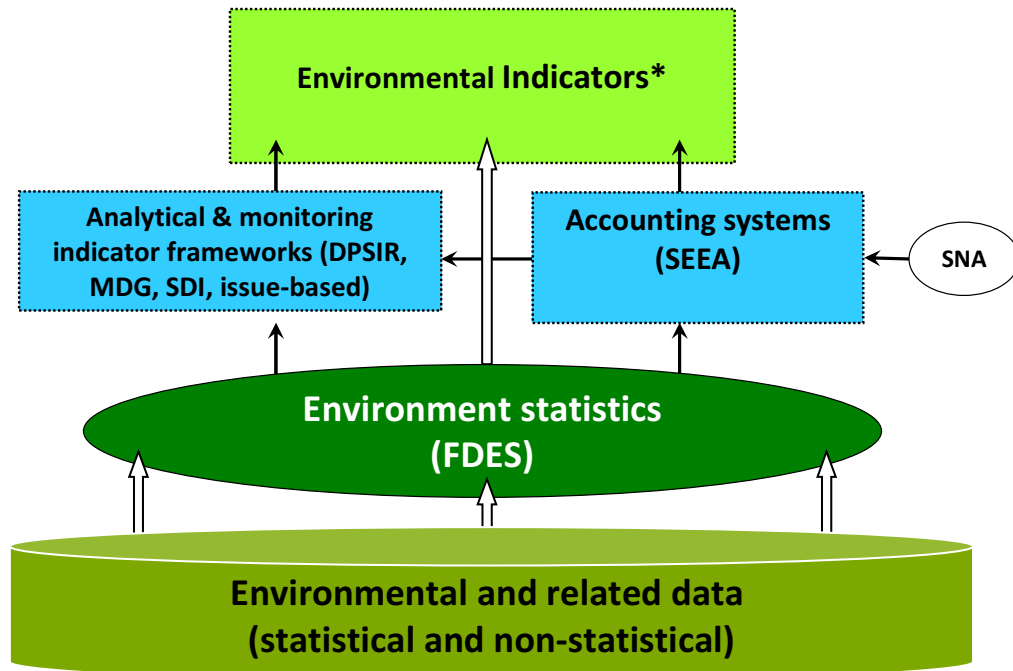
2.27. Each of the six components is broken down into sub-components that in turn contain relevant statistical topics. The statistical topics represent the measurable aspects of the components of the FDES. The sub-components have been created by taking into consideration, as far as possible, the types and sources of the data needed for the description of the statistical topics.

2.28. The components, sub-components and statistical topics of the FDES define the scope and boundaries of environment statistics. They provide an organizing structure for synthesizing and presenting the information in a comprehensive, consistent and coherent manner. The detailed description of the components, sub-components and statistical topics is given in Chapter 3.

2.5 Relationship of the FDES with other frameworks

2.29. As a multi-purpose statistical tool for the development of environment statistics, the FDES is closely related to and supports other systems and frameworks that are frequently used at the national and international levels. Figure 2.4 portrays a simplified illustration of these relations from data to statistics, accounts and indicators. Environmental data are large amounts of unprocessed observations and measurements about the environment. Environment statistics aggregate, synthesize and structure environmental and other data. The FDES is shown here as a tool to bring together and transform primary statistical and non-statistical data into environment statistics. These environment statistics can then be used to produce statistical series and indicators organized according to different analytical or policy frameworks or can be used, in combination with economic statistics to produce environmental-economic accounts that link environment statistics with the SNA.

Figure 2.4: Relationship of the FDES to other frameworks, systems and indicator sets



Note: Size of figures does not correlate to volume of data, statistics, indicators, etc.

DPSIR = Driving forces-Pressures-State-Impacts-Responses

SEEA = System of Environmental-Economic Accounting

SNA = System of National Accounts

*Economic and/or social statistics may also be needed

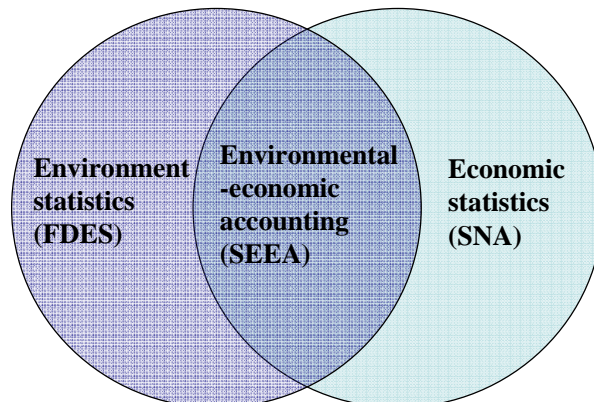
Relationship between the FDES and the SEEA

2.30. The SEEA is a tool for the analysis of the interactions between the environment and the economy both in physical and monetary terms. It applies the accounting concepts, structures, rules and principles of the SNA to environment statistics to link it to economic statistics in a manner that is consistent with the SNA. The United Nations Statistical Commission at its 43rd session in 2012 adopted the SEEA Central Framework as the initial version of the international standard for environmental-economic accounting.

2.31. At the heart of the SEEA Central Framework is an accounting system organizing environment and economic statistics that covers the stocks and flows between the environment and the economy. It includes physical and monetary flow accounts, supply and use tables, functional accounts (e.g., environment protection expenditure accounts), and physical and monetary asset accounts for natural resources.

2.32. The FDES and the SEEA Central Framework are complementary statistical frameworks where the common intersection is statistical content dealing with the environment (see *Figure 2.5*). The scope of the FDES is wider than that of the SEEA Central Framework. The SEEA Central Framework describes the interactions between the economy and the environment as stocks and flows of natural resources within and between the environment and the economy, the flow of residuals within and from the economy to the environment, as well as the associated monetary transactions. The FDES structures information about the environment as a whole and how it relates to humans, including the conditions and quality of the natural environment and human habitat, the impact of the environment on humans, the occurrence and impact of extreme events and disasters, the human habitat and its relation to environmental health, as well as social measures and instruments related to environment protection and engagement.

Figure 2.5: The FDES and the SEEA Central Framework



- 2.33. The statistics contained in Component 2 (Environmental resources and their use) and 3 (Emissions, residuals and waste) of the FDES are closely related to and support populating both the physical asset accounts and physical flow accounts, while Component 6 (Environment protection, management and engagement) contains statistics relevant to the monetary accounts of the SEEA Central Framework.
- 2.34. The SEEA Experimental Ecosystem Accounts (currently under development) will be a companion of the SEEA Central Framework. It extends the accounting to consider the measurement of flows of services to society provided by ecosystems and the measurement of ecosystem capital in terms of the capacity, and changes in capacity of ecosystems to provide those services in physical terms. It describes the valuation of ecosystems in so far as it is consistent with the market valuation principles of the SNA. Component 1 (Environmental conditions and quality) of the FDES contains statistics that can feed into the future ecosystem accounts.
- 2.35. Environmental accounts use a great part of environment statistics by reorganizing them according to economic accounting principles. One of the objectives of the FDES is to provide, as much as possible, the environment statistics necessary for the development of environmental-economic accounts. To achieve this objective, consistency between the concepts, terms and definitions used in the FDES and in the SEEA was ensured to the extent possible.

The FDES and its relationship with the Driving forces – Pressure – State – Impact – Response (DPSIR) Model

- 2.36. The Stress Response Environment Statistics System (S-RESS) framework was developed by Statistics Canada during the 1970s and 1980s and later adapted by the UN in the 1984 FDES and by the OECD. The Pressure-State-Response (PSR) and the DPSIR frameworks are adaptations of the S-RESS framework and are still in use today in many countries as well as internationally by UNEP, OECD or the European Environment Agency (EEA) for assessment and reporting purposes and for the categorization of indicators.
- 2.37. The DPSIR is a model that is based on the causal relationship between its D-P-S-I-R components. **D**iving forces are the socio-economic and socio-cultural forces driving human activities, which increase or mitigate pressures on the environment. **P**ressures are the stresses that human activities place on the environment. **S**tate, or state of the environment, is the condition of the environment. **I**mpacts are the effects of environmental degradation. **R**esponses refer to the responses by society to the environmental situation.
- 2.38. It is often difficult, however, to distinguish human and natural stressors on the environment, and even more challenging to link a particular stressor to a specific impact. In

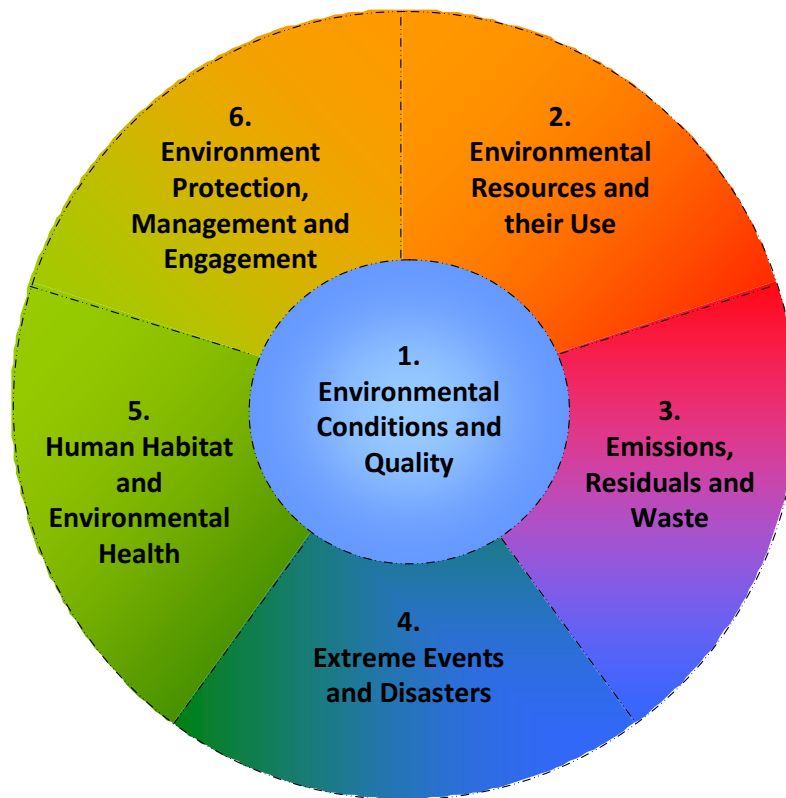
the natural world, each process and state influences and is influenced, making it difficult to separate out the pressure, the state and the response. The DPSIR model, however, is useful for grouping and reporting existing data, and the indicators that are derived by applying the framework are well known and widely used.

- 2.39. The FDES, while adopting certain concepts of the DPSIR framework, does not apply its causal sequence as an organizing principle. However, the statistical topics of the FDES can be rearranged according to the logic of the DPSIR model.

Chapter 3: The Structure and Components of the FDES

3.1. In Chapter 2, the conceptual foundation and the six constituent components of the FDES have been introduced. The objective of Chapter 3 is to explain in detail how the contents of the FDES are organized within its constituent components. The chapter explores each of the six components of the FDES, the sub-components that comprise each component, as well as the statistical topics that are grouped under each sub-component. It describes the relevance of the sub-components and statistical topics to environmental policy and provides general information on the main sources for the underlying statistics.

Figure 3.1: The components of the FDES



3.2. A comprehensive (but not exhaustive) set of environment statistics underlying the topics (the Basic Set of Environment Statistics) and a Core Set of Environment Statistics within this scope will be presented in Chapter 4.

3.1 The organization of the contents of the FDES

3.3. The FDES uses a multi-level approach. The first level of the structure defines the six fundamental components. Each individual FDES component is further broken down into its respective sub-components (second level) and statistical topics (third level). Each level uses numbering conventions as shown below in *Table 3.1*.

Table 3.1: Grouping levels of the FDES		
<i>1 digit</i>	<i>2 digits</i>	<i>3 digits</i>
1. Component	1.1 Sub-component	1.1.1 Statistical Topic

3.4. The six components of the FDES delineate the scope of environment statistics, and contain and organize the most relevant, specific sets of information in a useful way. Environmental conditions and quality (Component 1) is at the centre of the FDES. The other five components have been set up based on their relationship with the central Component 1. As depicted in *Figure 3.1*, all six components are intrinsically related with each other.

3.5. The contents of each individual component of the FDES are organized considering three main factors. Firstly, the contents are organized in accordance with the conceptual foundation described in Chapter 2, in which both environmental and human processes and activities modify environmental conditions, which in turn affect the human sub-system, triggering responses. Secondly, as a statistical tool to be applied by the environmental statistician, the content of the components of the FDES also take into consideration specific practical concerns, such as the methods of data collection or compilation, as well as the types and sources of data. Thirdly, the analytical coherence within sub-components and between statistical topics is also a key characteristic of the content of each component.

3.6. Sub-components have been selected using a holistic view of constituent parts of the component, meaning the sub-components attempt to organize all potential themes that fall under the component. Statistical topics have been selected in order to further categorize and group the different aspects underlying each sub-component.

3.7. While at the component level the FDES has been designed to be conceptually distinct, the contents of each component may overlap in some cases. Hence, often the same statistics can be used to describe more than one component. Their final allocation within the structure corresponds to both their most substantive content and nature as well as to the sources and methods of statistical production, so that both conceptual and statistical soundness are optimized. Therefore, the breakdown of components into their sub-components and topics is

not intended to be fixed, mutually exclusive or exhaustive. In line with the need to maintain a flexible and applicable FDES for environmental statisticians, the levels can be adapted and enriched according to each country's requirements, priorities and circumstances. Some countries may need more or less detail of information; other countries may wish to exclude some topics completely.

3.2 Components and sub-components of the FDES

Component 1: Environmental Conditions and Quality

- Sub-component 1.1: Physical Conditions
- Sub-component 1.2: Soil and Land Cover
- Sub-component 1.3: Biodiversity and Ecosystems
- Sub-component 1.4: Environmental Quality

Component 2: Environmental Resources and their Use

- Sub-component 2.1: Non-Energy Mineral Resources
- Sub-component 2.2: Energy Resources
- Sub-component 2.3: Land
- Sub-component 2.4: Biological Resources
- Sub-component 2.5: Water Resources

Component 3: Emissions, Residuals and Waste

- Sub-component 3.1: Emissions to Air
- Sub-component 3.2: Generation and Management of Wastewater
- Sub-component 3.3: Generation and Management of Waste

Component 4: Extreme Events and Disasters

- Sub-component 4.1: Natural Extreme Events and Disasters
- Sub-component 4.2: Technological Disasters

Component 5: Human Habitat and Environmental Health

- Sub-component 5.1: Human Habitat
- Sub-component 5.2: Environmental Health

Component 6: Environment Protection, Management and Engagement

- Sub-component 6.1: Environment Protection and Resource Management Expenditure
- Sub-component 6.2: Environmental Governance and Regulation
- Sub-component 6.3: Extreme Event Preparedness and Disaster Management
- Sub-component 6.4: Environmental Information and Awareness

3.8. In the following pages, the sub-components and statistical topics within each of the six components are described. The description includes: relevance to environmental policy; scope and content; the type of data typically used or obtained in measurement; most common sources of data; and the main institutional stakeholders required for the production of the underlying environment statistics. Relation to other frameworks and areas of statistics is also described, if appropriate.

3.3 Main attributes of the components of the FDES

3.9. Table 3.2 below summarizes key attributes of the six components of the FDES including a general description, the types of data that are included in each component, main sources and partners, as well as conceptual relationships between each component and other systems and frameworks. Geospatial information refers to statistics related to location or boundaries. Physical data refer to a variety of information that is measured in physical units, such as volume and area. Qualitative data refer to descriptions that rely primarily on non-statistical characterizations, though sometimes including quantitative aspects, such as environmental engagement. Monetary data refer to information described in terms of monetary units, such as government expenditure on environment protection.

Table 3.2: Main attributes of the FDES components

	Description	Types of Data	Main Sources	Relation to DPSIR and the SEEA
Component 1: Environmental Conditions and Quality	Geological, meteorological, geographic, biological, hydrological, physical and chemical characteristics of the environment; includes ecosystems and environmental quality	<ul style="list-style-type: none"> • Geospatial • Physical • Qualitative 	<ul style="list-style-type: none"> • Monitoring and remote sensing data • Environmental, meteorological, hydrological, geological and geographical authorities or institutions 	<ul style="list-style-type: none"> • State element in DPSIR model • Experimental ecosystem accounts in SEEA
Component 2: Environmental Resources and their Use	Quantities and changes in the quantities of environmental resources; as well as statistics on activities related to their use and management.	<ul style="list-style-type: none"> • Physical 	<ul style="list-style-type: none"> • Statistical surveys, administrative records, field surveys, land registers • Sector statistics on production and consumption activities, infrastructure • Remote sensing data • Statistics databases of respective national authorities and institutions such as mining, energy, agricultural, water and forest 	<ul style="list-style-type: none"> • Pressure and State elements in DPSIR model • Asset and physical flow accounts in SEEA Central Framework
Component 3: Emissions, Residuals and Waste	Generation, management and discharge of residuals and waste to air, water and land	<ul style="list-style-type: none"> • Physical 	<ul style="list-style-type: none"> • Administrative records • Estimates based on activity statistics and technical coefficients • Sector statistics • Monitoring data 	<ul style="list-style-type: none"> • Pressure and Response elements in DPSIR model • Physical flow accounts in SEEA Central Framework
Component 4: Extreme Events and Disasters	Occurrence and impact of natural and anthropogenic extreme events and disasters	<ul style="list-style-type: none"> • Physical • Monetary 	<ul style="list-style-type: none"> • Administrative records • Remote sensing • National emergency and disaster authorities • Seismic, meteorological monitoring and research centres • Industrial complexes that work with hazardous substances and processes 	<ul style="list-style-type: none"> • Pressure, Impact and Response elements in DPSIR model
Component 5: Human Habitat and Environmental Health	The built environment in which humans live, particularly with regard to population, housing, living conditions, basic services and environmental health	<ul style="list-style-type: none"> • Geospatial • Physical 	<ul style="list-style-type: none"> • For habitat, censuses, surveys, administrative records, and remote sensing, the housing and urban planning and oversight authorities • Cartographic authorities • Transport authorities • For health, administrative records, the health authority 	<ul style="list-style-type: none"> • Pressure and Impact elements in DPSIR model

<p>Component 6: Environmental Protection, Management and Engagement</p>	<p>Environment protection and resource management expenditure; environment regulation both direct and via market instruments; environmental information and engagement of the society; disaster preparedness</p>	<ul style="list-style-type: none"> • Monetary • Qualitative 	<ul style="list-style-type: none"> • Administrative records • Surveys • Entity producing government expenditure statistics • The statistical entity in charge of national or sub-national surveys • The environmental authority and other sector authorities 	<ul style="list-style-type: none"> • Response element in DPSIR model • Monetary flow accounts of the SESA Central Framework
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3.4 Component 1: Environmental Conditions and Quality

3.10. Component 1 includes statistics about the geographic, climatic, hydrological, biological, physical and chemical conditions and characteristics of the environment that determine the types, extent and conditions of ecosystems. Many of these natural conditions change very slowly as a result of natural processes or human influence. Others can show immediate and dramatic effects. Importantly, changes in environmental conditions and quality are the result of combined and accumulated impacts of natural and human processes; thus, connecting the changes with individual activities or events is not straightforward.

3.11. Component 1 brings together information from different disciplines with well-defined scientific concepts, frameworks and perspectives. Primary data sources include, but are not restricted to, meteorological, hydrological, geological and geographical, biological, as well as environmental research and management institutions. While scientific and monitoring data on environmental conditions and quality are manifold and increasing in both quantity and quality, their integration into environment statistics is not yet well developed.

3.12. Component 1 contains four sub-components:

- i. Sub-component 1.1: Physical Conditions;
- ii. Sub-component 1.2: Soil and Land Cover;
- iii. Sub-component 1.3: Biodiversity and Ecosystems; and
- iv. Sub-component 1.4: Environmental Quality.

3.13. Natural extreme events and disasters constitute a special type of natural (though sometimes human enhanced) process, which is closely related to this component. They are discussed under Component 4: Extreme Events and Disasters.

Sub-component 1.1: Physical Conditions

3.14. Sub-component 1.1: Physical Conditions, has been designed to capture those physical aspects of the environment which change slowly due to human influence. It contains statistics on climatic, hydrographic, geological and geomorphological conditions. While the

other sub-components are also part of the physical environment, their physical, biological or chemical characteristics can be influenced in the short to mid-term by human activities.

- 3.15. Statistics on these general physical conditions are important as they determine the environmental resources of a country. Without information on these baseline conditions, it is difficult for governments to judge the need for and efficacy of policies.

Topic 1.1.1: Atmosphere, climate and weather

- 3.16. This topic covers data on atmospheric and climatic conditions across territories and over time. Information on weather describes the way that the atmosphere is behaving over a given territory in the short term and is recorded by countries through a network of monitoring stations.¹⁵ Climate is determined by long-term weather conditions. Weather data are usually measured over time and across locations including aspects such as: temperature, humidity, pressure, precipitation, wind, solar radiation, and ultraviolet (UV) radiation.

- 3.17. The main sources are meteorological and atmospheric monitoring networks that are managed by national meteorological and atmospheric institutions and authorities. Although the data are primarily measured at specific stations, they can be statistically treated to provide information at the national and sub-national levels.

- 3.18. Statistics on air quality are covered under Sub-component 1.4: Environmental Quality.

Topic 1.1.2: Hydrographic characteristics

- 3.19. This topic includes hydrographic information on the extent and characteristics of rivers, lakes, reservoirs, underground aquifers and the watersheds and river basins they form. This information is best presented in the form of maps. The main primary sources are hydrographic information systems that are usually managed by national hydrological institutions and water authorities. The data are usually produced for individual river basins, for use at national and sub-national levels. Important exclusions from this topic include water quality statistics (contained in Topic 1.4.2: Freshwater quality and Topic 1.4.3: Marine water quality).

Topic 1.1.3: Geological and geographic information

- 3.20. This topic includes general geological and topographic information, presenting statistics that inform on the extent and characteristics of the country's territory and relief. These

¹⁵ In most countries, atmospheric, weather and climate authorities monitor and record these types of environmental data over long periods of time using a network of monitoring stations scattered throughout the country. Usually, they produce data covering potentially centuries of climate and atmospheric information with a very high level of detail. The data that are available in most countries is too dense and detailed for the purposes of environment statistics, so it must be treated (e.g., synthesized, aggregated, with central tendencies and variances established, both with respect to space and time) to produce environment statistics on climate and the atmosphere. Time and seasonal variability is crucial when recording and organizing these types of statistics. The territorial reference of the measurements is vital, as although the entire territory of a country cannot be monitored, the spatial configuration of the monitoring stations is usually pertinent to local and sub-national conditions and concerns.

characteristics typically change slowly over time; as such, the statistics produced are normally static. Because of their nature, these geographic (e.g., territorial borders, length of coastline, elevation, etc.) or geologic (e.g., bedrock, fault lines, volcanoes, etc.) data are often presented in the form of maps. More specific geological information, such as different types of mineral deposits, including their mining and extraction, are included in Component 2: Environmental Resources and their Use.

- 3.21. The main data sources are information systems that are run by national geographical and geological institutions and authorities.

Sub-component 1.2: Soil and Land Cover

Topic 1.2.1: Soil characteristics

- 3.22. Soil is a fundamental part of the environment. It provides the physical base to support the production and cycling of biological resources, provides the foundation for buildings and infrastructure, is the source of nutrients and water for agriculture and forestry systems, provides a habitat for diverse organisms, plays an essential role in carbon sequestration, and fulfils a complex buffering role against environmental variability, ranging from dampening diurnal and seasonal change in temperature and water supply to the storage and binding of a range of chemical and biological agents. Soil itself is an ecosystem where constant interactions between physical, chemical and biological processes take place. The organic matter of soil is either alive or in diverse degrees of decomposition, allowing for the soil to have space for water and air to be infiltrated. It shelters biodiversity, particularly that of decomposers, which make life possible. Soil is a buffer for a large range of environmental processes and is also a stock of carbon. The main environmental concerns about soil pertain to its degradation, erosion and depletion.
- 3.23. Statistics on soil resources are an important tool for policy makers, particularly when dealing with countries that rely heavily on sectoral production in agriculture and silviculture, for which the quality and amount of soil resources are very relevant. In addition, statistics on the amount of soil resources are needed to inform about and possibly trigger intervention in the management of issues around soil depletion, degradation and desertification.
- 3.24. Various soil types can be defined using information on different combinations of soil components and properties. Typologies of soils can be found at the global level (from FAO¹⁶ or the Harmonised World Soil Database¹⁷) and also many countries have produced a

¹⁶ FAO has described 29 soil types: acrisols, albeluvisols, alisols, andosols, anthrosols, arenosols, calcisols, cambisols, chernozems, cryosols, durisols, ferralsols, fluvisols, gleysols, gypsisols, histosols, kastanozems, leptosols, lixisols, luvisols, nitisols, phaeozems, planosols, plinthosols, podzols, regosols, solonchaks, solonetz and umbrisols.

¹⁷ Harmonised World Soil Database, Version 1.2, February 2012, describes 28 major soil groupings that can be used to categorise and map soils at a broad global scale. <http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/>

classification of their own soil types for national purposes.¹⁸ Most soil classifications combine the physical properties (e.g., texture, structure, density, porosity, consistency, temperature and colour) and the type of organic matter (e.g., plant material, fungi, bacteria, protozoa, arthropods, earthworms, etc.) sheltered by the soil that can be alive or in different levels of decomposition.

- 3.25. Information on nutrient content and soil degradation for specific types of soil or specific locations should also be included in this topic. The nutrient content of soil is typically assessed using data on levels of Calcium (Ca), Magnesium (Mg), Nitrogen (N), Phosphorous (P), Potassium (K), and Zinc (Zn). Other elements may also be measured in soil quality assessments, including, but not limited to, Aluminium (Al), Boron (B), Iron (Fe), and Manganese (Mn). Statistics on degradation include measures of erosion, salinization, compacting, and acidification of specific soil types in specific parts of the country. Data sources for soil nutrient content, as well as degradation types and extent, are usually produced by scientific research and monitoring programmes, as well as estimation and modelling by research institutions and agricultural authorities.
- 3.26. Statistics on soil resources can provide information on the area and volume of soil resources and what is lost due to soil erosion, excavation, catastrophic losses, changes in land cover and land use (e.g., soil covered by buildings or roads), and other causes (e.g., changes in soil structure due to compaction, acidity or salinity). Soil resources are measured through a series of inventory processes, known collectively as a soil survey. Typically, a soil survey produces maps of soil types, soil suitability for various purposes, hazard and degradation potential and, in some cases, maps of specific soil properties.
- 3.27. Data on soil typologies covering the national territory are primarily produced by scientific research institutions as well as by geological, geographical and, sometimes, agricultural authorities. Using maps to portray the extent of soil types adds value to the statistics. In addition, these soil typologies are sometimes used to produce zoning regulations to protect certain soil typologies that play an important part in ensuring environmental sustainability. Other important and complementary information includes site or area-based measures of soil loss or erosion processes, and simulation modelling of the way in which soil types relate to various climate and land use settings.
- 3.28. Soil pollution statistics are included under Topic 1.4.4: Soil pollution.

¹⁸ For example, the United States Department of Agriculture soil taxonomy includes 12 soil types: entisols, vertisols, inceptisols, aridisols, mollisols, spodosols, alfisols, ultisols, oxisols, histosols, andisols and gelisols.

Topic 1.2.2: Land cover

- 3.29. Land cover is defined by FAO as, “the observed (bio)physical cover on the earth's surface.” (FAO, 2005) Changes in land cover are the result of natural processes and changes in land use. Land cover includes inland water i.e., land-locked water (e.g., rivers, lakes, ponds, etc.), as well as coastal water bodies and inter-tidal areas, but not marine water.
- 3.30. The Land Cover Classification System (LCCS)¹⁹, developed by the FAO, can be used to systematically record the biophysical characteristics of all areas of land within any territory. The number of combinations of land cover features that can be created using the LCCS approach is enormous and apply to any type of land cover. After a comprehensive global consultation process, a classification composed of 14 classes has been developed in the SEEA Central Framework (included in Annex E).²⁰ These 14 classes have been generated using the LCCS approach and thus provide a comprehensive set of land cover types, mutually exclusive and unambiguous, with clear boundaries and systematic definitions. Furthermore, the identified classes are defined to be used as the basis for the development of ecosystem statistics. The aim of the classification is to provide a common framework to compile and aggregate land cover information available at the national level and make it comparable at the international level, and to provide a structure to guide data collection and the creation of land cover databases for countries in the process of establishing a land cover statistics domain.
- 3.31. The main source of land cover information is remote sensing data, usually satellite images or aerial photographs, that are interpreted and transformed into geospatial data and statistics (combined and validated by ground-truthing), mapping the different categories that cover the land.

Sub-component 1.3: Biodiversity and Ecosystems

- 3.32. This sub-component organizes environment statistics on biodiversity and ecosystems, as well as their recordable changes over time and across locations. Ecosystems can be broadly defined as a community of organisms, together with their physical environment, viewed as a system of interacting and interdependent relationships. Biodiversity is the variability among

¹⁹ The LCCS provides a basis for any piece of land to be defined and classified with a rigorous syntax and clear classification criteria, starting from a set of basic objects identified based on physiognomic criteria, i.e. on their physical appearance. When the land is vegetated, the basic objects described are the plants (divided into trees, shrubs and herbaceous vegetation); when the land has a non-vegetal cover, or no cover at all, the basic objects can be water, ice and snow, the abiotic or artificial surface. Then, basic information in the LCCS can be supplemented with information on properties and characteristics of basic objects. Properties are further physiognomic characterization of basic objects, such as height and cover. Characteristics are descriptive elements of the basic objects not directly related to its physiognomic aspect and allow distinguish, for example, whether the area is intended for agricultural purposes or if it is natural. A higher level abstraction of the basic objects that compose land cover classes, as used in LCCS, called the “LCML” (for Land Cover Meta Language) has also been developed for use as a framework to classify land cover and compare systems internationally. This meta language allows the existing well established national and regional land cover systems to remain in place, while still allowing the data to be integrated into common world level data sets following a common land cover standard. LCML is currently undergoing the approval process to become an ISO standard as a framework to classify land cover and compare systems internationally.

²⁰ United Nations, 2012. *System of Environmental-Economic Accounting*. White cover publication, pre-edited text subject to official editing. https://unstats.un.org/unsd/envaccounting/White_cover.pdf

living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part, including diversity within species, between species and of ecosystems.²¹ It is also a measure of ecosystem health. Protected areas and species are included in this sub-component because of their inherent relation to biodiversity. The main purpose of the designation of protected areas and species is to allocate resources in order to sustain the biodiversity and survival of threatened or key species that exist in certain zones.

- 3.33. Statistics related to biodiversity and ecosystems are critical given the increasing understanding of the role ecosystems play in human wellbeing and evidence of biodiversity loss across the planet and in particular biomes around the world. Maintaining biodiversity and ecosystem health is necessary in order to preserve the genetic and ecosystem inheritance of a country, as well as its ecological productivity. This subsequently also protects the productivity of ecosystems for the use of the economy and society, which are largely dependent on the diversity of ecological systems for human livelihoods (e.g., production, distribution and consumption).
- 3.34. Because of the importance of forests worldwide, the most important aspects and statistics required to describe them are organized under a separate Topic 1.3.3 Forests. Note that as forests constitute particular ecosystems, as such it is also contained within Topic 1.3.2 Ecosystems, while statistics on forests as a resource used in production processes are allocated in Component 2, Topic 2.4.1: Timber resources and their use.

Topic 1.3.1: Biodiversity

- 3.35. This topic includes statistics on flora and fauna species (biota), on protected flora and fauna species, and on protected areas.
- 3.36. Statistics on flora and fauna species include the number of known species, their populations and the status of their vulnerability. Data on species populations are usually available on species of specific significance. Data are often obtained from expert and ad-hoc scientific studies and assessments, as well as research conducted by NGOs and the civil society. This can result in scattered and non-systematised data. When available and appropriate, portraying information through GIS can also be particularly useful.
- 3.37. The main source of data on protected areas is administrative records. Data can also be found in secondary databases and reports on the state of ecosystems or the state of the environment. These can usually be found under the responsibility of environmental authorities and are frequently produced for the national and sub-national levels.

²¹ http://treaties.un.org/doc/Treaties/1992/06/19920605%2008-44%20PM/Ch_XXVII_08p.pdf

- 3.38. This topic is further subdivided into two parts, according to the sources and types of information, firstly flora and fauna (including protected flora and fauna), and secondly protected areas.
- 3.39. Flora and fauna. This part contains descriptive information on the existence, variety and trends of flora and fauna in various populations and communities. Quantitative and complementary information on biodiversity in both terrestrial and marine environments, as well as their localization, are included here. The typical themes include the number and population of known species of flora and fauna (terrestrial, freshwater and marine), threatened species, protected species, endemic species, and invasive species.
- 3.40. Human activities affect flora, fauna and biodiversity both directly and indirectly, resulting in changes that are reflected by statistics on the status of flora and fauna species. The IUCN Red List of Threatened Species categories²² are based on the level of threat. The main categories are “extinct”, “threatened”, “near threatened” and “of least concern”.
- 3.41. Protected areas. This part includes physical and descriptive information and statistics on protected areas within the country, often disaggregated into terrestrial and marine groupings. The IUCN Protected Area Management Categories²³ are based on the strictness of protection and serve as the classification for protected areas. The main categories are: (i) strict natural reserves; (ii) wilderness areas; (iii) national parks, natural monuments and features; (iv) habitat (species) protected areas; (v) protected landscapes; and (vi) protected areas with sustainable use of natural resources.

Topic 1.3.2: Ecosystems

- 3.42. This topic covers physical and descriptive information and statistics about a country’s main ecosystems, including their extent (area) and the conditions reflecting the state of their characteristics. The extent and conditions of the ecosystems determine their capacity to produce ecosystem services.
- 3.43. For the purposes of characterizing the ecosystems of a country, in the absence of an internationally agreed ecosystem classification, national classifications could be used and fully described for statistical purposes. Alternatively, the country could follow and adapt other internationally used ecosystem categories, such as the Millennium Ecosystem Assessment reporting categories. The broadest reporting categories used in the Millennium Ecosystem Assessment are Forest, Mountain, Cultivated, Dryland, Polar, Inland Water, Marine, Coastal, Island, Urban and Other. (Millennium Ecosystem Assessment, 2003)²⁴ As recognized by the Millennium Ecosystem Assessment, these ecosystem reporting categories

²² <http://intranet.iucn.org/webfiles/doc/SSC/RedList/RedListGuidelines.pdf>

²³ http://www.iucn.org/about/work/programmes/pa/pa_products/wcpa_categories/

²⁴ <http://www.maweb.org/documents/document.769.aspx.pdf>

can and do overlap, so countries may want to decide as to the exact composition, inclusions and exclusions of the main ecosystems and biomes in accordance with national or existing international definitions.

3.44. Ecosystem categories are complicated to describe because of scale considerations.

Ecosystems can be alternatively grouped into biomes, biogeographical regions, habitats, river basins/sub-basins, etc. Depending on the country, ecosystems and biomes can be subdivided into small homogenous units (in practice, land cover units which are homogenous considering provisioning ecosystem services) and broader spatial and statistical units reflecting socio-ecological systems.

3.45. For each ecosystem category, sets of statistics and indicators can be produced to capture baselines and trends over time and space. For example, the Heinz Center organizes ecosystem indicators and related information, to the extent possible, into four parts:

- i. Statistics on extent (location and size) and pattern describe the spatial area of ecosystems and how they are intermingled across the landscape (e.g., area of wetlands, rivers and streams, the proximity of croplands to residences, and habitat fragmentation).
- ii. Statistics on chemical and physical characteristic report on nutrients, carbon, oxygen, contaminants and key physical trends (e.g., the amount of nitrogen delivered by major rivers to the nation's coastal waters, soil nutrient depletion, and erosion of croplands).
- iii. Statistics on biological component provide information on the conditions of plants, animals and living habitats (e.g., species at risk of extinction and the percentage of species in a region that is not native).
- iv. Statistics on ecosystem goods and services describe the flows that humanity derives from the natural world, or the ecosystem services (e.g., amount of timber harvested and participation in outdoor recreation). (Heinz Center, 2008)²⁵

3.46. While information on ecosystems is well developed and increasingly available from ecosystem science and different disciplines, using them for statistics describing ecosystems are rather scarce and non-systematic. Developing meaningful statistics on ecosystems needs the collaboration of scientists and statisticians. Ongoing work on the SEEA Experimental Ecosystem Accounts will improve this situation in the future.

Topic 1.3.3: Forests

3.47. Forests around the world play a central role in human societies, providing livelihoods for millions of people around the world. Forests offer timber, food, shelter, fuel and medicinal products and they also perform significant ecosystem functions such as hydrological regulation, soil protection and biodiversity protection, among others. Forests benefit not only

²⁵ Heinz Center's The State of the Nation's Ecosystems 2008, USA. Key Ecosystem Characteristics.

local ecosystems, but also improve environments at regional and global scales, notably storing over 1 trillion tons of carbon.²⁶ Globally, there has been a rapid loss of forests world wide, accumulating to a total of 135.3 million hectares from 1990 to 2010. Between 2000 and 2010 there has been a global loss of 5.2 million hectares of forest per year, an area about the size of Costa Rica. (FAO, 2010)²⁷ Therefore, it is crucial to understand the extent and characteristics of forests and to produce statistics about their diverse dimensions.

3.48. The most important environment statistics in this topic include forest area and its changes (deforestation, and afforestation), which can be organized by type of forest (e.g., natural, cultivated, total). Further statistics may include forest biomass and its carbon storage, and a characterization of forest ecosystems that exist in the country, including types, location, area and the main species of flora and fauna living in the forest, by IUCN category.

3.49. Data on forest cover and its changes, as well as on biophysical characteristics may be obtained from remote sensing, forest inventories and forestry statistics from forest management agencies (e.g., agricultural and forestry authorities).

3.50. Statistics on forest area and its changes can be disaggregated by different forest types (e.g., primary forest, other naturally generated forest, planted forest, other wooded land, etc). Forest area can also be disaggregated according to dominant tree species, age distribution, productivity, primary use of forest, areas under sustainable forest management, protected forests, etc. Changes of forest area in the different categories are the result of economic activities (afforestation, deforestation), reclassifications among the categories, or natural processes (expansion or regression).

3.51. Other environment statistics related to forest can also be found in Topic 2.4.1: Timber resources and their use, where forest is treated as a natural resource, and in which statistics are organized in terms of stocks and changes, extraction of timber and use of fertilizers and pesticides, among others. Forest ecosystems can also be characterized in Topic 1.3.2: Ecosystems.

Sub-component 1.4: Environmental Quality

3.52. This sub-component organizes statistics on the concentration of pollutants in the air, freshwater, marine water, and soil, as well as on noise levels. Measurements of concentrations of substances in the environmental media reflect the combined and cumulated impact of human and natural processes. This pollution impacts both the human sub-system as well as ecosystems.

²⁶ FAO, 2006. Forests and Climate Change. <http://www.fao.org/newsroom/en/focus/2006/1000247/index.html>

²⁷ FAO, 2010. Global Forest Resources Assessment <http://foris.fao.org/static/data/fra2010/KeyFindings-en.pdf>

- 3.53. Statistics on environmental quality are required by policy makers, analysts and civil society in order to monitor and make evidence based policies to maintain and improve environmental quality globally and in each country. Pollutant concentration statistics provide information on the quality of the environment. The importance of the different pollutants can vary when considering the quality of the ecosystem or the health and wellbeing of humans.
- 3.54. The spatial implications of pollutant concentration statistics are important particularly because of the fluidity of ecosystems and media (e.g., fresh and marine water, air). Air and water serve as transporters of pollutants from one media to the other and from one geographic area to another. Transforming measurements on different pollutants into statistics can be laborious because of spatial and temporal considerations. This emphasizes the need for collaboration between statistical offices and environmental agencies regarding the design (sampling pattern) of monitoring networks.
- 3.55. When national or local maximum allowable levels of pollutants exist in countries, it can be important to compare these values with the actual measured pollutant levels. Statistics on frequency of occurrences or percent of pollution events above maximum allowable levels are usually more important measures of environmental quality than national aggregates or averages. The number and area of locations where maximum allowable levels are exceeded can however be important at the national level.
- 3.56. Most countries utilize the environmental media approach to pollutant concentration statistics, where data can be produced and organized to provide statistics on concentrations of the most relevant pollutants in air, water and soil. Depending on the specific situation, at least concentrations of some pollutants are monitored in countries, and as long as they are systematic and reliable, statistical series can be produced from these primary sources.
- 3.57. It should be noted that the emissions of these pollutants are not included here, but in Component 3: Emissions, Residuals and Waste, linked to the activities and processes that generate, manage and finally discharge them to the environment.

Topic 1.4.1: Air quality

- 3.58. This topic includes statistics on the ambient concentration of the most important air pollutants, including both gases and suspended solid particles that can have a negative effect on human and ecosystem health. Statistics on air quality are important as polluted air affects human health as well as the health of ecosystems.
- 3.59. Air quality is usually measured at monitoring stations. Data availability varies according to the country's circumstances. When monitoring programmes and stations exist, the data

produced require further processing for transformation into environment statistics. Based on their location and purpose, monitoring stations can be impact, regional or background stations. Impact stations are allocated to major sources of pollution and measure the direct impact on local air quality. Regional stations are not affected directly by pollution sources. They measure how the pollution is transported and how it changes through space and time. Background stations are usually allocated at places that are not directly affected by human activities and they provide data on natural conditions. Changes in background concentrations are usually slow and they reflect the combined result of human and natural processes. The ECE Standard Statistical Classification of Ambient Air Quality (1990) lists the most important substances, parameters and variables that are recommended to be measured at impact, regional and background monitoring stations (See Annex E: Classifications and environment statistics).

- 3.60. The national monitoring of air quality usually concentrates on urban settlements where polluting activities and the affected population are concentrated. Air quality in urban settlements is also relevant to Component 5: Human Habitat and Environmental Health.
- 3.61. Monitoring of air quality is also frequently carried out in ecosystems or habitats of outstanding value or of high vulnerability. Statistics based on these measurements can be used to describe certain aspects of ecosystem health.
- 3.62. The statistics pertaining to concentration of gases in the atmosphere that are climate change drivers under this topic refer to those relevant at a global scale, and include global concentrations of CO₂ (carbon dioxide) and of CH₄ (methane), which are the two main greenhouse gases. For a complete set of environment statistics needed to assess climate change see Chapter 5 where the FDES and the Core Set of Environment Statistics are applied to this and other cross-cutting environmental issues.

Topic 1.4.2: Freshwater quality

- 3.63. Without good quality freshwater ecosystems and humans cannot survive. In the water cycle, precipitation, aquifers, groundwater, lakes, rivers, coastal zones and oceans are all interconnected, therefore the choice of where to measure or monitor the pollutants and which pollutants to monitor will depend on local and national priorities, ecosystem characteristics and resources available. The identification of the pollutants that are most relevant for monitoring depends on a number of factors. These include the immediate and subsequent water uses that are important to humans, and the nature of the pollutants found in water bodies and watersheds that affect the bio-capacities and local ecological equilibriums in the country.

- 3.64. The quality of freshwater can be described by biological, hydromorphological and physico-chemical parameters in surface water and groundwater. Pollutants found in groundwater are important but systematic measurements are often difficult. Although aquifers and groundwater are being polluted from percolates and infusion from above ground activities, it is difficult to develop representative or comprehensive information about it. Most monitoring stations and regular monitoring programmes are aimed at measuring specific pollutants found in surface freshwater, in specific zones or areas where important pollution problems exist.
- 3.65. It is important to keep in mind that the fluidity of this medium presents a challenge with regard to selecting the most important spatial locations and the relevant frequency for monitoring stations and programmes. This can cause complications with regard to spatial and temporal aggregation when producing data sets. For example, the significance of pollutant concentrations can vary widely at different points in a water body depending on multiple factors including where and when the highest concentrations of pollutants are discharged into the body. Additionally, seasonal variations in the volume of freshwater can also affect the concentrations of pollutants.
- 3.66. Data for water quality statistics are primarily produced by monitoring stations. Monitoring programmes are usually constructed when a policy or quality norm is set up for specific locations that show the most problematic signs of pollution. The data from these monitoring stations require further processing to produce environment statistics on the water quality of specific locations. Typically the resulting environment statistics will be produced and relevant for specific local areas or parts of rivers and lakes, and are not representative at the national level.
- 3.67. The ECE Standard Statistical Classification of Freshwater Quality for the Maintenance of Aquatic Life (1992) lists the most important substances, parameters and statistics needed to assess freshwater quality (see Annex E: Classifications and environment statistics).

Topic 1.4.3: Marine water quality

- 3.68. The most commonly monitored marine pollutants and associated phenomena can be organized into two categories that distinguish among local and national and supranational levels, in terms of the type of pollution and associated phenomena.
- 3.69. Locally relevant statistics about marine and coastal water quality and pollutant concentrations can include, but are not restricted to, urban runoff, sedimentation, coral bleaching, heavy metals that bioaccumulate (e.g., mercury, lead, nickel, arsenic, cadmium), eutrophication, red tide and bacterial pollutants in marine fishing areas and recreational beaches.

- 3.70. Nationally and supranationally relevant statistics about marine water quality and pollutants can include, but are not restricted to, acidification of marine water, oil spills, coral bleaching, heavy metals that bioaccumulate (e.g., mercury, lead, nickel, arsenic, cadmium) and persistent toxins (e.g., polychlorinated biphenyls [PCBs], dichlorodiphenyltrichloroethane [DDT], other pesticides, furans, dioxins, phenols and radioactive waste). The resulting environment statistics will be produced for and be relevant to areas belonging to national and supranational marine and ocean environments.
- 3.71. Data sources for marine water quality statistics are typically either national or international monitoring stations, associated with scientific research. Monitoring programmes are usually constructed when the scientific interest for research is present, and/or when policy or quality norms are set up for specific areas that show the most problematic signs of marine pollution. The data from these monitoring stations require further processing to produce environment statistics on the water quality of specific locations.
- 3.72. Spatial and temporal considerations are very important when constructing statistics on this topic. For instance, with regard to oceanic and marine water pollutant concentrations, most monitoring stations and regular quality monitoring programmes are aimed at surface marine water and at coastline zones. There is a noted lack of monitoring aimed at deep oceans. The fluidity of the oceans' waters, their waves, tides and continued movement, make it a complex task to determine location, depth and appropriate time periods for measurement that are applicable for each relevant pollutant.
- 3.73. The ECE Standard Statistical Classification of Marine Water Quality (1992) lists the most important pollutants, parameters and statistics needed to assess marine water quality. There are a number of important marine environment and marine water quality statistics which a country may track. Examples include concentrations of bio-pollutants, heavy metals, persistent toxins and radioactive substances, as well as coral bleaching. Producing statistics on the concentrations and effects of pollutants and waste in marine water bodies is of the greatest importance to the health of ecosystems as well as to humans (see Annex E: Classifications and environment statistics).

Topic 1.4.4: Soil pollution

- 3.74. Soil contamination is typically caused by chemicals and other residuals disposed of by humans. The most common sources of soil contamination include leakage from underground storage tanks and pipelines, the use of pesticides in agriculture and forestry, the percolation of polluted waters, oil and fuel dumping, and direct discharges of wastewater and industrial residuals to the soil.

- 3.75. Some of the most commonly measured soil pollutants include petroleum hydrocarbons (e.g., oil residuals and solvents), pesticides and heavy metals.
- 3.76. Data sources for soil pollution are primarily produced by monitoring stations and will be related to those specific locations. The data from these monitoring stations require further processing to produce environment statistics on the soil quality of specific locations. The resulting environment statistics should be produced and be relevant for the specific local areas where the most problematic conditions of soil pollution exist. Due to local variations in soil quality it will be very difficult to develop figures that are representative at national level.
- 3.77. Soil pollution directly affects human and environmental health, and the productivity of land, depending on the pollutant concentration, depth of contact with biota and density of humans in polluted areas, and other factors. However, soil contamination is rarely monitored. Its documentation and measurement usually follows important pollution events that require clean-up or intervention. Thus, the data available for statistical purposes are usually limited and not systematic.

Topic 1.4.5: Noise

- 3.78. Noise pollution does not only exist in the most populated or busiest cities, but also everywhere where human activities are carried out, such as adjacent to highways, near airports and marine ports and around manufacturing, metal processing and mining establishments and construction sites. Noise pollution negatively affects the welfare and health of humans and also affects and changes biota, particularly fauna.
- 3.79. All available statistics on noise pollution are included in this topic. Noise pollution is typically measured using calibrated instruments in specific spatially located stations. This is usually the approach used when there are policies or programmes of noise abatement and control in place. These monitoring stations, run by the pertinent national or local environmental authority, typically produce data that need to be further processed to be converted into environment statistics. The resulting environment statistics are produced for and are relevant to the specific local areas where the most problematic conditions of noise pollution exist. They are not representative of the national territory.
- 3.80. Statistics on noise levels in urban settlements are also relevant to Component 5: Human Habitat and Environmental Health.

3.5 Component 2: Environmental Resources and their Use

- 3.81. Environmental resources or assets are the living and non-living constituents of the earth together comprising the biophysical environment that may provide benefits to humanity. Environmental resources include: subsoil resources; land; soil resources; biological resources; and water resources. They can be naturally renewable (e.g., fish, timber or water) or non-renewable (e.g., minerals).
- 3.82. Environmental resources are used as important inputs in production and consumption. They contribute to the provision of shelter, food, health care, infrastructure, communications, transportation, defence and virtually every other aspect of human activity. Consequently, statistics documenting their availability and quality over time are necessary for policy makers to make informed decisions, to avoid shortage or restriction of use, to ensure availability for new and emerging applications, to determine import dependence and other risks, as well as to generally enable continued use over time. Data regarding the availability of environmental resources and their use are important in order to sustainably manage current and future use by the human sub-system.
- 3.83. In Component 2, statistics on environmental resources and their use are focused on measuring stocks and changes in stocks of these resources. Changes in the stocks of environmental resources include additions and reductions, from both anthropogenic and natural activities. In the case of non-renewable resources, extraction usually means the depletion of the resource. For renewable resources, if extraction (e.g., abstraction, removal, harvesting, etc.) exceeds natural regeneration and human-made replenishment, the resource is depleted.
- 3.84. Statistics regarding the most important human activities related to the use of environmental resources help identify the possibilities for policy intervention. Under Component 2, the activities that directly extract, abstract, harvest or restructure individual environmental resources, are included. These activities have additional impacts on the environment beyond the direct use of individual environmental resources. Examples of analysis that brings together all environmental impacts of the individual activities is discussed and presented in Chapter 5: Applications of the FDES to cross-cutting environmental issues.
- 3.85. Component 2 contains five sub-components that correspond to the main categories of environmental resources:
- i. Sub-component 2.1: Non-energy Mineral Resources;

- ii. Sub-component 2.2: Energy Resources;
- iii. Sub-component 2.3: Land;
- iv. Sub-component 2.4: Biological Resources; and
- v. Sub-component 2.5: Water Resources.

Sub-component 2.1: Non-energy Mineral Resources

Topic 2.1.1: Stocks and changes of non-energy mineral resources

- 3.86. Stocks of non-energy mineral resources are defined as the amount of known deposits of non-metallic and metallic mineral resources. Classes of known deposits include: commercially recoverable deposits; potential commercially recoverable deposits; as well as non-commercial and other known deposits. The minerals in question vary from metal ores (including precious metals and rare earths), to stone, sand and clay, chemical and fertilizer minerals, salt and various other minerals such as gemstones, abrasive minerals, graphite, asphalt, natural solid bitumen and quartz and mica.
- 3.87. These non-energy environmental resources are not renewable so their depletion reduces their availability in the environment over time. The scale of their extraction can determine the amount of stress which is placed on the environment. Statistics on their stocks are required in order to assist in the sustainable management of these resources.
- 3.88. Non-energy minerals are extracted from the environment typically through mining and quarrying. These activities fall in ISIC Rev. 4 under Section B – Mining and quarrying. Extraction can be achieved by different methods such as underground or surface mining. Extraction of non-energy mineral resources reflects the quantity of the resource physically removed from the deposit during a period of time, usually one year. The difference between the opening and closing stocks of non-energy mineral resources for a particular year are mostly the result of extraction. However, new discoveries, reappraisals and reclassifications of stocks, as well as catastrophic losses, can also influence the difference between opening and closing stocks.
- 3.89. Main sources of statistics about non-energy mineral resource stocks are geological surveys and inventories and economic statistics on mining and quarrying. The institutional partners in the data collection will be the mining and energy authorities at the national and sub-national levels. Data are also available from governing commercial bodies such as gemstone and metallic mineral bourses, manufacturers associations, etc.

- 3.90. Non-energy mineral products that result from the extraction activities can be classified based on CPC version 2 Section 1 where metal ores; stone, sand and clay; and other non-energy minerals are included.

Sub-component 2.2: Energy Resources

Topic 2.2.1: Stocks and changes of mineral energy resources

- 3.91. Mineral energy resources are environmental resources which cannot be renewed in any human timescale, therefore their extraction and use in the economy results in the depletion of the resource, limiting their availability for future generations. Statistics on the magnitude of their stocks through time are required in order to assist in the sustainable management of these resources.
- 3.92. Stocks of mineral energy resources are defined as the amount of known deposits of mineral energy resources. They include natural gas, crude oil and natural gas liquids, oil shale, natural bitumen and extra heavy oil, coal and lignite, peat, uranium and thorium ores, among others. Classes of known deposits include: commercially recoverable deposits; potential commercially recoverable deposits; as well as non-commercial and other known deposits.
- 3.93. Extraction of mineral energy resources reflects the quantity of the resource physically removed from the deposit during a period of time, usually one year. The difference between the opening and closing stocks of mineral energy resources for a particular year are mostly the result of extraction. New discoveries, reappraisals and reclassifications of stocks, as well as catastrophic losses, can also influence the difference between opening and closing stocks.
- 3.94. Main sources of statistics about mineral energy resource stocks are geological surveys and inventories, while the institutional partners in the data collection will be the mining and energy authorities at the national and sub-national levels. Main sources of statistics about extraction of mineral resources are economic statistics on mining as well as energy statistics.

Topic 2.2.2: Production and use of energy

- 3.95. Energy production refers to the capture, extraction or manufacture of fuels or energy in forms which are ready for general use. Energy is produced for human use in a number of different ways, depending on its source. Energy production, distribution and use are made with different efficiency rates and these processes cause distinct environmental impacts (land use change, air pollution, GHG emissions, waste etc.) therefore producing statistics to describe these activities is key to environment sustainability policy.

Production of renewable and non-renewable energy

- 3.96. Total energy production originates in renewable and non renewable sources. These constitute key environment statistics that can assist when analysing the sustainability of the energy matrix at the national level.
- 3.97. Renewable energy is transformed from sources that replenish this flow. It is also cleaner than non-renewable energy and its carbon footprint is substantially less than fossil fuel energies. Global statistics show the progressive use of renewable energy resources is increasing, but still constitute an insufficient proportion of the total energy supply worldwide.
- 3.98. Renewable energy includes solar (photovoltaic and thermal), hydroelectric, geothermal, tidal action, wave action, ocean thermal, wind and traditional biomass, all of which are naturally replenished, even though their flow may be limited.
- 3.99. The stocks of renewable energy resources are not subject to depletion in a similar manner to the non-renewable energy resources. Additionally, their stocks can not be accurately measured. Thus, stocks of renewable energy resources are not included in the FDES. However, the use of renewable energy resources can be measured in terms of the energy produced (e.g., hydroelectric power, solar energy generation, wind energy production, etc.) and is included in the FDES.
- 3.100. The two main types of non-renewable energy sources are fossil and nuclear fuels. Much of the growth in energy consumption occurs as a result of use of fossil fuels.
- 3.101. A specific non-renewable source of energy is waste such as municipal solid waste, plastics, tire-derived fuels and other discarded combustible materials.
- 3.102. The main sources of statistics on renewable and non-renewable energy resources are energy statistics and energy balances that are available from national energy authorities or NSOs in most countries.
- 3.103. The production of energy from non-renewable and renewable sources is captured under the economic activities ISIC Rev. 4. Section C, Division 19 Manufacture of coke and refined petroleum products; and Section D, Division 35 Electricity, gas, steam and air conditioning supply. Energy products resulting from extraction and transformation activities can be classified according to the Standard International Energy Product Classification (SIEC) contained in the International Recommendations for Energy Statistics (IRES)²⁸.

²⁸ <http://unstats.un.org/statcom/doc11/BG-IRES.pdf>

Sub-component 2.3: Land

- 3.104. Statistics on land cover and land use fulfil a basic informational need of governments, policy makers, analysts and civil society. Without an understanding of the physical characteristics, of what the land in their territory is being used for - currently and over time -, and what production methods are being employed, policy makers are less able to determine impacts on ecosystems. Also, without this information, policy makers are unable to understand how sustainable certain uses are and which corresponding policy decisions may be required to regulate land usage and improve sustainability.
- 3.105. Land is a unique environmental resource that delineates the space in which economic activities and environmental processes take place and within which environmental resources and economic assets are located. The two primary aspects of land are land cover (see Component 1, Topic 1.2.2: Land cover) and land use. These aspects are strictly related: while land cover describes the biophysical aspect of land, land use refers to the functional aspects of land. Changes in land cover can be the result of natural processes and of land use operations. Thus, the use or non-use of the land determines the type of land cover. Generally, the total area of a country will remain unchanged from one period to the next. Hence, changes in the stocks of land will comprise changes within and between different classes of land cover and land use (land restructuring).
- 3.106. The total area of a country is the area enclosed by her inland borders and, if applicable, the sea.²⁹ While inland waters (e.g., rivers, lakes, ponds etc.), are included in land use classifications, marine water areas can be included only in a broader concept of land use. Certain types of land use analyses may include coastal waters (internal waters) or even Exclusive Economic Zones (EEZs).

Topic 2.3.1: Land use

- 3.107. Land use reflects both the activities undertaken and the institutional arrangements put in place for a given area for the purposes of economic production, or the maintenance and restoration of environmental functions. Land being “used” means the existence of some kind of human activity or management. Consequently, there are areas of land that are “not in use” by human activities. These areas are important from an ecological point of view. Land use statistics cover both land in use and land not in use. Statistics on land use are usually obtained by the combination of field surveys and remote sensing, mostly satellite images. Land use data may also be obtained from administrative land registers where available.

²⁹ The boundaries between the land and the sea vary considerably between countries depending on the different geographical features of a country. The conventions by which country area is determined, in particular the definition of baselines, focus on the boundary between land and sea and have been agreed internationally in the United Nations Convention on the Law of the Sea (UNCLOS).

3.108. A reference framework for the classification of land use is provided in the SEEA Central Framework³⁰ as agreed after a comprehensive global consultation process. The development of the land use classification included in the SEEA, led by the FAO, has been based on practices already in use in major international and national land use databases adjusted to meet the different needs which have arisen during the global consultation process on this issue. The aim of the land use classification presented in the SEEA is twofold: (i) to provide a reference framework for the compilation and aggregation of data at the international level; and (ii) to provide guidance to countries in the process of establishing a land use classification scheme. For more information, see Annex E: Classifications and environment statistics.

Topic 2.3.2: Land use change

3.109. Changes in land use can be reflected by statistics on changes within and between the different land use classes. Changes in land use will redistribute the area of the country among the land use categories. If presented in a matrix form, the information will show how increase or decrease in one category contributes to the decrease or increase of other land use categories. Land cover statistics can also be presented in a similar fashion. Cross-combination of land use and land cover categories show what kind of economic activities are carried out in the different land cover areas. Changes in land use frequently result in changes of land cover, however, land under different land cover categories will also increase or decrease due to managed or natural expansion or regression. Statistics on land cover and its changes also give information about the extent of different ecosystems (see also Topic 1.3.2: Ecosystems).

Sub-component 2.4: Biological Resources

3.110. Biological resources include timber resources, aquatic resources, crops, livestock and other biological resources provided by natural or cultivated ecosystems. Biological resources are renewable resources that are capable of regeneration through natural (non-managed or managed) processes. Biological resources form an important part of biodiversity and ecosystems. If harvesting and other losses surpass natural or managed regeneration or replenishment, biological resources become depleted.

3.111. Cultivated biological resources can impact the environment differently than natural ones. This is quite evident in the case of mono-cultivated, intensive crops that utilize irrigation, and increasing amounts of fertilizers and pesticides. Collection of statistics related to both natural and cultivated biological resources are required in order to provide policy makers with the data needed to monitor the sustainable usage of these resources. Ideally statistics on

³⁰ United Nations, 2012. *System of Environmental-Economic Accounting*. White cover publication, pre-edited text subject to official editing. https://unstats.un.org/unsd/envaccounting/White_cover.pdf

impact of fertilizer and pesticide use or soil nutrient balances would be ideal, but those are not easily measured, therefore the capture of use statistics would be an alternative.

Topic 2.4.1: Timber resources and their use

- 3.112. Timber resources can be natural or cultivated and are important environmental resources in many countries. They provide inputs for construction and the production of furniture, cardboard, cellulose, paper and other products. They are also a source of fuel and an important sink for carbon. Timber resources are defined by the volume of trees, living and dead, which can still be used for timber or fuel. This includes all trees regardless of diameter or tops of stems. The general proxy that should be considered for determining the volume of timber resources is the volume that is commercially usable.
- 3.113. Stocks of timber resources increase due to natural growth, new plantations or growth derived from management of plantations, and are measured as the gross annual increase. Stocks decrease due to removals of timber, natural losses and catastrophic losses. Timber resources may also change due to the increase of forest land, or changes in management practices (reclassification). The volume of timber removals can also be disaggregated according to the type of forestry product (e.g., industrial roundwood, fuelwood, etc.) or by tree species. Stock changes should be estimated separately for natural and cultivated timber resources.
- 3.114. The most important economic activity responsible for the use and management of timber resources is Forestry and logging (ISIC Rev 4. Section A, Division 02). This division includes: growing of standing timber; planting, replanting, transplanting, thinning and conserving of forests and timber tracts; growing of coppice, pulpwood and fire wood; operation of forest tree nurseries; production of roundwood; gathering and production of fire wood; and production of charcoal in the forest (using traditional methods). These activities can be carried out in natural or planted forests.
- 3.115. Forestry activities may also include the application of fertilizers and pest control. Statistics on fertilizer and pesticide use in forestry are very important to assess their impact on the environment.
- 3.116. The use of timber products in the economy and by households can be captured in physical and monetary supply and use tables originating from national accounts and also from forestry, manufacturing, energy and trade statistics. Linking timber resources to their use in the economy and to the SNA is the subject of the SEEA Central Framework.

Topic 2.4.2: Aquatic resources and their use

- 3.117. Aquatic resources include fish, crustaceans, molluscs, shellfish and other aquatic organisms such as sponges and seaweed, as well as aquatic mammals such as whales. Aquatic resources are subject to harvest for commercial reasons as well as part of recreational and subsistence fishing activities. The abundance and health of natural aquatic resources in inland and marine waters are also increasingly affected by water pollution and by the degradation of habitats. The dual impacts of excessive exploitation levels and habitat degradation result in the loss, or reduction, of the goods and services provided by the aquatic ecosystems, as well as a loss of biodiversity and genetic resources.
- 3.118. The aquatic resources for a given country comprise those resources that are considered to live within the EEZ of a country throughout their lifecycles, both coastal and inland fisheries. Migrating and straddling fish stocks are considered to belong to a given country during the period when those stocks inhabit its EEZ.
- 3.119. Aquatic resources may be either cultivated or natural biological resources. Aquatic resources produced within aquaculture facilities (for breeding or for harvest) are considered cultivated biological resources. All other aquatic resources harvested as part of capture production processes are considered natural biological resources. Changes in the stocks of aquatic resources are the result of growth in stocks, total removals, natural and catastrophic losses. Stock changes should be estimated separately for: natural and cultivated resources; the most important aquatic groups/species; and marine and freshwater groups/species. Aquaculture activities may also include the application of colorants, pellet, antibiotics, fungicides, hormones and other substances. Statistics on these aspects of aquaculture are very important to assess their impact on the environment.
- 3.120. The FAO International Standard Classification for Aquatic Animals and Plants (ISCAAP) is commonly used for statistics on aquatic resources. There is another set of terms established by FAO for the different stages of the catch, depending on the inclusion or exclusion of by-catch and by-product. The measurement of discarded catch is an important component in fully understanding the linkages between economic activity and the impact on aquatic resources.
- 3.121. The most important economic activity related to the use and management of aquatic resources is Fishing and aquaculture (ISIC Rev. 4, Section A, Division 03). This division includes capture fishery and aquaculture, covering the use of fishery resources from marine, brackish or freshwater environments, with the goal of capturing or gathering fish, crustaceans, molluscs and other marine organisms and products (e.g., aquatic plants, pearls, sponges, etc.).

3.122. The use of aquatic products in the economy and by households can be captured in physical and monetary supply and use tables originating from national accounts. Linking aquatic resources to their use in the economy and to the SNA is the subject of the SEEA Central Framework.

Topic 2.4.3: Crops

3.123. Crops refer to plants or agricultural produce grown at a large scale for food or other economic purposes, such as clothes or livestock fodder (ISIC Rev. 4, Section A, Division 01). Modern large-scale agriculture, in its race to improve crop production, has resulted in the use of increasing anthropogenic inputs in the form of labour, irrigation, chemical fertilizers, pesticides, and new or modified genetic material.

3.124. In terms of environment statistics, both the area used for cultivated crops as well as yields are important. Furthermore, the methods of production used in crops, which can have different environmental consequences, are highly relevant. Monoculture, the practice of intensively growing one type of crop over an area, can bring benefits to farmers, due to uniform growing requirements and standardized planting, maintenance and pest control. Overall, monocultures and resource intensive farming have brought about an increase in crop yield, greatly reducing the amount of land needed for crop production. Nonetheless, in recent decades the rise of monocultures has also led to widespread environmental sustainability concerns, including soil nutrient loss, widespread pest invasions and biodiversity loss. Organic production is growing in importance benefiting both environment and health but still constitutes a small proportion of crops worldwide.

3.125. In terms of environment statistics, this topic covers statistics about main crop types, annual and perennial crops, different planting methods, monoculture and resource-intensive crops, as well as organic farming production. Area harvested is especially important when measuring sown or planted areas (gross) versus harvested areas (net). (FAO, 2012)³¹ Fertilizers play a key part in the yield and quantity of crops produced, as well as in the environmental effects of agriculture. Therefore, the amount of natural fertilizers, such as manure or compost, and artificial fertilizers are also relevant. Because of their effect on biodiversity, invasive pests and pollution, statistics on the use of pesticides (e.g., herbicides, insecticides, fungicides, rodenticides, etc.) are also considered essential to environment statistics. With the large growth of modern intensive farming practices and genetically modified crops, constructing these statistics can be particularly relevant to some countries. Finally, imports and exports of crops can also be an important measure of the total production, apparent national consumption, and possibly also the associated pressure on the

³¹ FAO, 2012. *Crops Statistics – concepts, definitions and classifications*.
http://www.fao.org/fileadmin/templates/ess/ess_test_folder/documents/Production_trade/definitions/Crops_statistics_concepts_definitions_classifications.doc

environment. The main source of data and the key institutional partner for crop statistics is usually the agricultural authority.

Topic 2.4.4: Livestock

3.126. Livestock are animal species that are raised by humans for commercial purposes, consumption, or labour (ISIC Rev 4. Section A, Division 01). Usually raised in agricultural settings, typical livestock species include cows, poultry, pigs and sheep. Rising incomes and growing populations, especially in the developing world, have led to higher demands in livestock products, including milk, eggs and meat, driving growth in the livestock sector. (FAO, 2006)³² Nonetheless, livestock rearing is associated with multiple environmental degradation issues. According to the FAO, global livestock production contributes 18 percent of global greenhouse emissions, yet generates under 1.5 percent of global GDP. Furthermore, the livestock sector occupies the largest percentage of land used for anthropogenic purposes. Clearing land for pasture and feed crops has led to widespread deforestation and biodiversity loss, and overgrazing leads to erosion and compaction. Furthermore, livestock production accounts for large amounts of water use and acts as a source of water pollution from hormone use and other chemicals.

3.127. In spite of its prevalent environmental implications however, livestock contributes to the livelihoods of millions of the world's poor, providing an income source (sometimes the only source) for many. Therefore, measuring livestock impacts and driving efficiency in the production line is vital.

3.128. Environmentally relevant statistics on livestock include the number of live animals, as well as antibiotics and hormones used for them. Furthermore, imports and exports of livestock are also a good measure of national livestock quantity and possibly of pressure on the environment.

3.129. The main source of data and the institutional partner for livestock statistics is usually the agricultural authority.

Topic 2.4.5: Wild, uncultivated biological resources (other than fish and timber)

3.130. While the vast majority of biological resources are cultivated, there is a range of naturally occurring biological resources which provide inputs to the economy and form an important part of biodiversity. Environmentally relevant statistics on this topic focus on the use and management of these resources as this can affect biological diversity. These resources may include wild berries, fungi, bacteria, fruits, sap and other plant resources that are harvested (ISIC Rev. 4, Section A, group 0230) as well as wild animals that are trapped or killed for

³²FAO, 2006. *Livestock Impacts on the environment*. <http://www.fao.org/ag/magazine/0612sp1.htm>

production, consumption and trade. This topic excludes timber and fish, as they are included in Topics 2.4.1 and 2.4.2 respectively.

- 3.131. Today, wild animals are disappearing at alarming rates due to poaching, habitat and overuse of natural resources amongst other reasons. (World Wildlife Federation, 2012)³³ The conservation of key habitats and landscapes and the species within them is key in order to prevent further biodiversity loss. Furthermore, CITES states that the trade of wild species needs to be managed at national and international levels, to prevent over-exploitation.³⁴ Trade that is detrimental to the survival of a species and does not allow the species to live in a consistent level in its ecosystem has to be managed and measured. This can involve measuring imports and exports of such species for trade, how many wild animals are killed or trapped for food or sale, permits issued for hunting wild animals, as well as the total number of animals killed under these permits. Finally, non-wood forest products and other plants are also covered in this topic.
- 3.132. The main source of data and the institutional partners for wild biological resources statistics include the environmental, natural resources and wildlife authorities, as well as the government agency responsible for hunting.

Sub-component 2.5: Water Resources

- 3.133. Management of water resources, in terms of quantities, distribution and quality, is one of the most important priorities in the world today. Statistics on water resources, their abstraction, use and treatment are needed by policy makers for a number of reasons, which include: estimating the amount of available freshwater resources; monitoring abstraction from key water bodies to prevent overutilization; ensuring equitable usage of abstracted water; and to tracking the volume of water returned to the environment.
- 3.134. The International Recommendations for Water Statistics (IRWS)³⁵ provides the definitions and groupings for the purposes of statistics on water resources and their use.

Topic 2.5.1: Water resources

- 3.135. Water resources consist of fresh and brackish water, regardless of their quality, in inland water bodies including surface water, groundwater and soil water. Surface water includes water in artificial reservoirs, lakes, rivers and streams, snow, ice and glaciers. Renewable water resources of a country are generated by precipitation and inflows of water from other countries and reduced by evaporation, evapotranspiration and outflows to other countries or to the sea.

³³ World Wildlife Federation, 2012. *Protecting Wildlife*. <http://www.worldwildlife.org/species/>

³⁴ CITES, 2008. *Non-detriment findings*. <http://www.cites.org/eng/prog/ndf/index.php>

³⁵ United Nations, 2012. *International Recommendations for Water Statistics*. <http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf>

3.136. Statistics on water resources include the volume of water generated within the country or territory as the result of precipitation, the volume of water lost to evapotranspiration, the inflow of water from other territories, and the outflow of water to other territories or the sea. The statistics are sourced from hydrometeorological and hydrological monitoring, measurements and models. Statistics on the quality of water in water bodies are discussed under Topic 1.4.2: Freshwater quality and Topic 1.4.3: Marine water quality.

Topic 2.5.2: Abstraction, use and returns of water

3.137. Water is abstracted from surface and groundwater resources by economic activities and households. Water can be abstracted for own use or for distribution to other users. Statistics on water abstraction should be disaggregated according to the source of the water (surface or groundwater) and the economic activity of the abstractor. Statistics on water abstraction are usually available from administrative records (monitoring of actual water abstractions as well as abstraction permits).

3.138. After abstraction and distribution water is used in the economy in production and consumption activities. Water can be recycled and reused several times before returning it to the environment. Water use should be disaggregated according to economic activity and household use. The most significant water uses (e.g., irrigation in agriculture, hydropower generation and cooling) should be specified. There might be significant amounts of water losses during distribution, so these data should be captured here as well. Statistics on water use can be obtained from statistical surveys of primary users, household surveys and administrative records of the water supply industry.

3.139. In-stream water use refers to the use of water *in situ*, without abstracting it from its source that is, moving it from its natural cycle. A very important type of in-stream water use is the ecological use, that is, the water used as a habitat for living organisms. All human in-stream water uses, similarly to off-stream uses, have significant effects with regard to the ecological use of the same water resources. Examples of in-stream water use are transportation, hydropower generation, fishing, recreation and tourism, and waste loading (pollution dilution). In-stream activities are usually measured in terms of the intensity of the use. In-stream uses of water are covered under Topic 2.4.2: Aquatic resources and their use; Topic 2.2.2: Production and use of energy; Topic 3.2.3: Discharge of wastewater to the environment. Statistics on water transport, tourism and recreation can be used to indicate the pressures these activities put on water resources.

3.140. A large part of the water used in economic activities and by households is returned to the environment after or without treatment. The volume of returned water should be disaggregated according to the recipient (e.g., surface water, groundwater, soil, sea).

Statistics on the treatment and pollutant content of wastewater are discussed under Component 3, Sub-component 3.2: Generation and Management of Wastewater.

3.141. All economic activities and households can abstract, use and return water to the environment. The most important activities, in terms of the volume of water abstracted, are agriculture (irrigation and livestock), the generation of electricity (hydropower and cooling) and the water collection, treatment and supply industry (ISIC Rev. 4, Section E, Division 36) that includes the collection (abstraction), treatment and distribution of water for domestic and industrial needs. Collection of water from various sources, as well as distribution by various means is also included. Division 37 Sewerage accounts for a significant part of water returned to the environment.

3.142. The use of water in the economy and by households can be captured from water statistics and in physical and monetary supply and use tables originating from national accounts. Linking water resources to their use in the economy and to the SNA is the subject of the SEEA Central Framework.

3.6 Component 3: Emissions, Residuals and Waste

3.143. This component contains statistics on the amount and characteristics of residuals generated by human production and consumption processes, their management, and their final release to the environment. Residuals are solid, liquid and gaseous materials that are discarded, discharged or emitted through processes of production, consumption and accumulation. Residuals may be discarded, discharged or emitted directly to the environment or be captured, collected, treated, recycled or reused. The main groups of residuals are emissions, wastewater and waste.

3.144. Emissions are substances released to the environment as a result of production, consumption and accumulation processes. Generally, emissions are analysed by type of receiving environment (air, water bodies, or soil) and by type of substance.

3.145. Wastewater is discarded water that is no longer required by the owner or user. Water discharged into sewers, water received by water treatment plants and water discharged to the environment is all considered wastewater regardless of its quality. It also includes reused water which is wastewater supplied to a user for further use with or without treatment.

3.146. Waste covers discarded materials that are no longer required by the owner or user. It includes materials that are in solid or liquid state but excludes wastewater and emissions to air.

- 3.147. Emissions of pollutants, residuals and waste can have different impacts and effects on human and ecosystem health. They will be absorbed, or will persist and concentrate differently, depending on their nature, their scale and a combination of local environmental dynamics (e.g., wind, currents, as well as characteristics of land, air and water masses, etc.). Sometimes the substances are released or disposed of with little or no treatment, but increasingly, emissions are treated to reduce pollutants before they are released into the environment. These treatment and management processes, and their infrastructure are also contained in this component.
- 3.148. The subsequent concentrations of these residuals and pollutants in the different media are covered in Component 1, Sub-component 1.4: Environmental Quality.
- 3.149. Component 3 contains three sub-components:
- i. Sub-component 3.1: Emissions to Air;
 - ii. Sub-component 3.2: Generation and Management of Wastewater; and
 - iii. Sub-component 3.3: Generation and Management of Waste.

Sub-component 3.1: Emissions to Air

- 3.150. Air pollution can be caused by natural as well as anthropogenic sources. In the FDES, the focus is on the emission of pollutants from socio-economic processes. Emissions to air are gaseous and particulate substances released to the atmosphere by establishments and households as a result of production, consumption and accumulation activities. The statistical description of such emissions covers their sources and the quantities emitted by substances.
- 3.151. Policy makers, analysts and civil society require statistics on emissions to air in order to monitor the amount and type of emissions over time and across locations. These statistics can be used for evidence based policy making, particularly with regard to environmental regulations (e.g., the maximum allowable emission levels versus actual levels). They can also be used to model where the largest impacts on humans from air pollution can be expected. Importantly, these statistics are also required to monitor adherence to any MEAs, particularly the Kyoto and Montreal protocols, of which the country may be a party.
- 3.152. Air emissions can be measured directly, or can be estimated on the basis of fuel and other material input data and process-specific emission factors. This information is usually produced in the form of emission inventories, available primarily from environmental ministries or environment protection authorities. Emissions to air can be distinguished by the type of source (e.g., stationary or mobile, point or diffuse), by process, and by economic activity.

3.153. The groups of different chemicals relevant to statistics on emissions to air include: sulphur compounds; oxidized nitrogen compounds and oxidants; reduced nitrogen compounds; inorganic carbon compounds; halogen and inorganic halogen compounds; volatile organic compounds; heavy metals; and different fractions of particulate matter. The ECE Standard Statistical Classification of Ambient Air Quality (1990) lists the substances, parameters and variables needed for statistics on air emissions.

Topic 3.1.1: Emissions of Greenhouse Gases (GHG)

3.154. A special category of air emissions is the emissions of GHG. Emission inventories of GHG are compiled according to the guidelines developed by the IPCC, under the auspices of the United Nations Framework Convention on Climate Change (UNFCCC). The source categories of GHG emissions are based on processes and the categories of sinks for GHG emissions are also included. GHG includes both direct and indirect GHG. The most important direct GHG being carbon dioxide (CO₂) and methane (CH₄), and the most important indirect GHG being sulphur dioxide (SO₂) and nitrogen oxides (NO_x).

Topic 3.1.2: Consumption of Ozone Depleting Substances (ODS)

3.155. ODS is another important category of emissions that is actively monitored by the Montreal Protocol. Reported statistics worldwide have shown this protocol to be very effective in phasing out the use of these substances. However, as emissions of these substances are difficult to measure directly, countries report on the apparent consumption of ODS.

Topic 3.1.3: Emissions of other substances

3.156. There are a number of other environmentally important substances that are emitted to air beyond GHGs and ODS. The most important among these is lead (Pb) since it is linked to environmental and health problems, but there are a variety of other emissions that countries may wish to measure or estimate based on national circumstances and priorities.

Sub-component 3.2: Generation and Management of Wastewater

3.157. Statistics about the generation, management and discharge of wastewater, as well as the pollutant content of wastewater, are contained in this sub-component. Statistics on wastewater are needed by policy makers, analysts and civil society in order to properly manage this potentially harmful by-product of the human sub-system. Without statistics on the generation, management and discharge of wastewater it is difficult to assess and possibly intervene in regards to the volume and pollution levels of wastewater. Other policy relevant wastewater statistics include a disaggregation by economic activity of responsibility for its

generation, whether the wastewater is being treated, and what is being emitted to water bodies in the country.

3.158. Data availability in this field varies from country to country. The type of statistical source most commonly used is administrative registers, and in some cases estimation outputs. Countries usually report their wastewater and discharges to water based on statistics from the final treatment or collecting institution(s), or when no treatment of wastewater is in place, by estimating from the water used by different activities (e.g., households, industries) using technological coefficients. The main institutional partner will be the water authorities or institutions in charge of water provision, collection, treatment and/or final discharge to the environment (e.g., water regulating bodies, water authorities, municipalities, water utilities).

Topic 3.2.1: Generation and pollutant content of wastewater

3.159. This topic includes statistics on the volume of wastewater generated and the pollutant content of wastewater after the use of water by economic activities and households, before any collection or treatment is applied. Generation of wastewater is usually estimated based on the volume of water used. The wastewater generated can be discharged directly to the environment by the generator or it can be collected in sewerage systems and treated in wastewater treatment plants. Wastewater generation can be disaggregated by economic activity and households where statistics permit. The pollutant content of wastewater (emissions to water) can usually be obtained from monitoring at the place of generation or from estimates based on technological parameters.

Topic 3.2.2: Collection and treatment of wastewater

3.160. This topic includes statistics describing: (i) volumes of collected and transported wastewater to their final place of discharge or to treatment facilities; (ii) volume of wastewater treated by type of treatment (primary, secondary and tertiary); (iii) the physical infrastructure related to wastewater collection and treatment (e.g., number of treatment plants, capacities of plants, etc.); (iv) the pollutant content extracted in the treatment facilities; and (v) other relevant information.

3.161. Establishments engaged in the collection and treatment of wastewater are grouped under ISIC Rev.4 Section E, Division 37 Sewerage.

Topic 3.2.3: Discharge of wastewater to the environment

3.162. This topic captures information at the stage of final discharge of wastewater to the environment. It includes: (i) volume of wastewater discharged to the environment without treatment; (ii) volume of wastewater discharged to the environment after treatment, by type of treatment (primary, secondary and tertiary) and type of treatment facility (public, private, municipal, industrial); and (iii) effluent quality.

- 3.163. Statistics on the volume of wastewater discharged after treatment can be obtained from administrative records of the treatment plants. Statistics on the volume of wastewater released without treatment can be obtained from economic units and records of sewerage companies, or estimated on the basis of water use. The volume of discharged wastewater should also be disaggregated according to the recipient water body.
- 3.164. In addition to the volume of wastewater returned to the environment, it is also important to measure or estimate the volumes of different pollutants that are emitted with the wastewater or otherwise released to water bodies. Emissions to water are the substances released to water resources by establishments and households as a result of production, consumption and accumulation processes. Emissions to water should be disaggregated according to the releasing economic activities and should cover the most important substances.

Sub-component 3.3: Generation and Management of Waste

- 3.165. This sub-component describes statistics about generation and management of waste, including liquid and solid residual waste. Statistics include the amount of waste generated by waste type and by source, as well as the amount of waste collected, treated, and disposed.
- 3.166. Policy makers, particularly local governments, require statistics on solid waste in order to assess how its generation, treatment and disposal are changing over time. This in turns assists in planning for present and future waste management, in terms of transportation and facilities required. In addition, waste can also be a resource when recycled or used as a fuel source. Statistics on waste can also be useful in developing strategies to encourage waste reduction, reuse and recycling.

Topic 3.3.1: Generation of waste

- 3.167. This topic includes statistics describing the amount of waste generated before any collection or treatment is applied, by waste type, economic activity and households, if available. The waste lists used by countries and international organizations are usually based on the material content of the waste, or on the combination of material content and the generating process. Hazardous waste is a special group of waste that due to its toxic or other hazardous character needs special management; statistics on the generation of hazardous waste should also be included in this topic. Statistics on waste generation are usually less available than the ones describing their collection and disposal, covered in the following topic.

Topic 3.3.2: Management of waste

3.168. This topic contains statistics describing waste, including hazardous waste. Specifically, this topic includes statistics on: (i) the amount of waste collected and transported to treatment facilities or to their final disposal; (ii) the amount recycled or reused, by selected waste types/streams; (iii) the amount treated, by type of treatment (e.g., landfilling, incineration, composting, etc.); (iv) the physical infrastructure for waste treatment, including the number and capacity of treatment plants; and (v) other relevant information.

3.169. Establishment engaged in waste management are grouped under ISIC Rev 4 Section E Division 38 Waste collection, treatment and disposal activities, material recovery.

3.7 Component 4: Extreme Events and Disasters

3.170. This component organizes statistics regarding the occurrence and impacts of extreme events and disasters on human society's wellbeing and on the infrastructure of the human sub-system.

3.171. Component 4 contains the following two sub-components:

- i. Sub-component 4.1: Natural Extreme Events and Disasters; and
- ii. Sub-component 4.2: Technological Disasters.

Sub-component 4.1: Natural Extreme Events and Disasters

3.172. This sub-component structures statistics on the frequency and intensity of extreme events and disasters deriving from natural phenomena, as well as their impact on human lives and habitats and the environment as a whole. Statistics on natural extreme events and disasters are important to policy makers, analysts and civil society not only for assessing the impact of an ongoing disaster, but also for monitoring the frequency, intensity and impact of disasters over time.

3.173. In general, a disaster can be described as an “unforeseen and often sudden event that causes great damage, destruction and human suffering.” (CRED, 2009)³⁶ It is often an event that surpasses local capacities to respond to it and requires national and/or international, external assistance. For inclusion in this sub-component, a disaster should be categorized using the same criteria as the Centre for Research on the Epidemiology of Disasters' (CRED) Emergency Events Database (EM-DAT). This means that at least one of the following criteria must be fulfilled:

³⁶ CRED EM-DAT, 2009. *Emergency Events Database*. <http://www.emdat.be>

- i. Ten (10) or more people reported killed;
- ii. One hundred (100) or more people reported affected;
- iii. Declaration of a state of emergency; or
- iv. Call for international assistance has been made.

3.174. Natural extreme events and disasters impact human lives, habitats and ecosystems in different ways, depending on their intensity, but also on the preparedness of the human habitat and the environmental conditions prevailing in the territories, particularly those where humans live. Thus, the impacts and effects of natural disasters can be worsened or mitigated by the general social, living and infrastructural conditions of a given human habitat.

3.175. In recent decades, because of an increase in extreme events, natural disasters have become more frequent, more intensive, and also more destructive and deadly. There is now sufficient evidence to show that climate change has been associated with the increasing frequency and severity of extreme weather events. Climate change has resulted in increased global temperatures, rising sea levels, increased storms and precipitation, droughts, tropical cyclones, hurricanes, tornadoes and other climatic disruptions in many places around the world. As the occurrence and intensity of natural extreme events and disasters have increased globally, countries have faced increasing social and economic impacts.

3.176. The statistics structured in this component will take account of the whole sequence associated with each individual event, including the occurrence of the different types of extreme events, statistics on the impact of the disaster, including people affected and the assessment of economic loss. Statistics relating to the indirect health problems associated with natural disasters is covered in Sub-component 5.2: Environmental Health.

3.177. Extreme events and disasters can be categorized and classified using the current classification of the CRED EM-DAT. For more information on the full classification of CRED, please see Annex E: Classifications and environment statistics.

Topic 4.1.1: Occurrence of natural extreme events and disasters

3.178. The types of statistics included in this topic can include, but are not restricted to, the identification, location, magnitude, and type of natural extreme event and disaster.

Topic 4.1.2: Impact of natural extreme events and disasters

3.179. This topic should include information on the impact of a natural extreme event or disaster. Impact can be measured in a number of ways. Common dimensions include the number of people killed, injured, homeless and affected, as well as economic loss. The specific impact of each natural disaster on the integrity of the local ecosystem can also be reported on, where statistics exist.

- 3.180. Other statistics in this topic include: damage to buildings and other economic assets; economic disruption or loss of revenue for retail and other commercial services; number of roads, bridges and transportation networks affected; number of people affected (e.g., electricity transmission failures, compromised water supply and distribution); as well as statistics on vulnerability to disasters (e.g., population living in hazard prone areas).
- 3.181. The most common data sources are national and sub-national authorities responsible for disaster management and assistance, emergency management agencies and insurance companies.
- 3.182. Additionally, the Economic Commission for Latin America and the Caribbean (UN ECLAC) has developed a handbook which may be useful to other countries and regions, “ECLAC: Handbook for Estimating the Socio-economic and Environmental Effects of Disasters”.³⁷ It evaluates the overall impact of disasters associated with natural events and includes a methodology for evaluating this impact. This analysis of disaster impact in terms of damage and losses makes it possible to estimate the impact of disasters on economic growth, on the population’s living conditions and on environmental conditions in the region.

Sub-component 4.2: Technological Disasters

- 3.183. This sub-component structures statistics on technological disasters. These disasters may arise as a result of human intent, negligence or error, or from faulty or failed technological applications. This sub-component groups information on the occurrence and impact of such disasters on human lives and habitats, and on the environment as well as on disaster preparedness for such types of disasters.
- 3.184. Policy makers, analysts and civil society require statistics on technological disasters in order to understand who is ultimately responsible, what the immediate and potential impact may be, and to assess and mitigate future risks. To date, records of global technological disasters show increasing frequency and impact on humans, the infrastructure and the environment. This further reinforces the relevance and necessity of statistics on these issues for policy making and analysis.
- 3.185. There are three types of technological disasters recognized by CRED.³⁸ These are: industrial disasters which cover leakages of fluid toxic chemicals, oil spills and explosions; transport disasters which cover accidents associated with the mechanized transport of chemicals, volatile materials or other hazardous substance by road, rail, water or pipeline;

³⁷ ECLAC: Handbook for Estimating the Socio-economic and Environmental Effects of Disasters. LC/MEX/G.5 ECLAC Mexico Office, July, 2003. <http://www.eclac.cl/cgi-bin/getProd.asp?xml=/publicaciones/xml/4/12774/P12774.xml&xsl=/mexico/tpl-i/p9f.xsl&base=/mexico/tpl/top-bottom.xsl>

³⁸ Disaster profiles of EM-DAT, <http://www.emdat.be/disaster-profiles>

and miscellaneous disasters such as arson fires and other disasters of varied origin. All these types of disasters can impact large areas and affect both human safety and the environment in both the short and long term.

Topic 4.2.1: Occurrence of technological disasters

3.186. This topic structures information on the frequency and nature of the disasters that arise as a result of human intent, negligence, or error or from faulty or failed technological applications. Nuclear meltdowns and pipeline or tanker leakages that result in significant harm to the environment, including potentially significant consequent impacts on humans, are prime examples.

3.187. Technological disasters impact human lives, habitats and ecosystems in different ways, depending on the nature and intensity of the disaster. Their effects can be short term or may have significant or unknown duration. In the case of technological disasters, there is sometimes no precedence for a given disaster and the full magnitude of its effects cannot be fully anticipated or measured.

3.188. This topic should include information on the identification and characterization of the different types of events including information on location, magnitude and type of disaster. Additionally, where pertinent because of repeated episodes, the frequency of these technological disasters can also be critical in guiding policy-making and the development of deterrents.

3.189. It should be noted that information on the environmental media that are impacted is included under Sub-component 1.4: Environmental Quality, covering air, water, soil and noise, as relevant.

3.190. Data availability for this topic can extend over agencies such as emergency response services, optical and radar satellite operators for satellite information and seismic monitoring and research centres.

3.191. For inclusion in this sub-component, a technological disaster should be categorized using the same criteria as the CRED EM-DAT (see paragraph 3.173 for criteria).

Topic 4.2.2: Impact of technological disasters

3.192. This topic includes the specific impacts on humans, damage to the economy and the ecosystems arising from technological disasters. These impacts can include loss of life, injury, illness (e.g., radiation-related conditions and diseases) or other health impacts, property damage, loss of livelihoods and services and housing, social and economic disruption and environmental damage. When available, estimations of the loss of work days

and of the economic cost in monetary terms (e.g., loss of wages or costs of treatment) can be included here.

3.193. In terms of data availability, economic impact assessments are often carried out by central banks and ministries of economic development. Additionally, large technological disasters are often the subject of one time research projects by research or academic institutions assessing their impact. Insurance companies can also provide reliable appraisals of the impact.

3.194. Statistics on the environmental media that are impacted as a result of technological disasters are included in Sub-component 1.4: Environmental Quality, under the relevant heading (e.g., water, soil, air or land). Statistics on health impact of technological disasters can also be found in Topic 5.2.5: Toxic substance and radiation related diseases and conditions.

3.8 Component 5: Human Habitat and Environmental Health

3.195. This component contains statistics on the environment in which humans live and work, particularly with regard to living conditions and environmental health. Statistics on human habitat and environmental health are needed by policy makers, analysts and civil society in order to manage and improve conditions related to human settlements, shelter conditions, safe water, sanitation, and health, particularly in the context of rapid urbanization, increasing pollution, environmental degradation, disasters, extreme events, and climate change.

3.196. Human habitats can vary from tiny villages to large metropolitan agglomerations. Housing types also vary widely from slums to houses built up to local codes of construction. The increasing concentrations of humans into modern urban habitats pose special challenges to humans as well as to the physical environments in which these habitats are located. Pollution of the air, water, land and soil due to activities in human habitats continuously causes environmental change that can have damaging effects on agriculture, water resources and the energy sector as well as on human health. There are positive impacts on the environment from urbanization as well, including reduced transportation emissions per capita and reduced land use changes. The capacity of the environment to cope with the environmental changes caused by human habitation, or the resilience of the environment, will have an impact on both the health of the human habitat and that of the natural environment with which it is associated.

3.197. It is evident that the wellbeing and health risks associated with the environment (and also those posed by extreme events and disasters) can be substantially mitigated by the prevailing

conditions and characteristics of the human habitats. Several factors can mitigate or increase the effect of environmental and habitat-related risks on the wellbeing of humans. These factors include the existence of appropriate infrastructure for the provision of water and sanitation, adequate waste disposal, wise land use planning, clean and safe transportation, safe building design and other measures of good housing, and good ecosystem health. The existence of these conditions can improve a given human habitat, and the wellbeing and health of humans. Conversely, vulnerable human habitats are often more impacted by the changing environment and recover more slowly from pollution, environmental degradation, and disasters.

- 3.198. Component 5 contains two sub-components:
- i. Sub-component 5.1: Human Habitat; and
 - ii. Sub-component 5.2: Environmental Health.

Sub-component 5.1: Human Habitat

3.199. This sub-component includes relevant statistics on basic services and infrastructure of human habitats. Human habitat refers to the totality of the human community, whether people live in large cities or in towns or villages. Human habitat refers to the human population that resides in a settlement, physical elements (e.g., shelter and infrastructure), services (e.g., water, sanitation, waste disposal, transport), and the exposure of humans to potentially deleterious environmental conditions. Statistics on human habitats are required by policy makers, analysts and civil society in order to inform on how humans live and work in these habitats, how they transform the landscape and the supporting ecosystems, and in turn how this affects human wellbeing and health.

3.200. Human habitats can be found scattered through many kinds of territory, but increasingly, humans live in urban areas and in coastal areas. Where humans live and work, they typically transform the supporting ecosystems. The extent of human habitats, their ecological footprint (which is closely related to prevailing production and consumption patterns), the supporting and nearby environmental conditions and quality, as well as the human access to infrastructure and services, all affect both humans and the environment in a cyclical and iterative way.

3.201. The type of sources that are needed to document the state and changes in human habitats include censuses, surveys, administrative records, and remote sensing. Institutional partners of the NSO include housing and urban planning authorities, health and transportation authorities, as well as research institutions. Presenting the statistics spatially using maps and geospatial statistics adds important value to the information being produced.

3.202. The first topic in this sub-component covers urban and rural population statistics, providing information on the location where humans construct their habitats in any given country. The next two topics cover access to energy and water supply, sanitation, waste removal as well as housing conditions that have a direct bearing on human wellbeing and health. Complementary information, describing how the spatial location of populations around sources of pollution exposes them to possible health effects, is in the fourth topic. Finally, the fifth topic organizes information about additional urban environmental concerns such as transport, green areas, as well as urban planning and zoning.

Topic 5.1.1: Urban and rural population

3.203. Humans live in either rural or urban communities, building their shelters and institutions, while using environmental resources to satisfy human needs. Depending on the carrying capacity of ecosystems, these habitats and the use of environmental resources by them will affect environmental conditions, as well as human wellbeing and health.

3.204. Statistics on the location of human habitats can be found both in traditional demographic statistics, and increasingly in geospatial information sources. The potential for the use of geospatial demographics in the field of environment statistics is ample. They can be used not only as a reference but also in combination with other environment statistics to construct indicators. For instance, in combination with housing, water and sanitation statistics they can provide telling determinants of the environmental sustainability of human habitats and environmental health.

3.205. Main statistics pertaining to this topic are rural, urban and total population, including population density. When possible, these statistics should include geospatial information regarding specific geographic distributions in the country. Data availability is ample for this topic in most countries, the main source being both censuses and household surveys. These statistics are generally produced by NSOs, usually in the demographic or social domains.

Topic 5.1.2: Access to water, sanitation and energy

3.206. This topic includes statistics about access to safe water, sanitation and waste removal services and energy supply in urban and rural areas. Access to these basic services can have a positive effect both on human health and wellbeing, as well as on environmental quality.

3.207. As stated by the WHO, “poor water quality continues to pose a major threat to human health. Diarrhoeal disease alone amounts to an estimated 4.1 percent of the total daily global burden of disease and is responsible for the deaths of 1.8 million people every year. It has been estimated that fully 88 percent of that burden is attributable to unsafe water supply, sanitation and hygiene and is mostly concentrated on children in developing countries. A significant amount of disease could be prevented, especially in developing countries,

through better access to safe water supply, adequate sanitation facilities and better hygiene practices.” (WHO, 2004)³⁹

3.208. 1.3 billion people worldwide, the equivalent of the combined populations of Europe and Africa, has no access to electricity and twice that number, 40 percent of the world's population, rely on wood, coal, charcoal or animal waste to cook food, resulting in toxic smoke that causes lung disease and death. Domestic energy poverty refers to a situation where a household does not have access or cannot afford to have the basic energy or energy services to achieve day to day living requirements.

3.209. Relevant statistics on this topic include population using an improved drinking water source, as well as population using an improved sanitation facility. Statistics should be disaggregated by rural and urban population, and, when available, spatially distributed at the sub-national level. Statistics about the existence of and access to waste collection, transport, treatment and disposal services should also be collected as this is very important for environmental quality and human health concerns, particularly in highly dense urban centres. The last group of statistics under this topic refer to households with access to electricity and statistics on the fuels used for cooking and heating.

3.210. Data sources for this topic include ministries of health, NSOs and other agencies carrying out population censuses and household surveys that collect the relevant household data on energy, water, sanitation and waste removal. In some countries, the municipal authorities in charge of providing some or all of these services produce the related statistics. In some instances, other partners may include agencies responsible for cartography or GIS data.

Topic 5.1.3: Housing conditions

3.211. This topic includes information on the sufficiency of housing in terms of the following characteristics: access of population to an adequate dwelling; the characteristics of the houses in which both rural and urban population live, including the quality of the houses (e.g., building materials, overcrowding, compliance to local construction codes) and location in either safe or vulnerable zones. Housing access and conditions exert a direct effect on human wellbeing and health, these data therefore serve as critical measures of those attributes.

3.212. Housing condition statistics need to be described according to national conditions and priorities. Distribution of income directly influences the access to dwelling, the quality of the homes that different social groups can have, and their location. Poorly built, unsafe and less sanitary dwellings are usually the homes of the poorest elements of the population and this renders them more vulnerable to disaster and adverse health impacts.

³⁹ WHO, 2004. *Water Sanitation and Health, Burden of Disease and Cost-Effectiveness Estimates*. http://www.who.int/water_sanitation_health/diseases/burden/en/index.html

- 3.213. With regard to housing sufficiency, statistics can include, but are not restricted to, the number and proportion of individuals or families that do not have access to an adequate dwelling, or live in a precarious dwelling.
- 3.214. Depending on the country, common statistics describing the quality and the location of houses in either safe or vulnerable zones include: urban population living in slums or informal settlements as well as the number of dwellings with adequate building materials as defined by national or local standards. Additionally, when available, statistics on the density of the built environment and placement of houses in vulnerable zones are commonly used.
- 3.215. Poor or inadequate housing conditions, in urban areas, can be approached using the concept of “slums” and statistics on the magnitude and proportion of urban population living in them. MDG indicator 7.10 states that the urban population living in slum households is defined as a group of individuals living under the same roof lacking one or more of the following conditions: access to improved water, access to improved sanitation, sufficient living area, durability of housing, or security of tenure. Information on secure tenure is not available for most countries however, so typically only the first four indicators are used to define slum households.
- 3.216. Data sources for this topic include censuses and household surveys. The common partners of the NSO include the urban planning and housing authorities responsible for zoning, construction methods and materials of local houses and buildings.

Topic 5.1.4: Exposure to ambient pollution related to spatial location of population

- 3.217. This topic includes spatially described statistics on human populations exposed to different levels of air, water and noise pollution. This topic is unique in that it overlays pollutant emission and exposure data onto geographic and demographic data to create a more detailed understanding of the location of populations currently being exposed to pollutants and those most at risk of future exposure. Location-specific geospatial information on ambient pollutant levels is extremely important for environmental protection and environmental health policies, particularly in larger cities. Statistics for this topic include the number of people exposed to air, water or noise pollutants in specific areas and the proportion of the exposed population to the total population of the city or region. Sources include NSO censuses and surveys (for demographic statistics), environmental authorities (for point pollution emissions), and geographic or cartographic authorities.

Topic 5.1.5: Environmental concerns specific to urban habitats

- 3.218. A growing proportion of the world’s population (currently more than half) live in urban areas. This topic is intended to organize issues of specific relevance to this part of the

population. Depending on national and local conditions and priorities, additional environmentally relevant urban concerns should be included here. Such issues can include, but are not restricted to, the extent of urban sprawl, the availability of green areas for urban residents, the prevailing types of transportation in and between urban areas, and the existence and effectiveness of urban planning and zoning.

- 3.219. With regard to transportation, statistics can include the number of private, public and commercial vehicles by engine type, as well as the extent of roadway infrastructure. Most importantly from the environment statistics perspective, additional statistics should include the number of passengers transported by public transportation systems and the number of passengers transported annually by hybrid and electric public transportation, in total and as a proportion of all modes of transportation.
- 3.220. Data sources for this topic include administrative records, and remote sensing, while the common partners to the NSO include municipal authorities, urban planning and housing authorities responsible for zoning, as well as transport authorities and urban research centres.

Sub-component 5.2: Environmental Health

- 3.221. Environmental health is defined by the WHO as “those aspects of the human health and disease that are determined by factors in the environment. It also refers to the theory and practice of assessing and controlling factors in the environment that can potentially affect health.” (WHO, 2012)⁴⁰ The full scope of environmental health as defined by the WHO goes beyond the scope of the FDES. The FDES excludes indoor air pollution and the associated impacts on human health.
- 3.222. The impacts of changes in environmental conditions on human health are many and vary from country to country. The WHO is the leading global institution documenting the relationship between health and the environment. Notably, critical global statistics are set out through WHO’s presentation, “10 facts on preventing disease through healthy environments”. (WHO, 2010)⁴¹
- 3.223. Common measures of the health of human populations include statistics on mortality, morbidity and incidence associated with specific types of diseases and conditions that are heavily influenced by environmental conditions. Also, when available, estimations of the loss of work days and estimation of the economic cost in monetary terms (e.g., loss of wages or costs of treatment) can be included here. Associated statistics such as the emissions of pollutants to the environment can be found in Component 3: Emissions, Residuals and

⁴⁰ WHO, 2012. *Health topics – Environmental health*. http://www.who.int/topics/environmental_health/en

⁴¹ WHO, 2010. *10 facts on preventing disease through healthy environments*. http://www.who.int/features/factfiles/environmental_health/en

Waste, while statistics on pollution concentration in air, water, soil and marine waters can be found in Component 1, Sub-component 1.4: Environmental Quality.

3.224. The main partner and source of data on mortality, incidence and morbidity of environmentally related diseases and conditions is usually the sanitary or health authority in a country. Other partners could include regulatory agencies and environmental protection agencies.

3.225. Primary epidemiological data can be selected and further processed for transformation into the environmental health statistics that constitute this sub-component. The resulting health statistics will usually be produced using national and sub-national data and will include descriptive epidemiological data that can usually be updated on a yearly basis. Caution must be exercised when producing these types of environmental health statistics because health and environmental problems are multi-faceted and it may be difficult to establish causality between one health problem and specific environmental conditions.

Topic 5.2.1: Airborne diseases and conditions

3.226. This topic includes all airborne diseases and conditions that are caused or worsened by exposure to unhealthy levels of pollutants (such as respirable PM, SO₂ or O₃), usually found in urban habitats, and in particular in those cities with weaker air quality regulations and/or enforcement capabilities. Airborne diseases and conditions include, but are not limited to, upper and lower respiratory disease, obstructive pulmonary disease, asthma and allergic rhinitis.

Topic 5.2.2: Water-related diseases and conditions

3.227. This topic includes all water-related diseases and conditions that result from micro-organisms in the water humans drink as defined by the WHO. Water-related diseases and conditions are still a considerable public health problem in developing countries. They include, but are not limited to, diarrhoeal disease, gastroenteritis and water borne parasite infections.

Topic 5.2.3: Vector borne diseases

3.228. This topic includes vector borne diseases that are transmitted by vectors (e.g., insects and arachnids) that carry viruses, bacteria, protozoa and other pathogens, as defined by the WHO. Common vector borne diseases include, but are not limited to, malaria, dengue fever, yellow fever and Lyme disease. Some vector borne diseases are being directly affected by climate change, notably by the change in rain patterns and floods.

Topic 5.2.4: Health problems associated with excessive UV radiation exposure

3.229. This topic includes statistics on morbidity and mortality from skin cancer and also the incidence and treatment of cataracts associated with excessive UV radiation exposure. It is

very relevant, particularly in countries and zones where the atmospheric ozone layer is thinner or severely reduced.

Topic 5.2.5: Toxic substance and radiation related diseases and conditions

- 3.230. This topic includes diseases and conditions associated with exposure to toxic substances, residuals and/or waste that result from localized emissions. Toxic substances include toxic pesticides (e.g., pesticides that have teratogenic, carcinogenic, tumorigenic and/or mutagenic effects), and toxic industrial chemicals (e.g., lead, arsenic, mercury and nickel, among others). Toxic substance related diseases and health problems include, but are not limited to, chronic illnesses of the respiratory system (such as pneumonia, upper respiratory diseases, asthma and chronic obstructive pulmonary diseases), infertility, and congenital anomalies or malformations.
- 3.231. The exposure to toxic substances is usually the result of poor environmental management in energy production practices and waste management, and lack of information by stakeholders. The resulting diseases and conditions included under this topic can be caused by exposure to the toxins through different or undetermined media such as air, water, food, soil or a combination of these elements. In this respect, the resulting health problems in this topic cannot be categorized as primarily or solely attributable to air or water borne diseases.
- 3.232. This topic also includes diseases and conditions associated with exposure to nuclear radiation. The related diseases and health conditions may be both short and long term and could include, but are not limited to, thermal burns from infrared heat radiation, beta and gamma burns from beta and gamma radiation, radiation sickness or “atomic disease”, leukaemia, lung cancer, thyroid cancer and cancer of other organs, sterility and congenital anomalies or malformations, premature aging, cataracts and also increased vulnerability to disease as well as emotional disorders.
- 3.233. Nuclear radiation could occur from exposure to a nuclear explosion, meltdown or from fallout. Radioactive material is known to be emitted to surrounding air, water and soil of human habitats and ecosystems, in addition to obvious direct effects on humans. The conditions arising from exposure to humans can range from immediate thermal and mechanical injuries, through long term and delayed effects on organs and tissues as well as effects on emotional wellbeing. Nevertheless, caution must be exerted since the resulting health problems in this area cannot always be categorized as primarily or solely attributable to nuclear radiation. These statistics are also relevant as an impact in Topic 4.2.2: Impact of technological disasters.

3.234. The main source of epidemiological data is usually the sanitation or health authority in a country. Other institutions could include nuclear regulatory agencies and environmental protection agencies.

3.9 Component 6: Environment Protection, Management and Engagement

3.235. A country's engagement in the protection and management of the environment, and therefore the amount of resources it dedicates to the task, is related to information, awareness, social demand and also to the country's ability to finance environment protection activities and international efforts directed at these activities. International stewardship, national political engagement, civil society participation, as well as effective policies and programmes each have a role to play in mutually reinforcing each other.

3.236. This component organizes information on environment protection and resource management expenditure and economic and social instruments to regulate and manage various environmental issues and concerns, with the aim of improving the environment and maintaining the health of ecosystems. Statistics about environmental governance, institutional strength, enforcement of regulations and extreme event preparedness are also considered. This component also contains information on a wide variety of programmes and actions to increase awareness, including environmental information and education, as well as private and community activities aimed at diminishing environmental impacts and improving the quality of local environments.

3.237. Component 6 is organized into four sub-components:

- i. Sub-component 6.1: Environment Protection and Resource Management Expenditure;
- ii. Sub-component 6.2: Environmental Governance and Regulation;
- iii. Sub-component 6.3: Extreme Event Preparedness and Disaster Management; and
- iv. Sub-component 6.4: Environmental Information and Awareness.

Sub-component 6.1: Environment Protection and Resource Management Expenditure

3.238. Expenditure on environmental protection can be used as one measure of the public and private engagement in mitigating and restoring the environment towards its more sustainable use. The activities whose primary purpose is to reduce or eliminate pressures on the environment are called environment protection activities. Activities whose primary purpose is to make more efficient use of natural resources are called resource management activities.⁴² Monitoring and tracking the level of environment protection and resource management expenditure is important for policy makers, analysts and civil society in order to

⁴² The Classification of Environmental Protection Activities (CEPA)

determine the current and desired levels of engagement and commitment from both government and the private sector.

3.239. Environment protection activities are those activities whose primary purpose is the prevention, reduction and elimination of pollution and other forms of degradation of the environment. Resource management activities are those activities whose primary purpose is preserving and maintaining the stock of natural resources and hence safeguarding against depletion. These activities include, but are not limited to, reducing the withdrawals of natural resources (including through the recovery, reuse, recycling, and substitution of natural resources); restoring natural resource stocks (increases or recharges of natural resource stocks); the general management of natural resources (including monitoring, control, surveillance and data collection); and the production of goods and services used to manage or conserve natural resources. They cover the management of mineral and energy resources; timber resources; aquatic resources; other biological resources; water resources; research and development activities for resource management; and other resource management activities.

3.240. The Classification of Environmental Protection Activities (CEPA) has been in place since 2000, covering the classes of activities pertaining to environment protection. Subsequent work to develop an overarching Classification for Environmental Activities (CEA) that incorporates the CEPA and an interim listing of resource management activities has been undertaken. The CEA classification has been developed as part of the SEEA Central Framework (for further information see Annex E Classifications and environment statistics).

3.241. In addition to classifying environment protection and resource management expenditures according to their purpose, an important distinction that needs to be made is between the bearers of the expenditures. The bearer can be the general government, corporations, non-profit institutions, and households.

Topic 6.1.1: Government environment protection and resource management expenditure

3.242. Government (local, regional and central) expenditure to protect the environment is usually calculated by identifying and aggregating the expenditures considered to be primarily for environment protection and resource management purposes. These expenditures can be found by examining official government finance statistics found in government budgets and/or administrative reports on actual government expenditure incurred.

3.243. The main institutional partners are the official institutions in charge of reporting government expenditure (e.g., internal revenue services) and the national and sub-national level institutions (e.g., municipalities). The resulting statistics will usually be at the national level, and can sometimes be disaggregated by functional governmental entities or by

governmental levels. National accounts and government finance statistics are typically the divisions in the NSOs which need to be involved when developing these figures. These statistics are expressed in monetary units, typically with annual periodicity, depending on the availability of resources.

Topic 6.1.2: Corporate, non-profit institution and household environment protection and resource management expenditure

3.244. Statistics on environment protection and resource management expenditure statistics for corporations, non-profit institutions and households usually requires the use of specific surveys of establishments in different sectors and industries. Therefore, key elements that affect the quality of statistics being produced through this type of source include the existence of updated and precise establishment registers, sampling procedures and questionnaire quality. The technical capacity of individual establishments to respond adequately to environment protection and resource management questions is also an important factor.

Sub-component 6.2: Environmental Governance and Regulation

3.245. In order to provide a holistic view of a country's efforts towards sustaining and protecting the environment, policy makers, analysts and civil society require statistics on environmental governance and regulation at the national level. The magnitude of these activities can inform about the extent of institutional development, the availability of resources, and the existence and enforcement of regulating and market instruments whose primary purpose is to protect, regulate and manage the changing environment.

3.246. Successful national environmental governance requires institutional strength, as well as regulatory capabilities. Therefore, this sub-component includes the setting of standards and norms, the provision of adequate resources and ensuring the capability for enforcement of those standards and norms. Additionally, a nation's participation in MEAs and global environmental conventions are also included in this sub-component as a way of describing national participation in the global commitment to protect the environment.

3.247. Stakeholders need to be made aware of, and must sometimes also be given incentives to comply with, norms and standards. However, it is also critical that they are encouraged to voluntarily accept changes in production and consumption behaviour in order to protect the environment and use it in a sustainable manner. In this respect, information, education and perception elements are also included in this sub-component. Sector or industry-based voluntary agreements would also be included in this sub-component.

Topic 6.2.1: Institutional strength

3.248. Government and citizen engagement in environmental and sustainable development public policy is reflected in the extent to which institutions that manage and regulate the environment are in place and functioning properly at the national and sub-national levels. This topic includes, but is not restricted to, the characterization of: (i) environmental institutional extent and strength (e.g., existing public institutions, dedicated budget and staff, coordination mechanisms and strength); (ii) environmental regulating and/or licensing systems (e.g., existence of a system, magnitude of operations); and (iii) enforcement capabilities (e.g., existing institutions, dedicated budget and staff).

3.249. The main institutional partners here include the environmental authority, internal revenue services and other environmentally relevant authorities, along with other possible institutions where environmental regulations are enforced (e.g., local governments or sectoral authorities). The information to be produced for this topic should be mainly descriptive, but can also include monetary statistics on budgets. It is usually compiled at the national level but should also cover sub-national authorities.

Topic 6.2.2: Environmental regulation and instruments

3.250. This topic includes, but is not restricted to, the characterization of: (i) direct regulation instruments (e.g., environmental quality norms/standards for air, water, land, soil, ocean and for productive activities in particular, energy efficiency and renewability programmes); (ii) application of economic instruments (e.g., green taxes, green subsidies, labelling, certification, etc.); and (iii) voluntary agreements for environment protection and eco-efficiency (e.g., green economy policies, cleaner production for a corporation or industry, energy efficiency voluntary agreements).

3.251. Depending on the national institutional set up, the main partners in this case include the environmental authority, internal revenue services and other environmentally relevant authorities, along with other possible institutions where environmental regulations are enforced (e.g., local governments or sectoral authorities). Information to be produced for this topic will be mainly qualitative, but may also include monetary statistics on budgets.

Topic 6.2.3: Participation in MEAs and environmental conventions

3.252. This topic includes information on a country's participation⁴³ in different MEAs and other global environmental conventions. Such conventions include the Montreal and Kyoto protocols. The main institutional partners in this case include the environmental authority, along with other possible institutions in charge of MEAs or environmental conventions. The information to be produced in this topic is mainly qualitative.

⁴³ Participation means the country or area has become party to the agreements under the treaty or convention, which is achieved through a variety of means depending on country circumstances, namely: accession, acceptance, approval, formal confirmation, ratification, and succession. Countries or areas who have signed but not become party to the agreements under a given convention or treaty are not considered to be participating.

Sub-component 6.3: Extreme Event Preparedness and Disaster Management

- 3.253. Statistics describing extreme event and disaster preparedness will be different in each country depending on which type of extreme events and disasters usually occur or can potentially occur. In general, these statistics include the existence and strength of the disaster authority's facilities and infrastructure.
- 3.254. Statistics describing the expenditure dedicated to preparing for and managing disasters is located under Sub-component 6.1: Environment Protection and Resource Management Expenditure.
- 3.255. Extreme events and disaster preparedness expenditure should also be captured under this sub-component. It refers to any public or private expenditure whose primary purpose is to help inform, educate and protect the population from extreme events and disasters, including but not restricted to the set up and maintenance of warning systems, monitoring stations and systems, signals, communication systems, emergency centres and shelters, etc.

Topic 6.3.1: Preparedness for natural extreme events and disasters

- 3.256. Measures of disaster preparedness will vary according to community and the location's historical profile for natural extreme events and disasters. Relevant information can include: the existence of national extreme events and disaster plans; the type and number of shelters in place; the number, by type, of internationally certified emergency and recovery management specialists; the size and extent of training of volunteer teams and networks to be mobilized in the event of a natural extreme event or disaster; and the quantity of first aid and emergency supplies and equipment that are stockpiled. The existence of early warning systems for all major hazards is also an important data requirement.
- 3.257. Lead responsibility for plans for disaster preparedness is often delegated to infrastructure authorities or ministries of public works, construction and housing. Common data sources are national and sub-national authorities responsible for disaster management and assistance as well as emergency management agencies and municipalities. Global and regional meteorological forecasting agencies can also provide useful data on the spatial scale and likelihood of a crisis. Relevant population data can be obtained from NSOs and pertinent flood and drainage control information can be had from authorities responsible for flood and drainage control. Close agro-meteorological collaboration can also provide effective and actionable joint forecast information from the agriculture ministries and counterparts in meteorological agencies. This can complement data from each of their domains.

Topic 6.3.2: Preparedness for technological disasters

3.258. The motive forces behind disaster preparedness in the case of technological disasters can be quite different from the case of natural extreme events and disasters. Thus disaster preparedness (and also prevention) for these kinds of disasters tends to be focused more at the corporate and local levels.

3.259. Measures of corporate disaster preparedness will vary according to size of the enterprise, its location and the location's historical profile for technological disaster events. The scale can vary with the size of business relative to the local area, as a disaster which may just be a nuisance to a very large industrial complex in a large city may assume very tragic proportions in a one-factory town, where that enterprise is the main employer of its citizenry. Relevant information can include: the existence of an emergency management plan as well as the number, by type, of internationally certified emergency and recovery management specialists.

Sub-component 6.4: Environmental Information and Awareness

3.260. Statistics describing the production and availability of environmental information and education, as well as public awareness about the environmental situation in each country, are included in this sub-component. Statistics on environmental information, education, perception and awareness describe efforts to inform the public about the state of and changes in the environment, and to educate and promote participation in environmental issues at the local and national level.

3.261. The statistics in this sub-component are relevant for policy makers, analysts and civil society in order to understand what information and education programmes are in place in their country, whether these activities are increasing or decreasing over time, and potentially what the impact of information and education is on the public perception, awareness of environmental issues and social engagement in pro-environmental actions. An understanding of environmental perceptions of the general public and key local constituencies can also be useful for policy makers when shaping national environmental policy.

3.262. Information dissemination, outreach and education, as well as public perceptions on environmental issues and policies are all necessary, although not sufficient elements to forge environmentally sustainable options. In general, as information and awareness increases in a society, more pro-environmental behaviour and choices are expected from individuals and groups. Informed consumers and organized citizens have been able to change environmental and social practices in some industries, provided that there are reasonable alternatives and that the incentives are put in the right place.

3.263. The statistical topics included here are at an emerging stage of development in general, although important good practices and know-how have been accumulated by different countries. Because of the method of production, sources and institutional partners in each of the following sets of environment statistics differs.

Topic 6.4.1: Environmental information

3.264. The topic of environmental information can include, but is not restricted to, the characterization of: (i) national Environmental Information Systems (EIS); and (ii) environment statistics programme within national statistical systems (e.g., existence, dedicated resources and staff, products, user statistics, inter-institutional collaboration mechanisms).

3.265. The production and dissemination of environment statistics within national statistical systems is key to producing robust environmental and sustainable development indicators, to substantiate the elaboration of reports on the changing environment, and to guide policy making. Measuring and constructing statistics on information production and use is not very difficult, once a methodology is established and the updating of the information is done on a comparable basis. Determining which institution is responsible for producing which types of information can be helpful in identifying information gaps, areas of overlapping responsibility or efforts, and areas where efficiency gains can be achieved. Information on the structure and details of environment statistics programmes within NSOs (including their mandates, resources and dedicated staff), the existence of other relevant production in other ministries (e.g., environment), as well as the existence of inter-agency platforms of environmental statistics and indicators at the national level, have been increasingly examined and reported on. These efforts have formed part of global and regional efforts to strengthen this emerging field within NSOs and have been applicable at both the national and sub-national levels. It is also important to place the role of the NSOs into the wider picture of the institutions involved in producing environmental information.

3.266. The main institutional partners in this instance include the environmental authority and the NSO, along with other possible institutions where environmental reports containing statistics and indicators are produced. Information to be produced in this topic is mainly descriptive but can also include monetary statistics on budgets. It is usually compiled at the national level.

Topic 6.4.2: Environmental education

3.267. The environmental education topic can include but is not restricted to the characterization of environmental education programmes, the specific actions associated with them and the results they achieve.

3.268. Constructing statistics on environmental education programmes can be challenging.

There is typically some data available on curricula, numbers of students, graduates and hours of courses but it can prove hard to convert this information into systematic statistics in most countries, mostly for lack of metadata but also because of comparability problems.

3.269. The main institutional partners in this case include the ministry of education, ministry of environment or equivalents and the NSO, along with other institutions, like universities and non-profit institutions, where curricula on environmental education are developed and delivered. The information to be produced for this topic is mainly qualitative, but can also include monetary data on resources spent. It is usually compiled at the national and sub-national levels.

Topic 6.4.3: Environmental engagement

3.270. This topic is intended to capture any available statistics on participation in pro-environment activities in a country. Pro-environment activities are those activities undertaken by civil societies or community groups to protect, improve and manage the environment. It can include conservation programmes (e.g., energy efficiency, tree planting) and outreach programmes (e.g., efforts to increase public awareness of key environmental issues), among many other activities.

3.271. Data about environmental participation and actions are based on either administrative records or are obtained from surveys, and are usually produced at the sub-national level. The main institutional partners and sources of data in this case include the ministry of environment or equivalent, municipalities and local governments and NGOs.

Topic 6.4.4: Environmental perception and awareness

3.272. Information on environmental perception and awareness can include both the public or a specific group's level and type of knowledge, attitudes, values and awareness towards and about the environment. It also includes perceptions of environmental issues and policies.

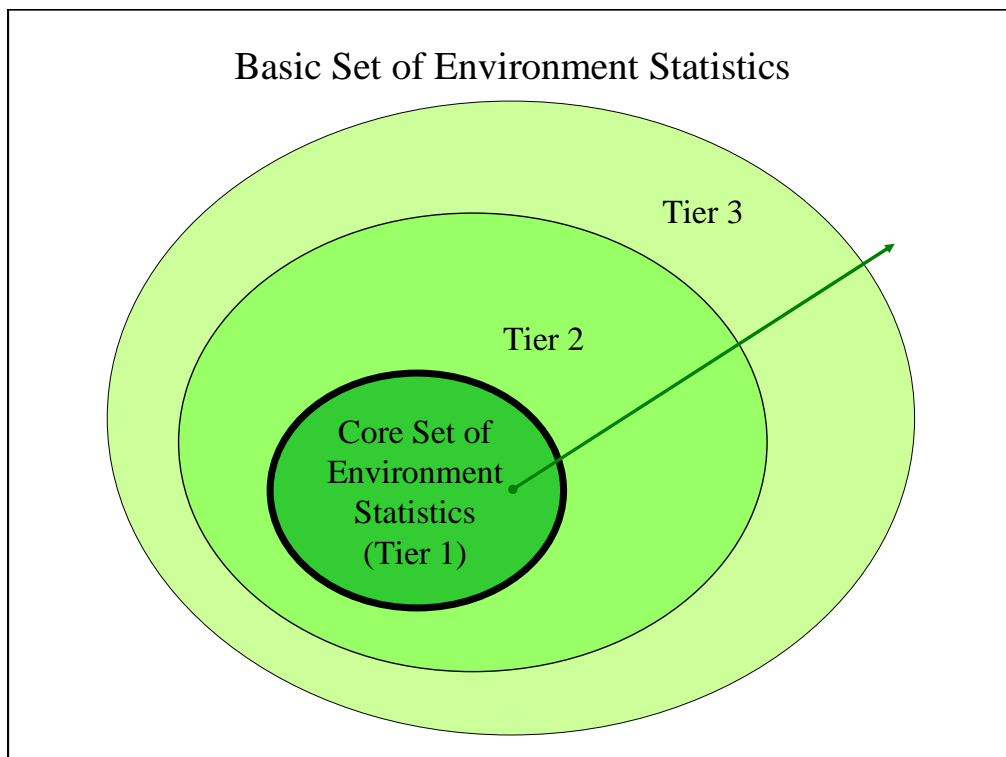
3.273. Increasingly, countries and international polling companies have been surveying the public to measure environmental knowledge, attitudes and reported behaviour. As a consequence, some of the statistical results in this field, when they are available and considered to be reliable, can be included in this topic. These statistics reflect public perceptions of different aspects of the environment. This body of information has been developing rapidly around the world. However, methodological challenges remain, particularly regarding data reliability, validity and international comparability, but the statistics are useful at the national and local levels.

3.274. The main institutional partners in this case include the environmental authority and the NSO, along with other possible institutions where environmental perception surveys could be carried out (e.g., local governments). These statistics are produced through surveys designed for data collection on this topic. Statistics belonging to this topic are mainly qualitative, and are usually compiled at the sub-national level.

Chapter 4: The Core Set of Environment Statistics

- 4.1. This chapter further elaborates the FDES by identifying statistics that describe the statistical topics, grouped within the Basic Set of Environment Statistics and the Core Set of Environment Statistics. They have been selected according to their relevance to environmental issues and to corresponding FDES topics, as well as on the basis of their potential use for calculating environmental indicators and for generating environmental accounts.
- 4.2. The statistics included in the Basic Set are comprehensive but neither exhaustive nor the only possible ones for assessment of the statistical topics. They should be considered a set of statistics which can assist in making decisions on priorities for statistical development. In order to do so, the Basic Set of Environment Statistics has been set up following a progression of three tiers, where Tier 1 defines the Core Set of Environment Statistics, that is, a set of statistics that all countries are recommended to consider producing in the short-term. The scope can be gradually widened to the statistics contained in Tier 2 and Tier 3 as national priorities require and as data availability and resources permit. (Description of Tiers 2 and 3 follow in para. 4.18.)

Figure 4.1: The Core Set embedded in the Basic Set of Environment Statistics



- 4.3. This approach is useful in providing an overview of the entire field of environment statistics and can help statisticians to identify data sources and make the arrangements for regular data acquisition. It serves as a starting point for the identification of appropriate statistical series and will help to determine relevant classifications.
- 4.4. The Core Set of Environment Statistics will be accompanied by detailed guidance elaborating on agreed concepts, definitions, classifications and data compilation methods. This methodological guidance will be used to train and assist countries that wish to incorporate the Core Set of Environment Statistics into their national statistical programmes. This would be invaluable in ensuring the availability of a defined set of relevant and internationally comparable environment statistics.
- 4.5. The final section in the chapter contains a series of tables, structured according to the FDES, which present the Core Set (Tier 1) of Environment Statistics, as well as the complete Basic Set of Environment Statistics which demonstrates how the Core Set is embedded in the Basic Set for each statistical topic of the FDES. These tables include columns illustrating, for each statistic, common disaggregations, temporal and spatial considerations, as well as available methodologies and classifications.

4.1 What is the Core Set of Environment Statistics

- 4.6. The Core Set of Environment Statistics consists of a limited number of statistics, as well as some non-statistical information on the environment (e.g., qualitative descriptions). The Core Set represents a broad consensus of opinion on the pertinence and feasibility of these statistics; as such, it is intended to foster collection, coordination and harmonization of environment statistics at the national, regional and international levels.
- 4.7. When a country faces stringent resource constraints in developing a national environment statistics programme, or is at early stages in the development of environment statistics, the Core Set is well suited to provide guidance in determining priorities, scope, timing and periodicity in the production of such statistics, depending on national circumstances. It presents a comprehensive body of relevant environment statistics which can easily be tailored to suit specific national needs.
- 4.8. The Core Set can also help in identifying data gaps in established national environment statistics programmes. Some countries may be in the position of having started environment statistics programmes in response to very specific event-driven imperatives. The use of the Core Set and the forthcoming methodological guidance for its compilation will allow them to build on such beginnings by adding or adjusting statistics based on an organized set of

concepts and definitions that have been agreed upon and are widely used. These can complement existing environment data collection activities to provide a more complete statistical description of environmental concerns for the country.

- 4.9. The Core Set provides guidance on statistics to include in a national environment statistics programme in order to be able to serve national and international policy-makers with the most necessary information on environmental issues of interest to countries, and those that go well beyond national boundaries. It incorporates the most pertinent statistics needed to report on global environmental conventions and MEAs and as such, its utilization in national statistical programmes will help improve reporting on these conventions and agreements.
- 4.10. In conclusion, the Core Set together with the Basic Set of Environment Statistics can contribute to the gradual production and strengthening of environment statistics within countries, and thus enable and support the development, monitoring and assessment of evidence-based environmental policies. They can be instrumental when dealing with the growing demand for monitoring and reporting on the environment and sustainable development. The FDES and the Core and Basic Sets of Environment Statistics provide a flexible framework from which the necessary environment statistics to inform on a whole range of environmental issues can be identified and organized. While the Core Set and the Basic Set are not exhaustive, they are comprehensive enough given the state of current knowledge to respond both to existing, as well as to newly emerging issues.

4.2 The process of development of the Core Set of Environment Statistics

- 4.11. The development of the Core Set of Environment Statistics began in 2010 with a review of the UNSD List of Environmental Indicators, adopted by the UN Statistical Commission in 1995, and the list of environment statistics contained in the two technical reports which accompanied the 1984 FDES.^{44,45} The process also involved an assessment of international data collection efforts, including major global or regional indicator initiatives. The selection of statistics also took into account pertinent data needed to respond to global environmental conventions and MEAs.
- 4.12. A review of 2,575 environmental indicators and statistics was carried out during the process. Indicators and statistics from 37 sources and 65 lists/sets from international, regional and inter-governmental institutions, global environmental conventions, academia

⁴⁴ Concepts and Methods of Environment Statistics Human Settlement Statistics – A Technical Report, Studies in Methods, Series F, No. 51, United Nations publication, Sales No. E88.XVII.14

⁴⁵ Concepts and Methods of Environment Statistics: Statistics of the Natural Environment - A Technical Report, Studies in Methods, Series F, No. 57, United Nations publication, Sales No. E91.XVII.18

and NGOs were reviewed. These indicators and statistics were then organized around preliminary themes and sub-themes. This approach helped determine the FDES component structure as it gave a good indication of global, regional and also thematic priorities. It also provided the opportunity to identify those closely related fields that, due to their importance, should be included in the scope of the FDES. For each indicator the necessary underlying statistics were listed separately. Additionally, statistics which were considered important in their own right, i.e., not necessarily as an input to any indicators, were also included.

- 4.13. Based on the aforementioned analysis, statistics that focus on the most important environmental and associated economic and social activities, which can be used for analysis and reporting on the environment, were included in the Basic Set of Environment Statistics. The Basic Set does not constitute an exhaustive collection of environment statistics, but it does present a selection of about 500 statistics that are considered relevant, appropriate, adequate and important for describing and measuring the environment, and for responding to policy needs or public information requirements. All environment statistics which were identified for inclusion in the Basic Set were then grouped according to the FDES structure outlined in Chapter 3 consisting of components, sub-components and topics.
- 4.14. The contents of the Basic Set were then subjected to a pilot test that has been conducted with more than 20 countries at various stages in developing their national environment statistics, from all regions of the world. The pilot test in each country mainly consisted of assessing the relevance and availability of the statistics included in the Basic Set. The countries were also asked to indicate the priority of each statistic for national policy making according to the three tiers. The results of this pilot have contributed to the prioritization and determination of the appropriate set of statistics to be included in the Core Set (Tier 1) as well as in Tiers 2 and 3.
- 4.15. The main selection criteria of the Core Set of Environment Statistics (Tier 1) were relevance, measurability and methodological soundness, further elaborated as follows:
 - i. Relevance: Core statistics should meet the needs of the broad variety users and be responsive to changes in the environment and related human activities;
 - ii. Measurability: Core statistics should have sufficient supporting data and meta-data readily available, be of accepted quality, and be regularly updated, or it should be possible to compile the statistics should be able to be compiled in the near term;
 - iii. Methodological soundness: Core statistics should adhere to professional and scientific methods, as well as to internationally agreed concepts and definitions to the extent possible.

4.16. The Basic Set was then split into three tiers of statistics and the Core Set of Environment Statistics (Tier 1) was identified. The three tiers of statistics (Core Set/Tier 1, Tier 2 and Tier 3) are defined as follows:

- Tier 1 is the Core Set of Environment Statistics which all countries, at any stage of development, are strongly recommended to consider producing in the short-term. The Core Set contains a limited number of environment statistics that are of high relevance and priority to the great majority of countries.
- Tier 2 includes environment statistics which, while also important and widely applicable, require a more significant investment in time, resources or technological development and countries are encouraged to consider producing them in the medium-term.
- Tier 3 includes environment statistics which are either of less priority or less-developed and in some cases require significant methodological development, so countries are encouraged to address producing them in the long-term.

4.3 Contents of the Core Set and the Basic Set of Environment Statistics

4.17. The following tables present the Core Set (Table 4.1) and the complete Basic Set of Environment Statistics (Table 4.2) separately. The tables organize the statistics by the components, sub-components and statistical topics of the FDES. The tables containing the complete Basic Set include additional columns which provide further guidance. The third column in this table provides illustrations of possible temporal, spatial and subject-based disaggregations for the statistics. It should be noted that these are not mutually exclusive and may overlap. The fourth column refers to existing available methodological guidance from international sources that offer concepts, descriptions, specifications, lists, classifications and statistical methodologies for the given topic of the FDES.

4.3.1 The Core Set of Environment Statistics

Table 4.1 The Core Set of Environment Statistics

Component	Sub-component	Topic	Core Set / Tier 1 Statistics	
Component 1: Environmental Conditions and Quality	Sub-component 1.1: Physical Conditions	Topic 1.1.1: Atmosphere, climate and weather	a. Temperature	1. Annual averages 2. Long-term annual averages
			b. Precipitation	1. Annual averages 2. Long-term annual averages
		Topic 1.1.2: Hydrographic characteristics	d. Watersheds	1. Description of main watersheds (e.g., extent, area, rivers, aquifers)
		Topic 1.1.3: Geological and geographic information	a. Geologic, geographic and geomorphologic conditions of terrestrial areas and islands	2. Area of country or region
			b. Coastal area (includes area of coral reefs, mangroves, etc.)	
		c. Main sea's characterization	1. Length of marine coastline	
	Sub-component 1.2: Soil and Land Cover	Topic 1.2.1: Soil characteristics	a. Soil characterization	1. Area of soil types
			b. Degradation	1. Area affected by soil erosion 2. Area affected by desertification
		Topic 1.2.2: Land cover	a. Extent and spatial distribution of main land cover categories (also in 1.3.3.b)	1. Area of land cover 2. Location of land cover
	Sub-component 1.3: Biodiversity and Ecosystems	Topic 1.3.1: Biodiversity	a. Flora - terrestrial, freshwater and marine (also in 1.3.2.c)	1. Number of known species by status category
			b. Fauna - terrestrial, freshwater and marine (also in 1.3.2.c)	1. Number of known species by status category
			c. Protected areas	1. Protected terrestrial (including inland water) and marine area (also in 1.3.3.a)
		Topic 1.3.2: Ecosystems	a. General ecosystem characteristics, extent and pattern	1. Area of ecosystem
			c. Biological components of ecosystems (also in 1.3.1.a-b)	4. Threatened species
		Topic 1.3.3: Forests	a. Forest area	1. Total 5. Area deforested

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	Sub-component 1.4: Environmental Quality	Topic 1.4.1: Air quality	a. Breathable particles	1. Concentration levels of PM₁₀ 2. Concentration levels of PM_{2,5}
			b. Breathable gases	1. Concentration level of tropospheric Ozone (O₃) 2. Concentration levels of carbon monoxide (CO)
			c. Ambient concentrations of other relevant pollutants	1. Concentration levels of sulphur dioxide (SO₂) 3. Concentration levels of nitrogen oxides (NO_x)
		Topic 1.4.2: Freshwater quality	a. Concentration of nutrients and chlorophyll	1. Nitrates in freshwater bodies 2. Phosphates in freshwater bodies
			b. Oxygen in freshwater bodies	1. Biochemical oxygen demand (BOD) in freshwater bodies
			c. Bacterial pollutants	1. Concentration of faecal coliforms in freshwater bodies
		Topic 1.4.3: Marine water quality	e. Coral bleaching	1. Area affected by coral bleaching
			j. Oxygen in marine water bodies	1. Biochemical oxygen demand (BOD) in marine water bodies
			k. Concentration of nutrients and chlorophyll	1. Nitrates in marine water bodies 2. Phosphates in marine water bodies
Component 2: Environmental Resources and their Use	Sub-component 2.1: Non-energy mineral resources	Topic 2.1.1: Stocks and changes of non-energy mineral resources	a. Non-energy mineral resources	1. Stocks of commercially recoverable resources 5. Extraction
	Sub-component 2.2: Energy resources	Topic 2.2.1: Stocks and changes of mineral energy resources	a. Mineral energy resources	1. Stocks of commercially recoverable resources 5. Extraction 11. Energy mineral imports 12. Energy mineral exports
		Topic 2.2.2: Production and use of energy	a. Renewable and non- renewable production of energy	1. Total 2. Non-renewable 3. Renewable
			b. Production of energy	1. Primary energy production 2. Secondary energy production
			c. Total consumption of energy	
			d. Electric energy	1. Electricity production 2. Installed capacities
	Sub-component 2.3: Land	Topic 2.3.1: Land use	a. Land use area	
			b. Area of inland water use	
			c. Coastal area (includes area of coral reefs, mangroves, etc.) (also in 1.1.3.b)	
Topic 2.3.2: Land use change	a. Land use change	3. Change of land use category by origin and destination		

	Sub-component 2.4: Biological Resources	Topic 2.4.1: Timber resources and their use	a. Timber resources	1. Stocks of timber resources
		Topic 2.4.2: Aquatic resources and their use	a. Fish capture production	
			b. Aquaculture production	
		Topic 2.4.3: Crops	a. Main annual and perennial crops	1. Area harvested 2. Area planted 3. Amount produced
			b. Amount used of:	1. Natural fertilizers (e.g., manure, compost, lime) 2. Artificial fertilizers 3. Pesticides
	Topic 2.4.4: Livestock	a. Livestock	1. Number of live animals	
	Sub-component 2.5: Water Resources	Topic 2.5.1: Water resources	a. Inflow of water to inland water resources	1. Precipitation 2. Inflow from neighbouring territories
			b. Outflow of water from inland water resources	1. Evapotranspiration 2. Outflow to neighbouring territories 4. Outflow of water to the sea
		Topic 2.5.2: Abstraction, use and returns of water	a. Total water abstraction	
			b. Water abstraction from surface water	
		c. Water abstraction from groundwater	1. From renewable groundwater resources 2. From non-renewable groundwater resources	
Component 3: Emissions, Residuals and Waste	Sub-component 3.1: Emissions to Air	Topic 3.1.1: Emissions of greenhouse gases	a. Total emissions of direct greenhouse gases, by gas:	1. Carbon dioxide (CO₂) 2. Methane (CH₄) 3. Nitrous oxide (N₂O)
			b. Total emissions of indirect greenhouse gases, by gas:	1. Sulphur dioxide (SO₂) 2. Nitrogen oxides (NO_x)
	Sub-component 3.2: Generation and Management of Wastewater	Topic 3.2.1: Generation and pollutant content of wastewater	a. Volume of wastewater generated	
		Topic 3.2.2: Collection and treatment of wastewater	a. Volume of wastewater collected	
			b. Volume of wastewater treated	
	Topic 3.2.3: Discharge of wastewater to the environment	a. Wastewater discharge	1. Total volume of wastewater discharged to the environment after treatment 2. Total volume of wastewater discharged to the environment without treatment	
Sub-component 3.3:	Topic 3.3.1:	a. Amount of waste generated by economic activity		

	Generation and Management of Waste	Generation of waste	c. Generation of hazardous waste	1. Hazardous waste generated
		Topic 3.3.2: Management of waste	a. Municipal waste	1. Total municipal waste collected 2. Amount of municipal waste treated by type of treatment 3. Number of municipal waste treatment and disposal facilities
			b. Hazardous waste	1. Total hazardous waste collected 2. Amount of hazardous waste treated by type of treatment 3. Number of hazardous waste treatment and disposal facilities
			d. Amount of recycled waste	
Component 4: Extreme Events and Disasters	Sub-component 4.1: Natural Extreme Events and Disasters	Topic 4.1.1: Occurrence of natural extreme events and disasters	a. Occurrence of natural extreme events and disasters:	1. Type of natural disaster (geophysical, meteorological, hydrological, climatological, biological) 2. Location
		Topic 4.1.2: Impact of natural extreme events and disasters	a. People affected by natural extreme events and disasters	1. Number of people killed
			b. Economic loss due to natural extreme events and disasters (e.g., damage to buildings, roadways, loss of revenue for businesses, loss of crops, etc.)	
Component 5: Human Habitat and Environmental Health	Sub-component 5.1: Human Habitat	Topic 5.1.2: Access to water, sanitation and energy	a. Population using an improved drinking water source	
			b. Population using an improved sanitation facility	
			d. Population connected to wastewater collection	
			e. Population connected to wastewater treatment	
	Topic 5.1.5: Environmental concerns specific to urban habitats	c. Number of private and public vehicles		
		Sub-component 5.2: Environmental Health	Topic 5.2.2: Water-related diseases and conditions	a. Water-related diseases and conditions (e.g., diarrhoeal disease, gastroenteritis and water borne parasite infections):
Topic 5.2.3: Vector borne diseases	a. Vector borne diseases (e.g., malaria, dengue fever, yellow fever and Lyme disease):		1. Incidence 2. Morbidity 3. Mortality	

Component 6: Environment Protection, Management and Engagement	Sub-component 6.1: Environment Protection and Resource Management Expenditure	Topic 6.1.1: Government environment protection and resource management expenditure	a. Government environment protection and management expenditure	1. Annual government environment protection expenditure
	Sub-component 6.2: Environmental Governance and Regulation	Topic 6.2.2: Environmental regulation and instruments	a. Direct regulation	1. List of regulated pollutants and description (e.g., by year of adoption and maximum allowable levels)
		Topic 6.2.3: Participation in MEAs and environmental conventions	a. Participation in MEAs and other global environmental conventions	1. List and description (e.g., year of participation⁴⁶ of country) of MEAs and other global environmental conventions

⁴⁶ Participation means the country or area has become party to the agreements under the treaty or convention, which is achieved through a variety of means depending on country circumstances, namely: accession, acceptance, approval, formal confirmation, ratification, and succession. Countries or areas who have signed but not become party to the agreements under a given convention or treaty are not considered to be participating.

4.3.2 The Basic Set of Environment Statistics

LEGEND:

1. The first level in the tables, preceded by a lower-case letter, is the statistics group/category; in some cases where there are no statistics below the first level, this level may also describe a specific statistic.
2. The second level in the tables, preceded by a number, identifies specific statistics.
3. **Bold text is Tier 1 (Core Set) statistics**; normal text is Tier 2 statistics; and *italicized text is Tier 3 statistics*.

Table 4.2 The Basic Set of Environment Statistics

Component 1: Environmental Conditions and Quality			
Sub-component 1.1: Physical Conditions			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 1.1.1: Atmosphere, climate and weather (CONTINUES ON NEXT PAGE)	a. Temperature <ol style="list-style-type: none"> 1. Annual averages 2. Long-term annual averages 3. Monthly averages 4. Annual minimum and maximum monthly average 	<ul style="list-style-type: none"> ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ World Meteorological Organization (WMO) ▪ Intergovernmental Panel on Climate Change (IPCC) ▪ National Oceanic and Atmospheric Administration (NOAA) / National Aeronautics and Space Administration (NASA)
	b. Precipitation <ol style="list-style-type: none"> 1. Annual averages 2. Long-term annual averages 3. Monthly averages 4. Annual minimum and maximum monthly average 		
	c. Humidity <ol style="list-style-type: none"> 1. Annual averages 2. Long-term annual averages 		
	d. Pressure <ol style="list-style-type: none"> 1. <i>Annual averages</i> 2. <i>Long-term annual averages</i> 3. <i>Monthly averages</i> 4. <i>Annual minimum and maximum monthly average</i> 		
	e. Wind speed <ol style="list-style-type: none"> 1. <i>Annual averages</i> 2. <i>Long-term annual averages</i> 		

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Component 1: Environmental Conditions and Quality			
Sub-component 1.1: Physical Conditions			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 1.1.1: Atmosphere, climate and weather (CONTINUED FROM PREVIOUS PAGE)	f. Solar radiation 1. <i>Annual averages</i> 2. <i>Long-term annual averages</i> 3. <i>Monthly averages</i> 4. <i>Annual minimum and maximum monthly average</i>	<ul style="list-style-type: none"> ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ World Meteorological Organization (WMO) ▪ Intergovernmental Panel on Climate Change (IPCC) ▪ National Oceanic and Atmospheric Administration (NOAA) / National Aeronautics and Space Administration (NASA)
	g. UV radiation 1. <i>Annual averages</i> 2. <i>Long-term annual averages</i> 3. <i>Monthly averages</i> 4. <i>Annual minimum and maximum monthly average</i>		
	h. Occurrence of El Niño or La Nina events, when relevant 1. <i>Occurrence</i> 2. <i>Location</i> 3. <i>Time period</i>		

Component 1: Environmental Conditions and Quality

Sub-component 1.1: Physical Conditions

Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 1.1.2: Hydrographic characteristics	a. Lakes 1. <i>Surface area</i> 2. <i>Location</i>	<ul style="list-style-type: none"> ▪ By watershed/river basin ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ United Nations Statistics Division (UNSD): International Recommendations for Water Statistics (IRWS) ▪ UN-Water
	b. Rivers 1. <i>Length</i> 2. <i>Surface area</i> 3. <i>Location</i>		
	c. Reservoirs 1. <i>Surface area</i> 2. <i>Location</i>		
	d. Watersheds 1. Description of main watersheds (e.g., extent, area, rivers, aquifers)		
	e. Seas 1. <i>Surface area of coastal waters or Exclusive Economic Zone (EEZ)</i> 2. <i>Depth</i> 3. <i>Location</i>	<ul style="list-style-type: none"> ▪ National, within coastal waters or EEZ 	
	f. Groundwater 1. <i>Extent of aquifers</i>	<ul style="list-style-type: none"> ▪ By watershed ▪ National ▪ Sub-national ▪ Renewable ▪ Non-renewable ▪ By salinity levels 	

Component 1: Environmental Conditions and Quality

Sub-component 1.1: Physical Conditions

Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 1.1.3: Geological and geographic information	a. Geologic, geographic and geomorphologic conditions of terrestrial areas and islands <ol style="list-style-type: none"> 1. Length of border 2. Area of country or region 3. Geographical location 4. Number of islands 5. Area of islands 6. Location of islands 7. <i>Main geomorphologic characteristics of islands</i> 8. <i>Spatial distribution of land relief</i> 9. <i>Characteristics of landforms</i> (e.g., location, area and height, as applicable, for plains, hills, plateaus, dunes, volcanoes, mountains, sea mounts, etc.) 10. <i>Area of rock types</i> 11. <i>Location of rock types</i> 12. <i>Area of tectonic plates</i> 13. <i>Location of tectonic plates</i> 14. <i>Length of fault lines</i> 15. <i>Location of fault lines</i> 	<ul style="list-style-type: none"> ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ UNSD: Demographic Yearbook ▪ UN Food and Agriculture Organization of the United Nations (FAO) ▪ Center for International Earth Science Information Network (CIESIN)
	b. Coastal area (includes area of coral reefs, mangroves, etc.) (also in 2.3.1.c)		
	c. Main sea characterization <ol style="list-style-type: none"> 1. Length of marine coastline 2. Coastal waters 3. Exclusive Economic Zone (EEZ) (also in 2.3.1.d) 4. <i>Sea level</i> 5. <i>Area of sea ice</i> 	<ul style="list-style-type: none"> ▪ National 	

Component 1: Environmental Conditions and Quality			
Sub-component 1.2: Soil and Land Cover			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 1.2.1: Soil characteristics	a. Soil characterization 1. Area of soil types	<ul style="list-style-type: none"> ▪ By location ▪ By soil type ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ FAO and the International Institute for Applied Systems Analysis (IIASA) Harmonized World Soil Database ▪ International Soil Reference and Information Centre (ISRIC) World Data Centre for Soils ▪ United Nations Convention to Combat Desertification (UNCCD) ▪ FAO Global Assessment of Human-induced Soil Degradation (GLASOD)
	b. Degradation 1. Area affected by soil erosion 2. Area affected by desertification 3. Area affected by salinization 4. Area affected by waterlogging 5. Area affected by acidification 6. <i>Area affected by compaction</i>		
	c. Nutrient content of soil, measured in levels of: 1. Nitrogen (N) 2. Phosphorus (P) 3. <i>Calcium (Ca)</i> 4. <i>Magnesium (Mg)</i> 5. <i>Potassium (K)</i> 6. <i>Zinc (Zn)</i>	<ul style="list-style-type: none"> ▪ By soil type ▪ By nutrient ▪ National ▪ Sub-national 	
Topic 1.2.2: Land cover	a. Extent and spatial distribution of main land cover categories (also in 1.3.3.b) 1. Area of land cover 2. Location of land cover	<ul style="list-style-type: none"> ▪ By type of land cover (e.g., artificial surfaces including urban and associated areas; herbaceous crops; woody crops; multiple or layered crops; grassland; tree covered areas; mangroves; shrub covered areas; shrubs and/or herbaceous vegetation, aquatic or regularly flooded; sparsely natural vegetated areas; terrestrial barren land; permanent snow and glaciers; inland water bodies; and coastal water bodies and inter-tidal areas)⁴⁷ ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ FAO Land Cover Classification System ▪ System of Environmental-Economic Accounting (SEEA) Central Framework (2012) land cover categories ▪ European Environment Agency (EEA)

⁴⁷ SEEA land cover categories, based on FAO Land Cover Classification System (<http://unstats.un.org/unsd/envaccounting/seearev/Chapters/cAnnex.pdf>)

Component 1: Environmental Conditions and Quality			
Sub-component 1.3: Biodiversity and Ecosystems			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 1.3.1: Biodiversity	a. Flora - terrestrial, freshwater and marine (also in 1.3.2.c) 1. Number of known species by status category 2. Species population 3. Number of endemic species 4. Number of invasive alien species 5. <i>Habitat fragmentation</i>	<ul style="list-style-type: none"> ▪ By class (e.g., mammals, fishes, birds, reptiles, etc.) ▪ By ecosystem (Marine, Coastal, Inland Water, Forest, Dryland, Island, Mountain, Polar, Cultivated, Urban)⁴⁸ ▪ By biome ▪ By habitat ▪ By status category (e.g., threatened) ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ Millennium Ecosystem Assessment ▪ UN Convention on Biological Diversity ▪ The International Union for the Conservation of Nature (IUCN) Red List of Threatened Species ▪ UN Economic Commission of Europe (ECE) Standard Statistical Classification of Flora, Fauna and Biotopes (1996) ▪ FAO FISHSTAT (Species population and number of invasive alien species)
	b. Fauna - terrestrial, freshwater and marine (also in 1.3.2.c) 1. Number of known species by status category 2. Species population 3. Number of endemic species 4. Number of invasive alien species 5. <i>Habitat fragmentation</i>	<ul style="list-style-type: none"> ▪ By management category⁴⁹ ▪ By ecosystem ▪ By biome ▪ By habitat ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ IUCN Protected Area Management Categories ▪ UNSD: Millennium Development Goal (MDG) Indicator 7.6 Metadata
	c. Protected areas 1. Protected terrestrial (including inland water) and marine area (also in 1.3.3.a)	<ul style="list-style-type: none"> ▪ By relevant species ▪ By ecosystem ▪ By biome ▪ By habitat ▪ By status category ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ IUCN Red List of Threatened Species ▪ UNSD: MDG Indicator 7.7 Metadata
	d. Protected species 1. Number of terrestrial, freshwater and marine protected flora species 2. Number of terrestrial, freshwater and marine protected fauna species	<ul style="list-style-type: none"> ▪ By ecosystem ▪ By biome ▪ By habitat ▪ By status category ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
	e. Other 1. <i>Trends in genetic diversity of domesticated animals, cultivated plants, and fish species of major socioeconomic importance</i> 2. <i>Trade in wildlife and captive-bred species</i>	<ul style="list-style-type: none"> ▪ By ecosystem ▪ By biome ▪ By habitat ▪ By status category ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

⁴⁸ Reporting categories used in the Millennium Ecosystem Assessment (<http://www.maweb.org/documents/document.769.aspx.pdf>)

⁴⁹ IUCN reporting categories: Strict natural reserves; Wilderness areas; National parks, Natural monuments and features; Habitat (species) protected areas; Protected landscapes; and Protected areas with sustainable use of natural resources (http://www.iucn.org/about/work/programmes/pa/pa_products/wcpa_categories/)

Component 1: Environmental Conditions and Quality			
Sub-component 1.3: Biodiversity and Ecosystems			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 1.3.2: Ecosystems	a. General ecosystem characteristics, extent and pattern <ol style="list-style-type: none"> 1. Area of ecosystem 2. Location within country 3. <i>Proximity of relevant ecosystem to urban areas and cropland</i> 	<ul style="list-style-type: none"> ▪ By ecosystem (e.g., Marine, Coastal, Inland Water, Forest, Dryland, Island, Mountain, Polar, Cultivated, Urban)⁵⁰ ▪ By biome ▪ By habitat ▪ By biogeographical region ▪ By river basin ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ Millennium Ecosystem Assessment ▪ UN Convention on Biological Diversity ▪ UNECE Standard Statistical Classification of Flora, Fauna and Biotopes (1996) ▪ IUCN Red List of Threatened Species ▪ Convention on Wetlands of International Importance, especially as Waterfowl Habitat (The Ramsar Convention)
	b. Ecosystem’s physical and chemical characteristics <ol style="list-style-type: none"> 1. <i>Nutrients</i> 2. <i>Carbon</i> 3. <i>Pollutants</i> 		
	c. Biological components of ecosystems (also in 1.3.1.a-b) <ol style="list-style-type: none"> 1. Biota (flora and fauna) 2. Endemic species 3. Biodiversity (aggregated measure of diversity of flora and fauna) 4. Threatened species 		

⁵⁰ Reporting categories used in the Millennium Ecosystem Assessment (<http://www.maweb.org/documents/document.769.aspx.pdf>)

Component 1: Environmental Conditions and Quality			
Sub-component 1.3: Biodiversity and Ecosystems			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1; Regular Text – Tier 2; <i>Italicized Text</i> – Tier 3)	Potential Aggregations and Scales	Methodological Guidance
Topic 1.3.3: Forests	a. Forest area <ol style="list-style-type: none"> 1. Total 2. Natural 3. Cultivated 4. Protected forest area (also in 1.3.1.c) 5. Area deforested 6. Area reforested 7. Area afforested 8. Forest area affected by fire 9. <i>Natural growth</i> b. Forest biomass <ol style="list-style-type: none"> 1. Total 2. <i>Carbon storage in living forest biomass</i> 	<ul style="list-style-type: none"> ▪ By forest type, as appropriate ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ FAO Global Forest Resources Assessment (FRA) ▪ UN Forum on Forests (UNFF) Monitoring, assessment and reporting (MAR) ▪ UNSD: MDG Indicator 7.1 Metadata ▪ Montreal Process (Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests) ▪ State of Europe’s Forests (Forest Europe/UNECE-FAO Forestry and Timber Section)

Component 1: Environmental Conditions and Quality			
Sub-component 1.4: Environmental Quality			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1; Regular Text – Tier 2; <i>Italicized Text</i> – Tier 3)	Potential Aggregations and Scales	Methodological Guidance
Topic 1.4.1: Air quality	a. Breathable particles <ol style="list-style-type: none"> 1. Concentration levels of PM₁₀ 2. Concentration levels of PM_{2.5} 3. Maximum allowable levels 4. Number of days where maximum allowable levels were surpassed per year 	<ul style="list-style-type: none"> ▪ Sub-national ▪ Daily maximum ▪ Monthly maximum and average ▪ Yearly maximum and average 	<ul style="list-style-type: none"> ▪ World Health Organization (WHO) ▪ UNECE Standard Statistical Classification of Ambient Air Quality (1990)
	b. Breathable gases <ol style="list-style-type: none"> 1. Concentration level of tropospheric Ozone (O₃) 2. Concentration levels of carbon monoxide (CO) 3. Maximum allowable levels 4. Number of days where maximum allowable levels were surpassed per year 		
	c. Ambient concentrations of other relevant pollutants <ol style="list-style-type: none"> 1. Concentration levels of sulphur dioxide (SO₂) 2. Concentration levels of lead (Pb) 3. Concentration levels of nitrogen oxides (NO_x) 4. Concentration levels of non-methane volatile organic compounds (NMVOCs) 5. <i>Concentration levels of dioxins</i> 6. <i>Concentration levels of furans</i> 7. <i>Windblown sand and dust</i> 8. Other pollutants 9. Maximum allowable levels 10. Number of days where maximum allowable levels were surpassed per year 		
	d. Global atmospheric concentrations of climate process drivers <ol style="list-style-type: none"> 1. Global atmospheric concentration levels of carbon dioxide (CO₂) 2. Global atmospheric concentration levels of methane (CH₄) 		

Component 1: Environmental Conditions and Quality				
Sub-component 1.4: Environmental Quality				
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance	
Topic 1.4.2: Freshwater quality	a. Concentration of nutrients and chlorophyll <ol style="list-style-type: none"> 1. Nitrates in freshwater bodies 2. Phosphates in freshwater bodies 3. Chlorophyll A in freshwater bodies 4. Maximum allowable levels 	<ul style="list-style-type: none"> ▪ By water body ▪ By watershed/ river basin 	<ul style="list-style-type: none"> ▪ UNECE Standard Statistical Classification of Freshwater Quality for the Maintenance of Aquatic Life (1992) ▪ UN Environment Programme Global Environment Monitoring System – Water (UNEP GEMS-Water) 	
	b. Oxygen in freshwater bodies <ol style="list-style-type: none"> 1. Biochemical oxygen demand (BOD) in freshwater bodies 2. Concentration of dissolved oxygen (DO) in freshwater bodies 3. Chemical oxygen demand (COD) in freshwater bodies 4. Maximum allowable levels 			
	c. Bacterial pollutants <ol style="list-style-type: none"> 1. Concentration of faecal coliforms in freshwater bodies 2. Maximum allowable levels 			
	d. Heavy metals that bioaccumulate (e.g., mercury, lead, nickel, arsenic, cadmium) <ol style="list-style-type: none"> 1. Concentrations in freshwater organisms 2. Maximum allowable levels 			
	e. Persistent organic pollutants (POPs) (e.g., PCBs, DDT, pesticides, furans, dioxins, phenols and radioactive waste) <ol style="list-style-type: none"> 1. Concentrations in the sediment and water, when applicable 2. Concentrations in freshwater organisms, when applicable 3. Maximum allowable levels 			<ul style="list-style-type: none"> ▪ UNECE Standard Statistical Classification of Freshwater Quality for the Maintenance of Aquatic Life (1992) ▪ UN Environment Programme Global Environment Monitoring System – Water (UNEP GEMS-Water) ▪ Stockholm Convention ▪ UNECE Standard Statistical Classification of Freshwater Quality for the Maintenance of Aquatic Life (1992) ▪ UN Environment Programme Global Environment Monitoring System – Water (UNEP GEMS-Water)
	f. Acidification of freshwater bodies <ol style="list-style-type: none"> 1. pH/Acidity/Alkalinity 			
	g. Temperature			
	h. <i>Sedimentation</i>			
	i. Salinity			
	j. Concentration of heavy metals in freshwater bodies			
	k. Other pollutants (e.g., antibiotics)			

Component 1: Environmental Conditions and Quality

Sub-component 1.4: Environmental Quality

Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 1.4.3: Marine water quality (CONTINUES ON NEXT PAGE)	a. Temperature	<ul style="list-style-type: none"> ▪ By coastal zone, delta, estuary or other local marine environment ▪ Sub-national ▪ National ▪ Supranational 	<ul style="list-style-type: none"> ▪ UNECE Standard Statistical Classification of Marine Water Quality (1992) ▪ NOAA/NASA ▪ UNEP Regional Seas Programme
	b. <i>Salinity</i>		
	c. <i>Density</i>		
	d. Bacterial pollutants <ol style="list-style-type: none"> 1. Faecal coliform concentrations in recreational marine waters 2. Maximum allowable levels 		
	e. Coral bleaching <ol style="list-style-type: none"> 1. Area affected by coral bleaching 		
	f. Heavy metals that bioaccumulate (e.g., mercury, lead, nickel, arsenic, cadmium) <ol style="list-style-type: none"> 1. Concentrations in marine organisms 2. Maximum allowable levels 		
	g. Plastic waste and other marine debris <ol style="list-style-type: none"> 1. <i>Amount of plastic waste and other debris in marine waters</i> 		
	h. <i>Urban runoff</i>		
	i. <i>Sedimentation</i>		
	j. Oxygen in marine water bodies <ol style="list-style-type: none"> 1. Biochemical oxygen demand (BOD) in marine water bodies 2. Concentration of dissolved oxygen (DO) in marine water bodies 3. Chemical oxygen demand (COD) in marine water bodies 4. Maximum allowable levels 		
	k. Concentration of nutrients and chlorophyll <ol style="list-style-type: none"> 1. Nitrates in marine water bodies 2. Phosphates in marine water bodies 3. Chlorophyll A in marine water bodies 4. Maximum allowable levels 		
	l. Red tide <ol style="list-style-type: none"> 1. <i>Occurrence</i> 2. <i>Impact</i> 3. <i>Location</i> 4. <i>Duration</i> 		
	m. Acidification of marine water bodies <ol style="list-style-type: none"> 1. <i>pH/Acidity/Alkalinity</i> 		

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Component 1: Environmental Conditions and Quality			
Sub-component 1.4: Environmental Quality			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 1.4.3: Marine water quality (CONTINUED FROM PREVIOUS PAGE)	n. Oil pollution <ol style="list-style-type: none"> 1. <i>Area of oil slicks</i> 2. <i>Amount of tar balls</i> 	<ul style="list-style-type: none"> ▪ By coastal zone, delta, estuary or other local marine environment ▪ Sub-national ▪ National ▪ Supranational 	<ul style="list-style-type: none"> ▪ UNECE Standard Statistical Classification of Marine Water Quality (1992) ▪ NOAA/NASA ▪ UNEP Regional Seas Programme
	o. POPs (e.g., PCBs, DDT, pesticides, furans, dioxins, phenols and radioactive waste) <ol style="list-style-type: none"> 1. <i>Concentrations in the sediment and water, when applicable</i> 2. <i>Concentrations in marine organisms, when applicable</i> 3. <i>Maximum allowable levels</i> 		<ul style="list-style-type: none"> ▪ UNECE Standard Statistical Classification of Marine Water Quality (1992) ▪ NOAA/NASA ▪ UNEP Regional Seas Programme ▪ Stockholm Convention

Component 1: Environmental Conditions and Quality			
Sub-component 1.4: Environmental Quality			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 1.4.4: Soil pollution	a. <i>Total area affected by pollution</i>	▪ Sub-national	
	b. Land area affected by contamination from: <ol style="list-style-type: none"> 1. Petroleum hydrocarbons (oil residuals) 2. <i>Solvents</i> 3. Pesticides 4. <i>Heavy metals</i> 5. <i>Acidification</i> 		
Topic 1.4.5: Noise	a. Levels of noise (decibels) from specific sources	▪ Sub-national	▪ WHO
	b. Levels of noise (decibels) in specific locations		
	c. Maximum allowable levels from different sources or in specific surrounding locations		

Component 2: Environmental Resources and their Use			
Sub-component 2.1: Non-energy mineral resources			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 2.1.1: Stocks and changes of non-energy mineral resources	a. Non-energy mineral resources <ol style="list-style-type: none"> 1. Stocks of commercially recoverable resources 2. New discoveries 3. <i>Upward reappraisals</i> 4. <i>Upward reclassifications</i> 5. Extraction 6. <i>Catastrophic losses</i> 7. <i>Downward reappraisals</i> 8. <i>Downward reclassifications</i> 9. Stocks of potentially commercially recoverable resources 10. <i>Stocks of non-commercial and other known resources</i> 11. Non-energy mineral imports 12. Non-energy mineral exports 	<ul style="list-style-type: none"> ▪ By mineral ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ United Nations Framework Classification for Energy and Mineral Resources (UNFC) ▪ SEEA Central Framework (2012) Asset and physical flow accounts ▪ ISIC Rev 4, Section B, Divisions 05-08

Component 2: Environmental Resources and their Use			
Sub-component 2.2: Energy resources			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1; Regular Text – Tier 2; <i>Italicized Text</i> – Tier 3)	Potential Aggregations and Scales	Methodological Guidance
Topic 2.2.1: Stocks and changes of mineral energy resources	a. Mineral energy resources <ol style="list-style-type: none"> 1. Stocks of commercially recoverable resources 2. New discoveries 3. <i>Upward reappraisals</i> 4. <i>Upward reclassifications</i> 5. Extraction 6. <i>Catastrophic losses</i> 7. <i>Downward reappraisals</i> 8. <i>Downward reclassifications</i> 9. Stocks of potentially commercially recoverable resources 10. <i>Stocks of non-commercial and other known resources</i> 11. Energy mineral imports 12. Energy mineral exports 	<ul style="list-style-type: none"> ▪ By resource (e.g., natural gas, crude oil and natural gas liquids, oil shale, natural bitumen and extra heavy oil (includes oil extracted from oil sands), coal and lignite, peat, non-metallic minerals except for coal or peat, uranium and thorium ores, and other metallic minerals) ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ UNSD: International Recommendations for Energy Statistics (IRES) ▪ Asset and physical flow accounts in SEEA Central Framework (2012) ▪ International Energy Agency (IEA) Energy Statistics Manual ▪ ISIC Rev 4, Section B, Divisions 05-08 ▪ UNFC

Component 2: Environmental Resources and their Use			
Sub-component 2.2: Energy resources			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 2.2.2: Production and use of energy	a. Renewable and non-renewable production of energy <ol style="list-style-type: none"> 1. Total 2. Non-renewable 3. Renewable 	<ul style="list-style-type: none"> ▪ By non-renewable resource (e.g., petroleum, natural gas, coal, fission fuels, non-sustainable firewood, waste, other non-renewables) ▪ By renewable resource (e.g., solar, wind, geothermal, hydropower and ocean resources, solid biomass, biogas and liquid biofuels) ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ IEA Energy Statistics Manual ▪ UNSD: IRES ▪ Joint Wood Energy Enquiry (UNECE-FAO Forestry and Timber Section)
	b. Production of energy <ol style="list-style-type: none"> 1. Primary energy production 2. Secondary energy production 	<ul style="list-style-type: none"> ▪ By primary energy source (e.g., petroleum, natural gas, coal, hydroenergy, geothermal, fission fuels, cane products, other primary) ▪ By secondary energy source (e.g., electricity, liquefied petroleum gas, gasoline/alcohol, kerosene, diesel oil, fuel oil, coke, charcoal, gases, other secondary) ▪ National ▪ Sub-national 	
	c. Total consumption of energy	<ul style="list-style-type: none"> ▪ By energy source ▪ By ISIC economic activity ▪ National ▪ Sub-national 	
	d. Electric energy <ol style="list-style-type: none"> 1. Electricity production 2. Installed capacities 	<ul style="list-style-type: none"> ▪ By energy source ▪ National ▪ Sub-national 	

Component 2: Environmental Resources and their Use				
Sub-component 2.3: Land				
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance	
Topic 2.3.1: Land use	a. Land use area	<ul style="list-style-type: none"> ▪ By land use category (e.g., agriculture, forestry, aquaculture, built up and related area, land used for maintenance and restoration of environmental functions, other land use not elsewhere classified, land not in use, aquaculture, maintenance and restoration of environmental functions, other inland water use not elsewhere classified, inland water not in use) ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ FAO ▪ ECE Standard Classification of Land Use ▪ SEEA Central Framework (2012) Annex 1 	
	b. Area of inland water use	<ul style="list-style-type: none"> ▪ By inland water use category (e.g., aquaculture, maintenance and restoration of environmental functions, other inland water use not elsewhere classified, inland water not in use) ▪ National ▪ Sub-national 		
	c. Coastal area (includes area of coral reefs, mangroves, etc.) (also in 1.1.3.b)	<ul style="list-style-type: none"> ▪ National 		
	d. Exclusive Economic Zone (also in 1.1.3.c)			
	e. Land ownership	<ul style="list-style-type: none"> ▪ By ownership category ▪ National ▪ Sub-national 		<ul style="list-style-type: none"> ▪ FAO Inter-departmental Working Group on Organic Agriculture
	f. <i>Area of land under organic farming</i>	<ul style="list-style-type: none"> ▪ National ▪ Sub-national 		
	g. Area of land under sustainable forest management			<ul style="list-style-type: none"> ▪ Forest Stewardship Council
	h. <i>Area of land under agroforestry</i>			
Topic 2.3.2: Land use change	a. Land use change <ol style="list-style-type: none"> 1. Increase of area within category 2. Decrease of area within category 3. Change of land use category by origin and destination 	<ul style="list-style-type: none"> ▪ By land use category (see 2.3.1.a above for examples) ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ FAO ▪ ECE Standard Classification of Land Use 	

Component 2: Environmental Resources and their Use			
Sub-component 2.4: Biological Resources			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 2.4.1: Timber resources and their use	a. Timber resources <ol style="list-style-type: none"> 1. Stocks of timber resources 2. Natural growth 3. Fellings 4. Removals 5. <i>Felling residues</i> 6. <i>Natural losses</i> 7. <i>Catastrophic losses</i> 8. <i>Reclassifications</i> 	<ul style="list-style-type: none"> ▪ By type (e.g., cultivated or natural) ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ FAO Forest resources assessment ▪ State of Europe’s Forests (Forest Europe/UNECE-FAO Forestry and Timber Section) ▪ UNECE/FAO Joint Working Party on Forest Statistics, Economics and Management ▪ ISIC Rev 4, Section A, Division 02 ▪ FAOSTAT database
	b. Amount used of: <ol style="list-style-type: none"> 1. Fertilizers 2. Pesticides 	<ul style="list-style-type: none"> ▪ National ▪ Sub-national 	
	c. Forest production	<ul style="list-style-type: none"> ▪ By type of product (e.g., timber, industrial roundwood, fuelwood, pulp, chips) ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ Central Product Classification (CPC) ▪ Joint Forest Sector Questionnaire (UNECE/FAO/Eurostat/International Tropical Timber Organization [ITTO]) ▪ FAO/ITTO/UNECE/Eurostat Inter-secretariat Working Group on Forest Sector Statistics ▪ UNECE Timber Committee ▪ UNECE/FAO Joint Working Party on Forest Statistics, Economics and Management ▪ ISIC Rev 4, Section A, Division 02 ▪ FAOSTAT database
	d. Fuelwood consumption	<ul style="list-style-type: none"> ▪ National ▪ Sub-national 	
	e. Imports of forest products	<ul style="list-style-type: none"> ▪ By type of product 	
	f. Exports of forest products		
			<ul style="list-style-type: none"> ▪ FAO/ITTO/UNECE/Eurostat Inter-secretariat Working Group on Forest Sector Statistics ▪ State of Europe’s Forests (Forest Europe/UNECE-FAO Forestry and Timber Section) ▪ ISIC Rev 4, Section A, Division 02 ▪ Harmonized System (HS) ▪ FAOSTAT database

Component 2: Environmental Resources and their Use			
Sub-component 2.4: Biological Resources			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 2.4.2: Aquatic resources and their use	a. Fish capture production	<ul style="list-style-type: none"> ▪ By relevant species ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ FAO ISCAAP ▪ ISIC Rev 4, Section A, Division 03 ▪ The United Nations Convention on the Law of the Sea (UNCLOS) ▪ UNSD: MDG Indicator 7.4 Metadata
	b. Aquaculture production		
	c. Imports of fish and fishery products	<ul style="list-style-type: none"> ▪ By relevant species ▪ By type of product ▪ By species ▪ National ▪ Sub-national 	
	d. Exports of fish and fishery products		
	e. Amount used of: <ul style="list-style-type: none"> 1. <i>Pellets</i> 2. <i>Hormones</i> 3. <i>Colorants</i> 4. <i>Antibiotics</i> 5. <i>Fungicides</i> 	<ul style="list-style-type: none"> ▪ National ▪ Sub-national 	
	f. Fish resources (natural; cultivated) <ul style="list-style-type: none"> 1. Stocks of fish resources 2. <i>Additions to fish resources</i> 3. <i>Reductions in fish resources</i> 	<ul style="list-style-type: none"> ▪ By relevant species ▪ By type (e.g., cultivated or natural) ▪ By species ▪ National ▪ Sub-national 	
Topic 2.4.3: Crops	a. Main annual and perennial crops <ul style="list-style-type: none"> 1. Area harvested 2. Area planted 3. Amount produced 4. <i>Amount of organic production</i> 5. <i>Amount of genetically modified crops produced</i> 	<ul style="list-style-type: none"> ▪ By crop ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ FAO Indicative Crop Classification (for 2010 round of agricultural censuses) ▪ FAO/WHO Specifications for Pesticides (2010) ▪ FAO Specifications for Commonly Used Fertilizers (2009) ▪ ISIC Rev 4, Section A, Division 1 ▪ FAOSTAT
	b. Amount used of: <ul style="list-style-type: none"> 1. Natural fertilizers (e.g., manure, compost, lime) 2. Artificial fertilizers 3. Pesticides 	<ul style="list-style-type: none"> ▪ By type of fertilizer ▪ By type of pesticide ▪ By crop ▪ National ▪ Sub-national 	
	c. Monoculture / resource-intensive crops <ul style="list-style-type: none"> 1. Area being used for production 2. Amount produced 3. <i>Amount of genetically modified crops produced</i> 	<ul style="list-style-type: none"> ▪ By crop ▪ National ▪ Sub-national 	
	d. Amount of crops imported		
	e. Amount of crops exported		

Component 2: Environmental Resources and their Use

Sub-component 2.4: Biological Resources

Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 2.4.4: Livestock	a. Livestock 1. Number of live animals 2. Number of animals slaughtered	<ul style="list-style-type: none"> ▪ By type of animal ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ FAOSTAT ▪ ISIC Rev 4, Section A, Division 1
	b. Amount used of: 1. <i>Antibiotics</i> 2. <i>Hormones</i>		
	c. Imports of livestock		
	d. Exports of livestock		
Topic 2.4.5: Wild, uncultivated biological resources (other than fish and timber)	a. Permits for regulated hunting of wild animals 1. Number of permits issued per year 2. Total number of animal kills allowed by permits		<ul style="list-style-type: none"> ▪ ISIC Rev 4, Section A, Division 1
	b. Exports and imports of endangered species		<ul style="list-style-type: none"> ▪ CITES
	c. <i>Reported wild animals killed or trapped for food or sale</i>		<ul style="list-style-type: none"> ▪ ISIC Rev 4, Section A, Division 1
	d. <i>Gathering of non-wood forest products and other plants</i>	<ul style="list-style-type: none"> ▪ By type of product ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ ISIC Rev 4, Section A, Group 0230

Component 2: Environmental Resources and their Use			
Sub-component 2.5: Water Resources			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 2.5.1: Water resources	a. Inflow of water to inland water resources <ol style="list-style-type: none"> 1. Precipitation 2. Inflow from neighbouring territories 3. <i>Inflow subject to treaties</i> 	<ul style="list-style-type: none"> ▪ Inflow secured through treaties/ not secured through treaties ▪ National ▪ Sub-national ▪ By territory of origin and destination 	<ul style="list-style-type: none"> ▪ UNSD: IRWS ▪ UNECE Standard Statistical Classification of Water Use (1989) ▪ UNSD: MDG Indicator 7.5 Metadata ▪ FAO AQUASTAT ▪ SEEA Central Framework (2012) Asset accounts ▪ SEEA Water ▪ UNSD: Environment Statistics Section – Water Questionnaire
	b. Outflow of water from inland water resources <ol style="list-style-type: none"> 1. Evapotranspiration 2. Outflow to neighbouring territories 3. <i>Outflow subject to treaties</i> 4. Outflow of water to the sea 		
	c. Inland water stocks <ol style="list-style-type: none"> 1. Surface water stocks in artificial reservoirs 2. <i>Surface water stocks in lakes</i> 3. Surface water stocks in rivers and streams 4. <i>Surface water stocks in wetlands</i> 5. <i>Surface water stocks in snow, ice and glaciers</i> 6. Groundwater stocks 7. <i>Water rights</i> 	<ul style="list-style-type: none"> ▪ National ▪ Sub-national 	

Component 2: Environmental Resources and their Use			
Sub-component 2.5: Water Resources			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1; Regular Text – Tier 2; <i>Italicized Text</i> – Tier 3)	Potential Aggregations and Scales	Methodological Guidance
Topic 2.5.2: Abstraction, use and returns of waters	a. Total water abstraction	<ul style="list-style-type: none"> ▪ By type of source ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ UNSD: IRWS ▪ UNECE Standard Statistical Classification of Water Use ▪ FAO AQUASTAT ▪ SEEA Central Framework (2012) ▪ SEEA Water ▪ UNSD: Environment Statistics Section – Water Questionnaire
	b. Water abstraction from surface water		
	c. Water abstraction from groundwater <ol style="list-style-type: none"> 1. From renewable groundwater resources 2. From non-renewable groundwater resources 		
	d. Water abstracted for own use	<ul style="list-style-type: none"> ▪ By ISIC economic activity ▪ National ▪ Sub-national 	
	e. Water abstracted for distribution	<ul style="list-style-type: none"> ▪ By ISIC economic activity ▪ National ▪ Sub-national 	
	f. Desalinated water	<ul style="list-style-type: none"> ▪ National ▪ Sub-national 	
	g. Reused water		
	h. Water use	<ul style="list-style-type: none"> ▪ By ISIC economic activity ▪ National ▪ Sub-national 	
	i. <i>Rainwater collection</i>	<ul style="list-style-type: none"> ▪ National ▪ Sub-national 	
	j. <i>Water abstraction from the sea</i>		
	k. Losses in distribution	<ul style="list-style-type: none"> ▪ By ISIC economic activity ▪ National ▪ Sub-national 	
	l. <i>Exports of water</i>	<ul style="list-style-type: none"> ▪ National ▪ Sub-national 	
	m. <i>Imports of water</i>		
	n. <i>Returns of water</i>	<ul style="list-style-type: none"> ▪ By ISIC economic activity ▪ National ▪ Sub-national 	

Component 3: Emissions, Residuals and Waste			
Sub-component 3.1: Emissions to Air			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1; Regular Text – Tier 2; <i>Italicized Text</i> – Tier 3)	Potential Aggregations and Scales	Methodological Guidance
Topic 3.1.1: Emissions of greenhouse gases	a. Total emissions of direct greenhouse gases, by gas: <ol style="list-style-type: none"> 1. Carbon dioxide (CO₂) 2. Methane (CH₄) 3. Nitrous oxide (N₂O) 4. Perfluorocarbons (PFCs) 5. Hydrofluorocarbons (HFCs) 6. Sulphur hexafluoride (SF₆) 	<ul style="list-style-type: none"> ▪ By ISIC economic activity ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ IPCC Emission Factor Database ▪ UN Framework Convention on Climate Change (UNFCCC) Reporting Guidelines ▪ UNECE Standard Statistical Classification of Ambient Air Quality (1990) ▪ UNSD: MDG Indicator 7.2 Metadata ▪ WHO
	b. Total emissions of indirect greenhouse gases, by gas: <ol style="list-style-type: none"> 1. Sulphur dioxide (SO₂) 2. Nitrogen oxides (NO_x) 3. Non-Methane Volatile Organic Compounds (NM-VOCs) 4. Other 		
Topic 3.1.2: Consumption of ozone depleting substances	a. Consumption of ozone depleting substances (ODS), by substance: <ol style="list-style-type: none"> 1. Chlorofluorocarbons (CFCs) 2. Hydrochlorofluorocarbons (HCFCs) 3. Bromofluorocarbons 4. Methyl chloroform 5. Carbon tetrachloride 6. Methyl bromide 7. Other 		
Topic 3.1.3: Emissions of other substances	a. Emissions of other substances: <ol style="list-style-type: none"> 1. Lead (Pb) 2. <i>Other</i> 	<ul style="list-style-type: none"> ▪ UNECE Standard Statistical Classification of Ambient Air Quality (1990) ▪ European Monitoring and Evaluation Programme (EMEP) is under the Convention on Long-range Transboundary Air Pollution. 	

Component 3: Emissions, Residuals and Waste			
Sub-component 3.2: Generation and Management of Wastewater			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 3.2.1: Generation and pollutant content of wastewater	a. Volume of wastewater generated	<ul style="list-style-type: none"> ▪ By ISIC economic activity ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ UNSD: IRWS ▪ ISIC Rev 4, Section E, Division 35 and 36 ▪ SEEA Water ▪ UNSD: Environment Statistics Section – Water Questionnaire
	b. Emissions of pollutants to wastewater	<ul style="list-style-type: none"> ▪ By pollutant ▪ By ISIC economic activity ▪ National ▪ Sub-national 	

Component 3: Emissions, Residuals and Waste			
Sub-component 3.2: Generation and Management of Wastewater			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 3.2.2: Collection and treatment of wastewater	a. Volume of wastewater collected	<ul style="list-style-type: none"> ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ UNSD: IRWS ▪ ISIC Rev 4, Section E, Division 35 and 36 ▪ UNSD: Environment Statistics Section – Water Questionnaire
	b. Volume of wastewater treated	<ul style="list-style-type: none"> ▪ By treatment type (e.g., primary, secondary, tertiary) ▪ National ▪ Sub-national 	
	c. Total urban wastewater treatment capacity <ol style="list-style-type: none"> 1. Number of plants 2. Capacity of plants 	<ul style="list-style-type: none"> ▪ By treatment type (e.g., primary, secondary, tertiary) ▪ National ▪ Sub-national 	
	d. Total industrial wastewater treatment capacity <ol style="list-style-type: none"> 1. Number of plants 2. Capacity of plants 	<ul style="list-style-type: none"> ▪ By treatment type (e.g., primary, secondary, tertiary) ▪ National ▪ Sub-national 	
Topic 3.2.3: Discharge of wastewater to the environment	a. Wastewater discharge <ol style="list-style-type: none"> 1. Total volume of wastewater discharged to the environment after treatment 2. Total volume of wastewater discharged to the environment without treatment 	<ul style="list-style-type: none"> ▪ By treatment type (e.g., primary secondary, tertiary) ▪ By recipient (e.g., surface water, groundwater, wetland, sea, soil) ▪ By ISIC economic activity ▪ National ▪ Sub-national 	
	b. Pollutant content of discharged wastewater	<ul style="list-style-type: none"> ▪ By pollutant or pollution parameter (e.g., BOD, COD, N, P) ▪ National ▪ Sub-national ▪ Net emission by ISIC economic activity 	

Component 3: Emissions, Residuals and Waste			
Sub-component 3.3: Generation and Management of Waste			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 3.3.1: Generation of waste	a. Amount of waste generated by economic activity	<ul style="list-style-type: none"> ▪ By ISIC economic activity ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ European Commission: European List of Waste, pursuant to European Waste Framework Directive ▪ Eurostat: Data Centre on Waste ▪ Eurostat: European Waste Classification for Statistics, version 4 (Waste categories) ▪ Basel Convention: Waste categories and hazardous characteristics ▪ Eurostat: Manual on Waste Statistics ▪ Eurostat: Guidance on classification of waste according to EWC-Stat categories ▪ SEEA Central Framework (2012) ▪ UNSD: Environment Statistics Section – Waste Questionnaire
	b. Amount of waste generated by waste category	<ul style="list-style-type: none"> ▪ By waste category (e.g., chemical waste, municipal waste, combustion waste, etc.) ▪ National ▪ Sub-national 	
	c. Generation of hazardous waste 1. Hazardous waste generated	<ul style="list-style-type: none"> ▪ By ISIC economic activity ▪ National ▪ Sub-national 	

Component 3: Emissions, Residuals and Waste

Sub-component 3.3: Generation and Management of Waste

Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 3.3.2: Management of waste	a. Municipal waste <ol style="list-style-type: none"> 1. Total municipal waste collected 2. Amount of municipal waste treated by type of treatment 3. Number of municipal waste treatment and disposal facilities 4. Capacity of municipal waste treatment and disposal facilities 	<ul style="list-style-type: none"> ▪ By type of treatment (e.g., recycled, incinerated, landfilled) ▪ By type of waste, when possible ▪ By ISIC economic activity ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ Eurostat: Data Centre on Waste ▪ Eurostat metadata: OECD/Eurostat definition of municipal waste ▪ UNSD: Environment Statistics Section – Waste Questionnaire ▪ Basel Convention: Waste categories and hazardous characteristics ▪ Eurostat: European Waste Classification for Statistics, version 4 (Waste categories) ▪ European Commission: European Waste Framework Directive (Waste treatment operations) ▪ Eurostat: Manual on Waste Statistics ▪ Eurostat: Guidance on classification of waste according to EWC-Stat categories ▪ Rotterdam Convention
	b. Hazardous waste <ol style="list-style-type: none"> 1. Total hazardous waste collected 2. Amount of hazardous waste treated by type of treatment 3. Number of hazardous waste treatment and disposal facilities 4. Capacity of hazardous waste treatment and disposal facilities 		
	c. Other/industrial waste <ol style="list-style-type: none"> 1. Total other/industrial waste collected 2. Amount of other/industrial waste treated by type of treatment 3. Number of treatment and disposal facilities by type of treatment 4. Capacity of industrial waste treatment and disposal facilities 		
	d. Amount of recycled waste	<ul style="list-style-type: none"> ▪ By specific waste streams (e.g., e-waste, packaging waste, end of life vehicles) ▪ By waste category ▪ National ▪ Sub-national 	
	e. Import and export of waste	<ul style="list-style-type: none"> ▪ By waste category (e.g., chemical waste, municipal waste, combustion waste, etc.) 	
	f. Import and export of hazardous waste		

Component 4: Extreme Events and Disasters			
Sub-component 4.1: Natural Extreme Events and Disasters			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 4.1.1: Occurrence of natural extreme events and disasters	a. Occurrence of natural extreme events and disasters: <ol style="list-style-type: none"> 1. Type of natural disaster (geophysical, meteorological, hydrological, climatological, biological) 2. Location 3. Magnitude (where applicable) 4. Date of occurrence 5. Duration 6. Hazard prone areas 7. Population living in hazard prone areas 	<ul style="list-style-type: none"> ▪ By event ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ Centre for Research on the Epidemiology of Disasters Emergency Event Database (CRED EM-DAT) ▪ Economic Commission for Latin America and the Caribbean (UNECLAC) Handbook for Estimating the Socio-economic and Environmental Effects of Disasters
	Topic 4.1.2: Impact of natural extreme events and disasters		
	b. Economic loss due to natural extreme events and disasters (e.g., damage to buildings, roadways, loss of revenue for businesses, loss of crops, etc.)	<ul style="list-style-type: none"> ▪ By event ▪ By ISIC economic activity ▪ National ▪ Sub-national ▪ By direct and indirect damage 	
	c. Effects of natural extreme events and disasters on integrity of ecosystems <ol style="list-style-type: none"> 1. <i>Area affected by natural disasters</i> 2. <i>Loss of vegetation cover</i> 3. <i>Effect on watershed area</i> 4. <i>Other</i> 	<ul style="list-style-type: none"> ▪ By event ▪ By ecosystem ▪ National ▪ Sub-national 	
	d. <i>External assistance received</i>	<ul style="list-style-type: none"> ▪ By event 	

Component 4: Extreme Events and Disasters

Sub-component 4.2: Technological Disasters

Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 4.2.1: Occurrence of technological disasters	a. Occurrence of technological disaster <ol style="list-style-type: none"> 1. Type of disaster (industrial, transportation, miscellaneous) 2. <i>Location</i> 3. <i>Date of occurrence</i> 4. <i>Duration</i> 	<ul style="list-style-type: none"> ▪ By event ▪ By ISIC economic activity ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ CRED EM-DAT ▪ UNECLAC: Handbook for Estimating the Socio-economic and Environmental Effects of Disasters
Topic 4.2.2: Impact of technological disasters	a. People affected by technological disaster <ol style="list-style-type: none"> 1. Number of people killed 2. <i>Number of people injured</i> 3. <i>Number of people homeless</i> 4. <i>Number of people affected</i> 	<ul style="list-style-type: none"> ▪ By event ▪ National ▪ Sub-national 	
	b. Economic loss due to technological disaster	<ul style="list-style-type: none"> ▪ By event ▪ By ISIC economic activity ▪ National ▪ Sub-national ▪ By direct and indirect damage 	
	c. Effects of disasters on integrity of ecosystem <ol style="list-style-type: none"> 1. <i>Area affected by anthropogenic/technological disasters</i> 2. <i>Loss of vegetation cover</i> 3. <i>Effect on watershed area</i> 4. <i>Other (e.g., for oil spills: volume of oil released into the environment, impact on ecosystem)</i> 	<ul style="list-style-type: none"> ▪ By event ▪ National ▪ Sub-national 	
	d. <i>External assistance received</i>	<ul style="list-style-type: none"> ▪ By event ▪ National 	

Component 5: Human Habitat and Environmental Health			
Sub-component 5.1: Human Habitat			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 5.1.1: Urban and rural population	a. Total population living in urban areas		<ul style="list-style-type: none"> ▪ UN Population Division ▪ UN Population Fund (UNFPA)
	b. Total population living in rural areas		
	c. Total urban area		
	d. Total rural area		
Topic 5.1.2: Access to water, sanitation and energy	a. Population using an improved drinking water source	<ul style="list-style-type: none"> ▪ Urban ▪ Rural ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ UNSD: MDG Indicator 7.8 and 7.9 Metadata ▪ UN-Water ▪ UNSD: Environment Statistics Section – Water Questionnaire ▪ WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation
	b. Population using an improved sanitation facility		
	c. Population served by municipal waste collection		
	d. Population connected to wastewater collection	<ul style="list-style-type: none"> ▪ By treatment type (e.g., primary, secondary, tertiary) ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ UNSD: IRWS ▪ ISIC Rev. 4, Section E, Division 35 and 36 ▪ UNSD: Environment Statistics Section – Water Questionnaire
	e. Population connected to wastewater treatment		
	f. Population with access to electricity		
Topic 5.1.3: Housing conditions	a. Urban population living in slums	<ul style="list-style-type: none"> ▪ Urban ▪ Rural ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ UN Habitat ▪ UNSD: MDG Indicator 7.10 Metadata
	b. <i>Houses in zones vulnerable to particular environmental health issues, natural disasters and extreme events, or anthropogenic disasters</i>		
	c. <i>Population living in a precarious dwelling</i>		
	d. <i>Population living in informal settlements</i>		
	e. <i>Homeless population</i>		
	f. <i>Number of dwellings with adequacy of building materials defined by national or local standards</i>		

Component 5: Human Habitat and Environmental Health			
Sub-component 5.1: Human Habitat			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 5.1.4: Exposure to ambient pollution related to spatial location of population	a. Population exposed to air pollution (e.g., SO ₂ , NO _x , O ₃) in main cities	▪ By pollutant (e.g., SO ₂ , NO _x , O ₃)	▪ WHO
	b. <i>Population exposed to noise pollution in main cities</i>		▪ WHO
Topic 5.1.5: Environmental concerns specific to urban habitats	a. Extent of urban sprawl		<ul style="list-style-type: none"> ▪ UN Habitat ▪ WHO ▪ UNEP Urban Environment Unit
	b. Available green areas		
	c. Number of private and public vehicles	▪ By type of engine	
	d. Traffic congestion		
	e. Population using public modes of transportation		
	f. <i>Population using hybrid and electric modes of transportation</i>		
	g. Extent of the roadways		
	h. <i>Existence of urban planning and zoning regulations and instruments in main cities</i>		
	i. <i>Effectiveness of urban planning and zoning regulations and instruments in main cities</i>		

Component 5: Human Habitat and Environmental Health			
Sub-component 5.2: Environmental Health			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 5.2.1: Airborne diseases and conditions	a. Airborne diseases and conditions (e.g., upper and lower respiratory disease, obstructive pulmonary disease, asthma and allergic rhinitis): <ol style="list-style-type: none"> 1. Incidence 2. Morbidity 3. Mortality 4. <i>Loss of work days</i> 5. <i>Estimates of economic cost in monetary terms</i> 	<ul style="list-style-type: none"> ▪ By disease or condition ▪ National ▪ Sub-national ▪ Urban ▪ Rural ▪ By gender ▪ By age group ▪ By time period 	<ul style="list-style-type: none"> ▪ WHO
Topic 5.2.2: Water-related diseases and conditions	a. Water-related diseases and conditions (e.g., diarrhoeal disease, gastroenteritis and water borne parasite infections): <ol style="list-style-type: none"> 1. Incidence 2. Morbidity 3. Mortality 4. <i>Loss of work days</i> 5. <i>Estimates of economic cost in monetary terms</i> 		
Topic 5.2.3: Vector borne diseases	a. Vector borne diseases (e.g., malaria, dengue fever, yellow fever and Lyme disease): <ol style="list-style-type: none"> 1. Incidence 2. Morbidity 3. Mortality 4. <i>Loss of work days</i> 5. <i>Estimates of economic cost in monetary terms</i> 		
Topic 5.2.4: Health problems associated with excessive UV radiation exposure	a. Problems associated with excessive UV radiation exposure (e.g., skin cancer, cataracts): <ol style="list-style-type: none"> 1. <i>Incidence</i> 2. <i>Morbidity</i> 3. <i>Mortality</i> 4. <i>Loss of work days</i> 5. <i>Estimates of economic cost in monetary terms</i> 		

Component 5: Human Habitat and Environmental Health			
Sub-component 5.2: Environmental Health			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 5.2.5: Toxic substance and radiation related diseases and conditions	<p>a. Toxic substance related diseases and conditions (e.g., chronic illnesses of the respiratory system such as pneumonia, upper respiratory diseases, asthma and chronic obstructive pulmonary diseases; infertility; and congenital anomalies or malformations), including nuclear radiation related health problems (e.g., short and long term health problems including thermal burns from infrared heat radiation, beta and gamma burns from beta and gamma radiation, radiation sickness or “atomic disease”, leukaemia, lung cancer, thyroid cancer and cancer of other organs, sterility and congenital anomalies or malformations, premature aging, cataracts and also increased vulnerability to disease as well as emotional disorders):</p> <ol style="list-style-type: none"> 1. Incidence 2. Morbidity 3. Mortality 4. <i>Loss of work days</i> 5. <i>Estimates of economic cost in monetary terms</i> 	<ul style="list-style-type: none"> ▪ By category of toxic substance ▪ By disease or condition ▪ National ▪ Sub-national ▪ Urban ▪ Rural ▪ By gender ▪ By age group 	<ul style="list-style-type: none"> ▪ WHO

Component 6: Environment Protection, Management and Engagement			
Sub-component 6.1: Environment Protection and Resource Management Expenditure			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 6.1.1: Government environment protection and resource management expenditure	a. Government environment protection and resource management expenditure <ol style="list-style-type: none"> 1. Annual government environment protection expenditure 2. Annual government resource management expenditure 	<ul style="list-style-type: none"> ▪ By environmental activity ▪ By ministry ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ Classification of Environmental Activities (CEA) ▪ SEEA Central Framework (2012) Annex 1 ▪ Eurostat – SERIEE Environmental Protection Expenditure Accounts Compilation Guide
Topic 6.1.2: Corporate, non-profit institution and household environment protection and resource management expenditure	a. Private sector environment protection and resource management expenditure <ol style="list-style-type: none"> 1. Annual corporate environment protection expenditure 2. <i>Annual corporate resource management expenditure</i> 3. <i>Annual household environment protection expenditure</i> 4. <i>Annual household resource management expenditure</i> 5. <i>Annual non-profit institution environment protection expenditure</i> 6. <i>Annual non-profit institution resource management expenditure</i> 	<ul style="list-style-type: none"> ▪ By environmental activity ▪ By ISIC economic activity ▪ National ▪ Sub-national 	

Component 6: Environment Protection, Management and Engagement

Sub-component 6.2: Environmental Governance and Regulation

Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 6.2.1: Institutional strength	a. Environmental institutions and their resources <ol style="list-style-type: none"> 1. Name of the main environmental authority/agency and year of establishment 2. Annual budget of main environmental authority/agency 3. Number of staff of main environmental authority/agency 4. List of environmental departments in other ministries/agencies and year of establishment 5. Annual budget of environmental departments in other ministries/agencies 6. Number of staff of environmental departments in other ministries/agencies 	<ul style="list-style-type: none"> ▪ National ▪ Sub-national 	
Topic 6.2.2: Environmental regulation and instruments	a. Direct regulation <ol style="list-style-type: none"> 1. List of regulated pollutants and description (e.g., by year of adoption and maximum allowable levels) 2. Description (e.g., name, year established) of licensing system to ensure compliance with environmental standards for businesses or other new facilities 3. Number of applications for licenses received and approved per year 4. List of quotas for biological resource extraction 5. Budget and number of staff dedicated to enforcement of environmental regulations <hr/> b. Economic instruments <ol style="list-style-type: none"> 1. <i>List and description (e.g., year of establishment) of green/environmental taxes</i> 2. <i>List and description (e.g., year of establishment) of environmentally relevant subsidies</i> 3. <i>List of eco-labelling and environmental certification programmes</i> 4. Volume of trade of emission permits 	<ul style="list-style-type: none"> ▪ Per media (e.g., water, air, land, soil, oceans) ▪ By ISIC economic activity ▪ National ▪ Sub-national 	

Component 6: Environment Protection, Management and Engagement

Sub-component 6.2: Environmental Governance and Regulation

Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1; Regular Text – Tier 2; <i>Italicized Text</i> – Tier 3)	Potential Aggregations and Scales	Methodological Guidance
Topic 6.2.3: Participation in MEAs and environmental conventions	a. Participation in MEAs and other global environmental conventions <ol style="list-style-type: none"> 1. List and description (e.g., year of participation⁵¹ of country) of MEAs and other global environmental conventions 		<ul style="list-style-type: none"> ▪ Secretariats of MEAs

⁵¹ Participation means the country or area has become party to the agreements under the treaty or convention, which is achieved through a variety of means depending on country circumstances, namely: accession, acceptance, approval, formal confirmation, ratification, and succession. Countries or areas who have signed but not become party to the agreements under a given convention or treaty are not considered to be participating.

Component 6: Environment Protection, Management and Engagement			
Sub-component 6.3: Extreme Event Preparedness and Disaster Management			
Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 6.3.1: Preparedness for extreme events and natural disasters	a. National natural extreme event and disaster preparedness and management systems <ol style="list-style-type: none"> 1. Existence of national disaster plans/programmes 2. Description (e.g., number of staff) of national disaster plans/programmes 3. Type of shelters in place or able to be deployed 4. Number of shelters in place or able to be deployed 5. <i>Type of internationally certified emergency and recovery management specialists</i> 6. <i>Number of internationally certified emergency and recovery management specialists</i> 7. <i>Number of volunteers</i> 8. <i>Quantity of first aid, emergency supplies and equipment stockpiles</i> 9. <i>Existence of early warning systems for all major hazards</i> 10. <i>Expenditure on disaster prevention, preparedness, clean-up and rehabilitation</i> 	<ul style="list-style-type: none"> ▪ National ▪ Sub-national 	<ul style="list-style-type: none"> ▪ International Emergency Management Organization (IEMO) ▪ The United Nations Office for Disaster Risk Reduction (UNISDR) ▪ Hyogo Framework for Action
Topic 6.3.2: Preparedness for technological disasters	a. National technological disaster preparedness and management systems <ol style="list-style-type: none"> 1. <i>Existence and description (e.g., number of staff) of public disaster management plans/programmes (and private when available)</i> 2. <i>Expenditure on clean-up and rehabilitation after a disaster</i> 		

Component 6: Environment Protection, Management and Engagement

Sub-component 6.4: Environmental Information and Awareness

Topic	Statistics and Related Information (Bold Text – Core Set/Tier 1 ; Regular Text – Tier 2; <i>Italicized Text – Tier 3</i>)	Potential Aggregations and Scales	Methodological Guidance
Topic 6.4.1: Environmental information	a. Environmental information systems <ol style="list-style-type: none"> 1. Existence of publicly accessible environmental information system 2. Annual number of visits/users of specific environmental information programmes or environmental information systems b. Environment statistics <ol style="list-style-type: none"> 1. Description of national environment statistics programmes (e.g., existence, year of establishment, lead agency, human and financial resources) 2. <i>Number and type of environment statistics products and periodicity of updates</i> 3. Existence and number of participant institutions in interagency environment statistics platforms or committees 	<ul style="list-style-type: none"> ▪ National ▪ Sub-national 	
Topic 6.4.2: Environmental education	a. Environmental education <ol style="list-style-type: none"> 1. <i>Allocation of resources by central and local authorities for environmental education</i> 2. <i>Number and description of environmental education programmes in schools</i> 3. <i>Number of students pursuing environment-based higher education (e.g., science, management, education, engineering)</i> 		
Topic 6.4.3: Environmental engagement	a. Environmental engagement <ol style="list-style-type: none"> 1. <i>Participation in pro-environment activities</i> 		
Topic 6.4.4: Environmental perception and awareness	a. Public environmental perception and awareness <ol style="list-style-type: none"> 1. <i>Number of environmental awareness community programmes</i> 2. <i>Description of environmental awareness community programmes</i> 3. <i>Perception and attitudes about environmental issues or concerns</i> 4. <i>Perception and attitudes about environmental policies</i> 		

Chapter 5: Applications of the FDES to cross-cutting environmental issues

- 5.1 The FDES is a framework which organizes the domain of environment statistics into six components which are further broken down into sub-components and statistical topics. The statistical topics in the FDES, and the underlying environment statistics in the Core Set of Environment Statistics and the Basic Set of Environment Statistics, can be combined and reorganized in different ways according to specific analytical needs and policy requirements. This is an inherent aspect of the design of the FDES as a flexible multi-purpose framework.
- 5.2 This chapter describes how to identify and organize FDES topics, and statistics from the Core Set of Environment Statistics and the Basic Set of Environment Statistics, necessary to inform on three selected cross-cutting issues: water, energy and climate change. The chapter discusses these environmental issues and provides a detailed listing of the relevant corresponding individual environment statistics for each issue. Statistics related to these cross-cutting issues are certainly relevant from the regional and global perspectives, but the emphasis in this chapter is on the national level, as this is where most data collection will take place.
- 5.3 When compiling environment statistics on a particular cross-cutting issue, it is important to start by first understanding the scientific background, underlying processes and cause-effect relationships. It is also necessary to analyze and understand its relevance to the country and to particular sub-national areas, productive sectors and social groups, its national policy implications and commitments, as well as the institutional aspects and the international context. This comprehensive view will help the environmental statistician better adapt the FDES, the Core Set of Environment Statistics and the Basic Set of Environment Statistics to provide environment statistics that fit the needs of users.
- 5.4 The cross-cutting issues of water, energy and climate change discussed in this chapter are examples and should be considered illustrative applications of selected cross-cutting issues. The FDES users might wish to develop other analyses of cross-cutting issues for specific purposes, according to national relevance and needs (e.g., sustainable management of natural resources, or environmental impacts of specific activities such as tourism, transport, agriculture, mining, manufacturing, etc.).
- 5.5 The statistics for describing the selected cross-cutting issues are organized based on a logical sequence of events that illustrate the relevant related processes. These sequences resemble the occurrence of events, according to the nature of the issue itself. In each

case, the correspondence of these sequences with the FDES structure is described. Each application is presented both at the level of the statistical topics and at the level of individual statistics from the Core Set of Environment Statistics and the Basic Set of Environment Statistics.

5.1 Water

5.6 Water is fundamental to every form of life and plays a critical role in human development. It is critical both in terms of quantity and quality. Increasing scarcity of and competition for water resources and potable water impede development, compromise ecosystem functions, undercut human health, and play roles in conflicts between and within states. Between 1990 and 2010, over 2 billion people gained access to improved water sources and 1.8 billion people gained access to improved sanitation facilities. The WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (JMP)⁵² noted that the MDG target for drinking water was met in 2010 (the proportion of people without access to improved drinking water sources had been halved from 24 percent to 11 percent, since 1990). However, they have also noted that the benefits were very unevenly distributed. Challenges persist in trying to reduce disparities and increase sanitation coverage.

5.7 The quality of and access to potable water remains a critical public health issue, particularly in developing countries, though the issue is generally improving over recent decades. There are also increasing pressures on water supply from human consumption and agricultural practices. Efforts to restructure natural hydrological systems have provided benefits to the human sub-system but have also created new environmental issues. These issues are wide-ranging and include water-borne diseases, stress on ecosystems, loss of natural and human habitats, reduction of fish and aquatic plant productivity, waterlogging and salinization of soils, and conflicts between up- and downstream water users. In addition, deforestation has also contributed to higher levels of siltation and more devastating and frequent floods, as well as the degradation of ecosystems and productivity in inland as well as coastal waters. The need to monitor sustainable management of water resources, and the demand for related environment statistics, is increasing worldwide.

5.8 Water use and returns affect the environment in different ways. If water is abstracted faster than its natural replenishment, the resource can be depleted and even exhausted. Water abstraction itself affects the environment by decreasing, at least momentarily, the available water for other purposes including key ecological functions. Distribution losses also can cause inefficiency and require higher amounts to be extracted. When the water

⁵² <http://www.wssinfo.org/>

is used and then returned to the environment, quality and pollution become the major problems. Returns of water can either be treated or not, and to different extents, so when it is returned it has the potential to adversely affect the environment. Water temperature is also an important factor in returns to the environment for key ecological functions. There is also the problem of distribution and access to adequate drinking water and water for other uses such as small scale agriculture, particularly in rural areas of developing countries. Similar problems of access also occur with regard to sanitation facilities in developing countries.

- 5.9 Protecting the quality of freshwater is important for ecosystems, drinking water supply, food production and recreational water use. The main causes of water quality degradation include: elevated levels of salinity; suspended matter; nutrients (which can be positive for food production of aquatic resources in certain circumstances); toxins and odour compounds; pesticides and other contaminants; water temperature; dissolved oxygen and pH outside natural ranges; as well as radiological hazards.
- 5.10 In addition to quantity and quality of water supply, the distribution of this supply within countries is of key importance. When assessing distribution of total available water, it is necessary to take into account spatial and temporal considerations. Sub-national statistics must be used, as aggregated national statistics can be misleading, and sub-national statistics must be assessed in the context of the specific geographic location as challenges of equitable water distribution will vary dependent on location (e.g., rainforest versus desert). Seasonality must also be taken into account as precipitation levels change over time and seasonal flooding occurs in certain areas.
- 5.11 International partners in water assessment and management include UN-Water, the UN inter-agency coordination mechanism for all freshwater-related issues, which has drinking water and sanitation among its key focus areas.⁵³ The UN has also issued water quantity, quality and sanitation MDGs, specifically target 7.a, indicator 7.5 (proportion of total water resources used) and target 7.c, indicators 7.8 (proportion of population using an improved drinking water source) and 7.9 (proportion of population using an improved sanitation facility). In addition, the UN has developed the *International Recommendations for Water Statistics* (IRWS) in an effort to assist countries to establish and strengthen information systems for water as part of their integrated water resources management.⁵⁴ This publication was adopted by the UN Statistical Commission in 2010.

⁵³ <http://www.unwater.org/>

⁵⁴ <http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf>

With regard to environmental economic water accounting, the SEEA-Water is also available.⁵⁵

5.12 The Rio+20 United Nations Conference on Sustainable Development (20-22 June 2012) provided the context for the pivotal role of water. It noted in its outcome document that water was “at the core of sustainable development”⁵⁶, through its link to key global challenges such as poverty eradication, the empowerment of women and the protection of human health. It underscored the need to address environmental challenges such as floods, droughts and water scarcity and ultimately the balancing between water supply and demand. It urged investment in water infrastructure and sanitation services and stressed the necessity to significantly improve water quality, wastewater treatment and water efficiency, while reducing water losses.

Application of the FDES to water statistics

5.13 In the figures below, the FDES has been applied for the specific purpose of organizing the relevant environment statistics needed to inform on issues related to water resources. Two approaches have been followed.

5.14 The first approach illustrates how the structure of the FDES and its six components describe the relationship of water with the environment, the society and the economy in a holistic manner, as shown by *Figure 5.1* and *Figure 5.2*.

5.15 The second approach shows how the statistical topics of the FDES can be reorganized with a narrower focus on the management of water supply and wastewater treatment, following the sequence of abstraction, distribution and use of water, returns of water and emissions to the environment, and protection and mitigation activities, as shown in *Figures 5.3* and *5.4*.

⁵⁵ System of Environmental-Economic Accounts for Water (SEEA-Water). Part I of SEEA-Water was adopted as an interim international statistical standard by the United Nations Statistical Commission (UNSC) in 2007.

<http://unstats.un.org/unsd/envaccounting/seeaw/seeawaterwebversion.pdf>

⁵⁶ “The future we want.” Paragraph 119, 2012.

<http://www.uncsd2012.org/content/documents/727The%20Future%20We%20Want%2019%20June%201230pm.pdf>

Figure 5.1: Water and the environment in the FDES - topic level

Component 1: Environmental Conditions and Quality	
Sub-component 1.1: Physical Conditions	
1.1.1	Atmosphere, climate and weather
1.1.2	Hydrographic characteristics
1.1.3	Geological and geographic information
Sub-component 1.2: Soil and Land Cover	
1.2.2	Land cover
Sub-component 1.3: Biodiversity and Ecosystems	
1.3.1	Biodiversity (freshwater and marine)
1.3.2	Ecosystems (freshwater and marine)
Sub-component 1.4: Environmental Quality	
1.4.2	Freshwater quality
1.4.3	Marine water quality

Component 2: Environmental Resources and their Use	
Sub-component 2.3: Land	
2.3.1	Land use (inland water, coastal area and EEZ)
Sub-component 2.4: Biological Resources	
2.4.2	Aquatic resources and their use
Sub-component 2.5: Water Resources	
2.5.1	Water resources
2.5.2	Abstraction, use and returns of waters

Component 3: Emissions, Residuals and Waste	
Sub-component 3.2: Generation and Management of Wastewater	
3.2.1	Generation and pollutant content of wastewater
3.2.2	Collection and treatment of wastewater
3.2.3	Discharge of wastewater to the environment

Component 4: Extreme Events and Disasters	
Sub-component 4.1: Natural Extreme Events and Disasters	
4.1.1	Occurrence of natural extreme events and disasters (draughts and floods)
4.1.2	Impact of natural extreme events and disasters (draughts and floods)
Sub-component 4.2: Technological Disasters	
4.2.1	Occurrence of technological disasters (only affecting marine and freshwater bodies)
4.2.2	Impact of technological disasters (only affecting marine and freshwater bodies)

Component 5: Human Habitat and Environmental Health	
Sub-component 5.1: Human Habitat	
5.1.2	Access to water, sanitation and energy
Sub-component 5.2: Environmental Health	
5.2.2	Water-related diseases and conditions

Component 6: Environment Protection, Management and Engagement	
Sub-component 6.1: Environment Protection and Resource Management Expenditure	
6.1.1	Government environment protection and resource management expenditure (water related)
Sub-component 6.2: Environmental Governance and Regulation	
6.2.1	Institutional strength (only institutions directly regulating and managing water)
6.2.2	Environmental regulation and instruments (regulating, managing and affecting water only)
6.2.3	Participation in MEAs and environmental conventions (regulating, managing and affecting water only)
Sub-component 6.3: Extreme Event Preparedness and Disaster Management	
6.3.1	Preparedness for extreme events and natural disasters (related to flooding)

Figure 5.2: Water and the environment in the Core Set and Basic Set of Environment

Statistics - environment statistics level

(**Bold Text – Core Set/Tier 1**; Regular Text – Tier 2; *Italicized Text – Tier 3*)

Component 1: Environmental Conditions and Quality	
Sub-component 1.1: Physical Conditions	
Topic 1.1.1: Atmosphere climate and weather	1.1.1.b: Precipitation 1.1.1.b.1: Annual averages 1.1.1.b.2: Long-term annual averages 1.1.1.b.3: Monthly averages 1.1.1.b.4: Annual minimum and maximum monthly average 1.1.1.c: Humidity 1.1.1.c.1: Annual averages 1.1.1.c.2: Long-term annual averages 1.1.1.h: Occurrence of El Niño and La Niña events, where relevant <i>1.1.1.h.1: Occurrence</i> <i>1.1.1.h.2: Location</i> <i>1.1.1.h.3: Time period</i>
Topic 1.1.2: Hydrographic characteristics	1.1.2.a: Lakes <i>1.1.2.a.1: Surface area</i> <i>1.1.2.a.2: Location</i> 1.1.2.b: Rivers <i>1.1.2.b.1: Length</i> <i>1.1.2.b.2: Surface area</i> <i>1.1.2.b.3: Location</i> 1.1.2.c: Reservoirs <i>1.1.2.c.1: Surface area</i> <i>1.1.2.c.2: Location</i> 1.1.2.d: Watersheds 1.1.2.d.1: Description of main watersheds 1.1.2.e: Seas <i>1.1.2.e.1: Surface area of coastal waters or Exclusive Economic Zone (EEZ)</i> <i>1.1.2.e.2: Depth</i> <i>1.1.2.e.3: Location</i> 1.1.2.f: Groundwater <i>1.1.2.f.1: Extent of aquifers</i>
Topic 1.1.3: Geological and geographic information	1.1.3.b: Coastal area (also in 2.3.1.c) 1.1.3.c: Main sea’s characterization 1.1.3.c.1: Length of marine coastline 1.1.3.c.2: Coastal waters 1.1.3.c.3: Exclusive Economic Zone (EEZ, also in 2.3.1.d) <i>1.1.3.c.4: Sea level</i> <i>1.1.3.c.5: Area of sea ice</i>
Sub-component 1.2: Soil and Land Cover	
Topic 1.2.2: Land cover	1.2.2.a: Extent and spatial distribution of main land cover categories (also in 1.3.3.b) 1.2.2.a.1: Area of land cover (e.g., mangrove, aquatic or regularly flooded; permanent snow and glaciers; inland water bodies; and coastal water bodies and inter-tidal areas) 1.2.2.a.2: Location of land cover
Sub-component 1.3: Biodiversity and Ecosystems	
Topic 1.3.1: Biodiversity (freshwater and marine)	1.3.1.a: Flora - freshwater and marine (also in 1.3.2.c) 1.3.1.a.1: Number of known species by status category 1.3.1.a.2: Species population 1.3.1.a.3: Number of endemic species 1.3.1.a.4: Number of invasive alien species <i>1.3.1.a.5: Habitat fragmentation</i> 1.3.1.b: Fauna - freshwater and marine (also in 1.3.2.c) 1.3.1.b.1: Number of known species by status category 1.3.1.b.2: Species population 1.3.1.b.3: Number of endemic species 1.3.1.b.4: Number of invasive alien species <i>1.3.1.b.5: Habitat fragmentation</i> 1.3.1.c: Protected areas 1.3.1.c.1: Protected terrestrial (including inland water) and marine area (also in 1.3.3.a) 1.3.1.d: Protected species

	<p>1.3.1.d.1: Number of freshwater and marine protected flora species 1.3.1.d.2: Number of freshwater and marine protected fauna species</p> <p>1.3.1.e: Other <i>1.3.1.e.1: Trends in genetic diversity of cultivated plants and fish species of major socioeconomic importance</i> <i>1.3.1.e.2: Trade in wildlife and captive-bred species (freshwater and marine)</i></p>
Topic 1.3.2: Ecosystems (freshwater and marine)	<p>1.3.2.a: General ecosystem characteristics, extent and pattern 1.3.2.a.1: Area of ecosystem 1.3.2.a.2: Location within country <i>1.3.2.a.3: Proximity of relevant ecosystem to urban areas and cropland</i></p> <p>1.3.2.b: Ecosystem's physical and chemical characteristics <i>1.3.2.b.1: Nutrients</i> <i>1.3.2.b.2: Carbon</i> <i>1.3.2.b.3: Pollutants</i></p> <p>1.3.2.c: Biological components of ecosystems (also in 1.3.1.a-b) 1.3.2.c.1: Biota (flora and fauna) 1.3.2.c.2: Endemic species 1.3.2.c.3: Biodiversity (aggregated measure of diversity of flora and fauna) 1.3.2.c.4: Threatened species</p>
Sub-component 1.4: Environmental Quality	
Topic 1.4.2: Freshwater quality	<p>1.4.2.a: Concentration of nutrients and chlorophyll 1.4.2.a.1: Nitrates in freshwater bodies 1.4.2.a.2: Phosphates in freshwater bodies 1.4.2.a.3: Chlorophyll A in freshwater bodies 1.4.2.a.4: Maximum allowable levels</p> <p>1.4.2.b: Oxygen in freshwater bodies 1.4.2.b.1: Biochemical oxygen demand (BOD) in freshwater bodies 1.4.2.b.2: Concentration of dissolved oxygen (DO) in freshwater bodies 1.4.2.b.3: Chemical oxygen demand (COD) in freshwater bodies 1.4.2.b.4: Maximum allowable levels</p> <p>1.4.2.c: Bacterial pollutants 1.4.2.c.1: Concentration of faecal coliforms in freshwater bodies 1.4.2.c.2: Maximum allowable levels</p> <p>1.4.2.d: Heavy metals that bioaccumulate (e.g., mercury, lead, nickel, arsenic, cadmium) 1.4.2.d.1: Concentrations in freshwater organisms 1.4.2.d.2: Maximum allowable levels</p> <p>1.4.2.e: Persistent organic pollutants (POPs) (e.g., PCBs, DDT, pesticides, furans, dioxins, phenols and radioactive waste) 1.4.2.e.1: Concentrations in the sediment and water, when applicable 1.4.2.e.2: Concentrations in freshwater organisms, when applicable 1.4.2.e.3: Maximum allowable levels</p> <p>1.4.2.f: Acidification of freshwater bodies 1.4.2.f.1: pH/Acidity/Alkalinity</p> <p>1.4.2.g: Temperature 1.4.2.h: <i>Sedimentation</i></p> <p>1.4.2.i: Salinity</p> <p>1.4.2.j: Concentration of heavy metals in freshwater bodies</p> <p>1.4.2.k: Other pollutants (e.g., antibiotics)</p>
Topic 1.4.3: Marine water quality	<p>1.4.3.a: Temperature 1.4.3.b: <i>Salinity</i> 1.4.3.c: <i>Density</i></p> <p>1.4.3.d: Bacterial pollutants 1.4.3.d.1: Faecal coliform concentrations in recreational marine waters 1.4.3.d.2: Maximum allowable levels</p> <p>1.4.3.e: Coral bleaching 1.4.3.e.1: Area affected by coral bleaching</p> <p>1.4.3.f: Heavy metals that bioaccumulate (e.g., mercury, lead, nickel, arsenic, cadmium) 1.4.3.f.1: Concentrations in marine organisms 1.4.3.f.2: Maximum allowable levels</p> <p>1.4.3.g: Plastic waste and other marine debris <i>1.4.3.g.1: Amount of plastic waste and other debris in marine waters</i></p> <p>1.4.3.h: <i>Urban runoff</i> 1.4.3.i: <i>Sedimentation</i></p> <p>1.4.3.j: Oxygen in marine water bodies 1.4.3.j.1: Biochemical oxygen demand (BOD) in marine water bodies 1.4.3.j.2: Concentration of dissolved oxygen (DO) in marine water bodies</p>

	<p>1.4.3.j.3: Chemical oxygen demand (COD) in marine water bodies 1.4.3.j.4: Maximum allowable levels 1.4.3.k: Concentration of nutrients and chlorophyll 1.4.3.k.1: Nitrates in marine water bodies 1.4.3.k.2: Phosphates in marine water bodies 1.4.3.k.3: Chlorophyll A in marine water bodies 1.4.3.k.4: Maximum allowable levels 1.4.3.l: Red tide <i>1.4.3.l.1: Occurrence</i> <i>1.4.3.l.2: Impact</i> <i>1.4.3.l.3: Location</i> <i>1.4.3.l.4: Duration</i> 1.4.3.m: Acidification of marine water bodies <i>1.4.3.m.1: pH/Acidity/Alkalinity</i> 1.4.3.n: Oil pollution <i>1.4.3.n.1: Area of oil slicks</i> <i>1.4.3.n.2: Amount of tar balls</i> 1.4.3.o: POPs (PCBs, DDT, pesticides, furans, dioxins, phenols and radioactive waste) <i>1.4.3.o.1: Concentrations in the sediment and water, when applicable</i> <i>1.4.3.o.2: Concentrations in marine organisms, when applicable</i> <i>1.4.3.o.3: Maximum allowable levels</i></p>
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Component 2: Environmental Resources and their Use

Sub-component 2.3: Land	
Topic 2.3.1: Land use	2.3.1.b: Area of inland water use
Sub-component 2.4: Biological Resources	
Topic 2.4.2: Aquatic resources and their use	<p>2.4.2.a: Fish capture production 2.4.2.b: Aquaculture production 2.4.2.c: Imports of fish and fishery products 2.4.2.d: Exports of fish and fishery products 2.4.2.e: Amount used of: <i>2.4.2.e.1: Pellets</i> <i>2.4.2.e.2: Hormones</i> <i>2.4.2.e.3: Colorants</i> <i>2.4.2.e.4: Antibiotics</i> <i>2.4.2.e.5: Fungicides</i> 2.4.2.f: Fish resources (natural; cultivated) 2.4.2.f.1: Stocks of fish resources 2.4.2.f.2: Additions to fish resources 2.4.2.f.3: Reductions in fish resources</p>
Sub-component 2.5: Water Resources	
Topic 2.5.1: Water resources	<p>2.5.1.a: Inflow of water to inland water resources 2.5.1.a.1: Precipitation 2.5.1.a.2: Inflow from neighbouring territories <i>2.5.1.a.3: Inflow subject to treaties</i> 2.5.1.b: Outflow of water from inland water resources 2.5.1.b.1: Evapotranspiration 2.5.1.b.2: Outflow to neighbouring territories <i>2.5.1.b.3: Outflow subject to treaties</i> 2.5.1.b.4: Outflow of water to the sea 2.5.1.c: Inland water stocks 2.5.1.c.1: Surface water stocks in artificial reservoirs 2.5.1.c.2: <i>Surface water stocks in lakes</i> 2.5.1.c.3: Surface water stocks in rivers and streams 2.5.1.c.4: <i>Surface water stocks in wetlands</i> 2.5.1.c.5: <i>Surface water stocks in snow, ice and glaciers</i> 2.5.1.c.6: Groundwater stocks 2.5.1.c.7: <i>Water rights</i></p>
Topic 2.5.2: Abstraction, use and returns of waters	<p>2.5.2.a: Total water abstraction 2.5.2.b: Water abstraction from surface water 2.5.2.c: Water abstraction from groundwater 2.5.2.c.1: From renewable groundwater resources 2.5.2.c.2: From non-renewable groundwater resources 2.5.2.d: Water abstracted for own use</p>

	2.5.2.e: Water abstracted for distribution 2.5.2.f: Desalinated water 2.5.2.g: Reused water 2.5.2.h: Water use 2.5.2.i: <i>Rainwater collection</i> 2.5.2.j: <i>Water abstraction from the sea</i> 2.5.2.k: Losses in distribution 2.5.2.l: <i>Exports of water</i> 2.5.2.m: <i>Imports of water</i> 2.5.2.n: <i>Returns of water</i>
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Component 3: Emissions, Residuals and Waste

Sub-component 3.2: Generation and Management of Wastewater	
Topic 3.2.1: Generation and pollutant content of wastewater	3.2.1.a: Volume of wastewater generated 3.2.1.b: Emissions of pollutants to wastewater
Topic 3.2.2: Collection and treatment of wastewater	3.2.2.a: Volume of wastewater collected 3.2.2.b: Volume of wastewater treated 3.2.2.c: Total urban wastewater treatment capacity 3.2.2.c.1: Number of plants 3.2.2.c.2: Capacity of plants 3.2.2.d: Total industrial wastewater treatment capacity 3.2.2.d.1: Number of plants 3.2.2.d.2: Capacity of plants
Topic 3.2.3: Discharge of wastewater to the environment	3.2.3.a: Wastewater discharge 3.2.3.a.1: Total volume of wastewater discharged to the environment after treatment 3.2.3.a.2: Total volume of wastewater discharged to the environment without treatment 3.2.3.b: Pollutant content of discharged wastewater

Component 4: Extreme Events and Disasters

Sub-component 4.1: Natural Extreme Events and Disasters	
Topic 4.1.1: Occurrence of natural extreme events and disasters (only floods)	4.1.1.a: Occurrence of natural extreme events and disasters (droughts and floods): 4.1.1.a.1: Type of natural disaster 4.1.1.a.2: Location 4.1.1.a.3: Magnitude (where applicable) 4.1.1.a.4: Date of occurrence 4.1.1.a.5: Duration (in days) 4.1.1.a.6: Hazard prone areas 4.1.1.a.7: Population living in hazard prone areas
Topic 4.1.2: Impact of natural extreme events and disasters (only floods)	4.1.2.a: People affected by natural extreme events and disasters (droughts and floods) 4.1.2.a.1: Number of people killed 4.1.2.a.2: Number of people injured 4.1.2.a.3: Number of people homeless 4.1.2.a.4: Number of people affected 4.1.2.b: Economic loss due to natural extreme events and disasters (droughts and floods) 4.1.2.c: Effects of natural extreme events and disasters on integrity of ecosystems (droughts and floods) 4.1.2.c.1: <i>Area affected by natural disasters</i> 4.1.2.c.2: <i>Loss of vegetation cover</i> 4.1.2.c.3: <i>Effect on watershed area</i> 4.1.2.c.4: <i>Other</i> 4.1.2.d: <i>External assistance received (only floods)</i>
Sub-component 4.2: Technological Disasters	
Topic 4.2.1: Occurrence of technological disasters (only affecting marine and freshwater)	4.2.1.a: Occurrence of technological disaster (only affecting marine and freshwater bodies) 4.2.1.a.1: Type of disaster 4.2.1.a.2: <i>Location</i> 4.2.1.a.3: <i>Date of occurrence</i> 4.2.1.a.4: <i>Duration (in days)</i>

bodies)	
Topic 4.2.2: Impact of technological disasters (only affecting marine and freshwater bodies)	<p>4.2.2.a: People affected by technological disaster (only affecting marine and freshwater bodies)</p> <p>4.2.2.a.1: Number of people killed</p> <p>4.2.2.a.2: <i>Number of people injured</i></p> <p>4.2.2.a.3: <i>Number of people homeless</i></p> <p>4.2.2.a.4: <i>Number of people affected</i></p> <p>4.2.2.b: Economic loss due to technological disaster (only affecting marine and freshwater bodies)</p> <p>4.2.2.c: Effects of disasters on integrity of ecosystem (only affecting marine and freshwater bodies)</p> <p>4.2.2.c.1: <i>Area affected by anthropogenic/technological disasters</i></p> <p>4.2.2.c.2: <i>Loss of vegetation cover</i></p> <p>4.2.2.c.3: <i>Effect on watershed area</i></p> <p>4.2.2.c.4: <i>Other (e.g., for oil spills: volume of oil released into the environment, impact on ecosystem)</i></p> <p>4.2.2.d: <i>External assistance received</i></p>

Component 5: Human Habitat and Environmental Health

Sub-component 5.1: Human Habitat	
Topic 5.1.2: Access to water, sanitation and energy	<p>5.1.2.a: Population using an improved drinking water source</p> <p>5.1.2.b: Population using an improved sanitation facility</p> <p>5.1.2.d: Population connected to wastewater collection</p> <p>5.1.2.e: Population connected to wastewater treatment</p>
Sub-component 5.2: Environmental Health	
Topic 5.2.2: Water-related diseases and conditions	<p>5.2.2.a: Water-related diseases and conditions (e.g., diarrhoeal disease, gastroenteritis and water borne parasite infections)</p> <p>5.2.2.a.1: Incidence</p> <p>5.2.2.a.2: Morbidity</p> <p>5.2.2.a.3: Mortality</p> <p>5.2.2.a.4: <i>Loss of work days</i></p> <p>5.2.2.a.5: <i>Estimates of economic cost in monetary terms</i></p>

Component 6: Environment Protection, Management and Engagement

Sub-component 6.1: Environment Protection and Resource Management Expenditure	
Topic 6.1.1: Government environment protection and resource management expenditure (see Note)	<p>6.1.1.a: Government environment protection and resource management expenditure</p> <p>6.1.1.a.1: Annual government water environment protection expenditure</p> <p>6.1.1.a.2: Annual government water resource management expenditure</p> <p>Note –</p> <p>For environmental protection expenditure include:</p> <ul style="list-style-type: none"> ▪ Wastewater management ▪ Waste management (disposal at sea) ▪ Protection and remediation of soil, groundwater and surface water ▪ Protection of biodiversity and landscape ▪ Research and development – water protection related. <p>For resource management expenditure include:</p> <ul style="list-style-type: none"> ▪ Management of aquatic resources ▪ Management of water resources ▪ Research and development – water resources
Sub-component 6.2: Environmental Governance and Regulation	
Topic 6.2.1: Institutional strength (only institutions directly regulating and managing water)	<p>6.2.1.a: Environmental institutions and their resources</p> <p>6.2.1.a.1: Name of the main environmental (water) authority/agency and year of establishment</p> <p>6.2.1.a.2: Annual budget of main environmental (water) authority/agency</p> <p>6.2.1.a.3: Number of staff of main environmental (water) authority/agency</p> <p>6.2.1.a.4: List of environmental (water) departments in other ministries/agencies and year of establishment</p> <p>6.2.1.a.5: Annual budget of environmental (water) departments in other ministries/agencies</p> <p>6.2.1.a.6: Number of staff of environmental (water) departments in other ministries/agencies</p>
Topic 6.2.2: Environmental regulation and instruments (regulating, managing and affecting water only)	<p>6.2.2.a: Direct regulation</p> <p>6.2.2.a.1: List of regulated water pollutants and description (e.g., by year of adoption and maximum allowable levels)</p> <p>6.2.2.a.2: Description (e.g., name, year established) of licensing system to ensure compliance with environmental (water) standards for businesses or other new facilities</p> <p>6.2.2.a.3: Number of applications for licenses (compliance with water standards) received and approved per year</p> <p>6.2.2.a.4: List of quotas for biological (aquatic) resource extraction</p>

	<p>6.2.2.a.5: Budget and number of staff dedicated to enforcement of water regulations</p> <p>6.2.2.b: Economic instruments</p> <p><i>6.2.2.b.1: List and description (e.g., year of establishment) of water-related environmental taxes</i></p> <p><i>6.2.2.b.2: List and description (e.g., year of establishment) of subsidies relevant to water</i></p> <p><i>6.2.2.b.3: List of water eco-labelling and environmental certification programmes</i></p> <p>6.2.2.b.4: Volume of trade of emission permits</p>
<p>Topic 6.2.3: Participation in MEAs and environmental conventions (regulating, managing and affecting water only)</p>	<p>6.2.3.a: Participation in MEAs and other global environmental conventions</p> <p>6.2.3.a.1: List and description (e.g., year of participation⁵⁷ of country) of MEAs and other global environmental conventions regulating, managing and affecting water</p>
Sub-component 6.3: Extreme Event Preparedness and Disaster Management	
<p>Topic 6.3.1: Preparedness for extreme events and natural disasters</p>	<p>6.3.1.a: National natural extreme events and disaster preparedness and management systems</p> <p>6.3.1.a.1: Existence of national disaster plans/programmes (related to flooding)</p> <p>6.3.1.a.2: Description of national disaster plans/programmes (related to flooding)</p>

⁵⁷ Participation means the country or area has become party to the agreements under the treaty or convention, which is achieved through a variety of means depending on country circumstances, namely: accession, acceptance, approval, formal confirmation, ratification, and succession. Countries or areas who have signed but not become party to the agreements under a given convention or treaty are not considered to be participating.

Figure 5.3: Topics in the FDES that relate to water, according to the sequence of water use and management

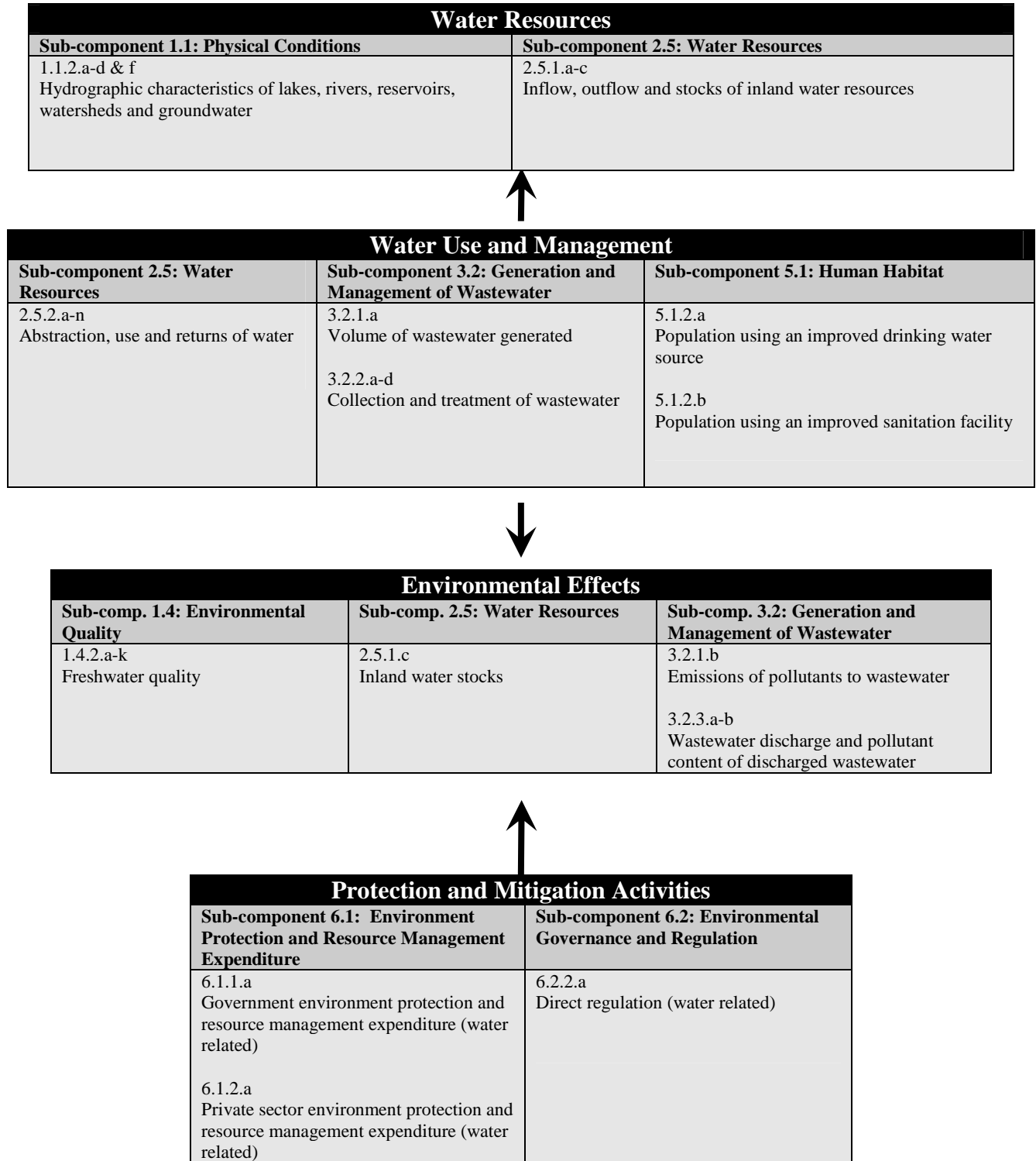


Figure 5.4: Water statistics in the Core Set and Basic Set of Environment Statistics, according to the sequence of water use and management
(**Bold Text – Core Set/Tier 1**; Regular Text – Tier 2; *Italicized Text – Tier 3*)

Water Resources
Sub-component 1.1: Physical Conditions
1.1.2.a: Lakes <i>1.1.2.a.1: Surface area</i> <i>1.1.2.a.2: Location</i> 1.1.2.b: Rivers <i>1.1.2.b.1: Length</i> <i>1.1.2.b.2: Surface area</i> <i>1.1.2.b.3: Location</i> 1.1.2.c: Reservoirs <i>1.1.2.c.1: Surface area</i> <i>1.1.2.c.2: Location</i> 1.1.2.d: Watersheds 1.1.2.d.1: Description of main watersheds 1.1.2.f: Groundwater <i>1.1.2.f.1: Extent of aquifers</i>
Sub-component 2.5: Water Resources
2.5.1.a: Inflow of water to inland water resources 2.5.1.a.1: Precipitation 2.5.1.a.2: Inflow from neighbouring territories <i>2.5.1.a.3: Inflow subject to treaties</i> 2.5.1.b: Outflow of water from inland water resources 2.5.1.b.1: Evapotranspiration 2.5.1.b.2: Outflow to neighbouring territories <i>2.5.1.b.3: Outflow subject to treaties</i> 2.5.1.b.4: Outflow of water to the sea 2.5.1.c: Inland water stocks 2.5.1.c.1: Surface water stocks in artificial reservoirs <i>2.5.1.c.2: Surface water stocks in lakes</i> 2.5.1.c.3: Surface water stocks in rivers and streams <i>2.5.1.c.4: Surface water stocks in wetlands</i> <i>2.5.1.c.5: Surface water stocks in snow, ice and glaciers</i> 2.5.1.c.6: Groundwater stocks <i>2.5.1.c.7: Water rights</i>
Water Use and Management
Sub-component 2.5: Water Resources
2.5.2.a: Total water abstraction 2.5.2.b: Water abstraction from surface water 2.5.2.c: Water abstraction from groundwater 2.5.2.c.1: From renewable groundwater resources 2.5.2.c.2: From non-renewable groundwater resources 2.5.2.d: Water abstracted for own use 2.5.2.e: Water abstracted for distribution 2.5.2.f: Desalinated water 2.5.2.g: Reused water 2.5.2.h: Water use 2.5.2.i: <i>Rainwater collection</i> 2.5.2.j: <i>Water abstraction from the sea</i> 2.5.2.k: Losses in distribution 2.5.2.l: <i>Exports of water</i> 2.5.2.m: <i>Imports of water</i> 2.5.2.n: <i>Returns of water</i>
Sub-component 3.2: Generation and Management of Wastewater
3.2.1.a: Volume of wastewater generated 3.2.2.a: Emissions of pollutants to wastewater 3.2.2.b: Volume of wastewater treated 3.2.2.c: Total urban wastewater treatment capacity 3.2.2.c.1: Number of plants 3.2.2.c.2: Capacity of plants

Sub-component 5.1: Human Habitat

5.1.2.a: Population using an improved drinking water source

5.1.2.b: Population using an improved sanitation facility

5.1.2.d: Population connected to wastewater collection

5.1.2.e: Population connected to wastewater treatment

Environmental Effects**Sub-component 1.4: Environmental Quality**

1.4.2.a: Concentration of nutrients and chlorophyll

1.4.2.a.1: Nitrates in freshwater bodies**1.4.2.a.2: Phosphates in freshwater bodies**

1.4.2.a.3: Chlorophyll A in freshwater bodies

1.4.2.a.4: Maximum allowable levels

1.4.2.b: Oxygen in freshwater bodies

1.4.2.b.1: Biochemical oxygen demand (BOD) in freshwater bodies

1.4.2.b.2: Concentration of dissolved oxygen (DO) in freshwater bodies

1.4.2.b.3: Chemical oxygen demand (COD) in freshwater bodies

1.4.2.b.4: Maximum allowable levels

1.4.2.c: Bacterial pollutants

1.4.2.c.1: Concentration of faecal coliforms in freshwater bodies

1.4.2.c.2: Maximum allowable levels

1.4.2.d: Heavy metals that bioaccumulate (e.g., mercury, lead, nickel, arsenic, cadmium)

1.4.2.d.1: Concentrations in freshwater organisms

1.4.2.d.2: Maximum allowable levels

1.4.2.e: Persistent organic pollutants (POPs) (e.g., PCBs, DDT, pesticides, furans, dioxins, phenols and radioactive waste)

1.4.2.e.1: Concentrations in the sediment and freshwater, when applicable

1.4.2.e.2: Concentrations in freshwater organisms, when applicable

1.4.2.e.3: Maximum allowable levels

1.4.2.f: Acidification of freshwater bodies

1.4.2.f.1: pH/Acidity/Alkalinity

1.4.2.g: Temperature

1.4.2.h: Sedimentation

1.4.2.i: Salinity

1.4.2.j: Concentration of heavy metals in freshwater bodies

1.4.2.k: Other pollutants (e.g., antibiotics)

Sub-component 2.5: Water Resources

2.5.1.c: Inland water stocks

2.5.1.c.1: Surface water stocks in artificial reservoirs

2.5.1.c.2: *Surface water stocks in lakes*

2.5.1.c.3: Surface water stocks in rivers and streams

2.5.1.c.4: *Surface water stocks in wetlands*2.5.1.c.5: *Surface water stocks in snow, ice and glaciers*

2.5.1.c.6: Groundwater stocks

2.5.1.c.7: *Water rights***Sub-component 3.2: Generation and Management of Wastewater**

3.2.1.b: Emission of pollutants to wastewater

3.2.3.a: Wastewater discharge

3.2.3.a.1: Total volume of wastewater discharged to the environment after treatment**3.2.3.a.2: Total volume of wastewater discharged to the environment without treatment**

3.2.3.b: Pollutant content of discharged wastewater

Protection and Mitigation Activities**Sub-component 6.1: Environment Protection and Resource Management Expenditure**

6.1.1.a: Government environment protection and resource management expenditure

6.1.1.a.1: Annual government environment protection expenditure (related to water)

6.1.1.a.2: Annual government resource management expenditure (related to water)

6.1.2.a: Private sector environment protection and resource management expenditure

6.1.2.a.1: Annual corporate environment protection expenditure (related to water)

6.1.2.a.2: *Annual corporate resource management expenditure* (related to water)6.1.2.a.3: *Annual household environment protection expenditure* (related to water)6.1.2.a.4: *Annual household resource management expenditure* (related to water)6.1.2.a.5: *Annual non-profit institution environment protection expenditure* (related to water)6.1.2.a.6: *Annual non-profit institution resource management expenditure* (related to water)

Sub-component 6.2: Environmental Governance and Regulation

6.2.2.a: Direct regulation

6.2.2.a.1: List of regulated pollutants and description (related to water)

6.2.2.a.2: Description of licensing system to ensure compliance with environmental standards for businesses or other new facilities (water related)

6.2.2.a.3: Number of applications for licenses (compliance with water standards) received and approved per year

6.2.2.a.5: Budget and number of staff dedicated to enforcement of water regulations

5.16 Some of the most commonly used water-related indicators that can be derived from the core set are as follows:

- Proportion of total water resources used (MDG indicator 7.5)
- Proportion of population using an improved drinking water source (MDG indicator 7.8)
- Proportion of population using an improved sanitation facility (MDG indicator 7.9)
- Water use intensity, by economic activity

5.2 Energy

- 5.17 Energy input is a necessary for all human controlled processes. Energy incorporates the concept of the transformation of “available energy” to “unavailable energy” (e.g., burning of hydrocarbons) and conversion from an “unusable” to a “usable” form (e.g., hydropower to electricity). Energy, unlike all other natural resources, is not a material substance but instead is the capacity of a physical system to perform work. The amount of energy in a physical system remains constant, and is finite, though its quality or availability diminishes through transformation.
- 5.18 Energy production and use affects the environment in different ways. The first issue relates to depletion of non-renewable energy resources, for as mineral energy resources are extracted, depletion occurs. In addition, extraction of mineral energy resources involves mining operations which disturb ecosystems, restructure the land, remove soil and water and produce wastes. Extraction techniques also result in the removal of large areas of surface vegetation, deep-well drilling and the use of heavy equipment for exploratory wells on land and off-shore oil rigs for exploration of ocean geology. The sheer quantity in the output of coal and the complex infrastructure required in oil and gas development have created large-scale environmental disturbances through the construction of pipelines, railways and large-scale terminal shipping facilities. This situation is further exacerbated by hazards of oil spills, well-head and pipeline explosion and fires, as well as the chemical pollution of the associated petrochemical industry.
- 5.19 The use of mineral energy resources also affects the environment. It is estimated that fossil fuels supply more than 80 percent of the world’s primary energy. Combustion of fossil fuels pollutes the air, affects human health, and results in significant GHG emissions. Renewable energy does not face the depletion problem of mineral energy resources, but the harvesting of renewable energy can also affect the natural environment, particularly in large hydro energy facilities. Regardless of how energy is produced, its distribution requires facilities which can also change the land and affect natural areas. Each country must construct public policies to lead the required changes in their energy production and use in order to meet the demands of development in a sustainable and clean manner.
- 5.20 Energy plays a critical role in socio-economic development. The outcome document of the Rio+20 United Nations Conference on Sustainable Development, “The future we want”, addressed energy within the context of sustainable development.⁵⁸ Among other things, it called for action to ensure “access to sustainable modern energy services for

⁵⁸ “The future we want.” Paragraph 125-129, 2012.

<http://www.uncsd2012.org/content/documents/727The%20Future%20We%20Want%2019%20June%201230pm.pdf>

all”. It also reaffirmed support for cleaner energy technologies, citing “increased use of renewable energy sources and other low-emission technologies”, “more efficient use of energy” and “greater reliance on advanced energy technologies” as parts of an appropriate energy mix for meeting developmental needs. This document urged governments to create enabling environments for investment in cleaner energy technologies. The core challenge facing policy makers in regards to energy production and consumption remains in balancing the demand and need for energy with the impacts from its production and consumption. There is therefore great need for coordination and harmonization over all levels, as data are needed for policy, regulation, science and to complement the economic and social aspects when doing analysis.

5.21 As such, reliable and robust energy statistics are a priority issue for the international statistical community. Energy statistics have been discussed by the United Nations Statistical Commission since its inception and at its forty-second session (February 2011), the Commission adopted the *International Recommendations for Energy Statistics*.⁵⁹ Statistics on energy production and consumption are usually available in both physical and monetary units, the latter being the sale of and expenditure for energy commodities (e.g., fuel and electricity). The physical measures are of prime interest from an environmental perspective.

Application of the FDES to energy statistics

5.22 In the figures below, those aspects of energy statistics which are related to environment statistics using the FDES are described. The figures have been constructed to reflect the process from energy resources through their extraction, the production and consumption of energy and their environmental effects, to protection and mitigation activities.

5.23 The sequence depicted in *Figures 5.5* and *5.6* for the theme of energy contains four boxes. *Figure 5.5* presents this information at the topic level, while *Figure 5.6* goes into more detail and presents the individual environment statistics which can be used to assess energy production and use.

⁵⁹ <http://unstats.un.org/unsd/statcom/doc11/BG-IRES.pdf>

Figure 5.5: Topics in the FDES that relate to the production and use of energy

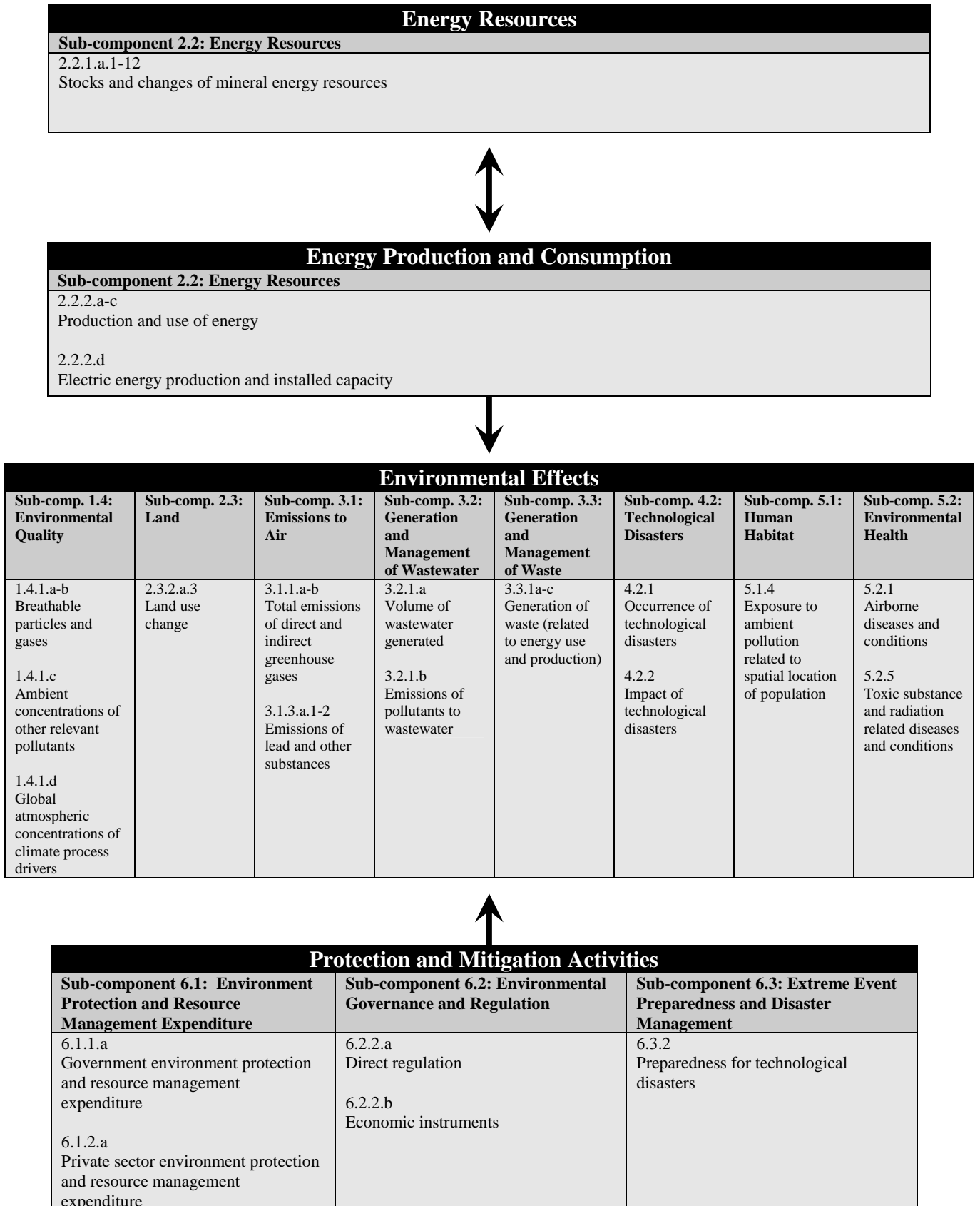


Figure 5.6: Energy production and use statistics in the Core Set and Basic Set of Environment Statistics

(**Bold Text – Core Set/Tier 1**; Regular Text – Tier 2; *Italicized Text – Tier 3*)

Energy Resources
Sub-component 2.2: Energy Resources
2.2.1.a: Mineral energy resources 2.2.1.a.1: Stocks of commercially recoverable resources 2.2.1.a.2: New discoveries 2.2.1.a.3: <i>Upward reappraisals</i> 2.2.1.a.4: <i>Upward reclassifications</i> 2.2.1.a.5: Extraction 2.2.1.a.6: <i>Catastrophic losses</i> 2.2.1.a.7: <i>Downward reappraisals</i> 2.2.1.a.8: <i>Downward reclassifications</i> 2.2.1.a.9: Stocks of potentially commercially recoverable resources 2.2.1.a.10: <i>Stocks of non-commercial and other known resources</i> 2.2.1.a.11: Energy mineral imports 2.2.1.a.12: Energy mineral exports
Energy Production and Consumption
Sub-component 2.2: Energy Resources
2.2.2.a: Renewable and non-renewable production of energy 2.2.2.a.1: Total 2.2.2.a.2: Non-renewable 2.2.2.a.3: Renewable 2.2.2.b: Production of energy 2.2.2.b.1: Primary energy production 2.2.2.b.2: Secondary energy production 2.2.2.c: Total consumption of energy 2.2.2.d.: Electric energy 2.2.2.d.1: Electric production 2.2.2.d.2: Installed capacities
Environmental Effects
Sub-component 1.4: Environmental Quality
1.4.1.a: Breathable particles 1.4.1.a.1: Concentration levels of PM₁₀ 1.4.1.a.2: Concentration levels of PM_{2.5} 1.4.1.a.3: Maximum allowable levels 1.4.1.a.4: Number of days where maximum allowable levels were surpassed per year 1.4.1.b: Breathable gases 1.4.1.b.1: Concentration level of tropospheric ozone (O₃) 1.4.1.b.2: Concentration level of carbon monoxide (CO) 1.4.1.b.3: Maximum allowable levels 1.4.1.b.4: Number of days where maximum allowable levels were surpassed per year 1.4.1.c: Ambient concentrations of other relevant pollutants 1.4.1.c.1: Concentration levels of sulphur dioxide (SO₂) 1.4.1.c.2: Concentration levels of lead (Pb) 1.4.1.c.3: Concentration levels of nitrogen oxides (NO_x) 1.4.1.c.4: Concentration levels of non-methane volatile organic compounds (NMVOCs) 1.4.1.c.5: <i>Concentration levels of dioxins</i> 1.4.1.c.6: <i>Concentration levels of furans</i> 1.4.1.c.8: Other pollutants (related to energy production and use) 1.4.1.c.9: Maximum allowable levels 1.4.1.c.10: Number of days where maximum allowable levels were surpassed per year 1.4.1.d: Global atmospheric concentrations of climate process drivers 1.4.1.d.1: Global atmospheric concentration levels of carbon dioxide (CO ₂) 1.4.1.d.2: Global atmospheric concentration levels of methane (CH ₄)

Sub-component 2.3: Land
2.3.2.a: Land use change (energy production and use related) 2.3.2.a.1: Increase of area within category 2.3.2.a.2: Decrease of area within category 2.3.2.a.3: Change of land use category by origin and destination
Sub-component 3.1: Emissions to Air
3.1.1.a: Total emissions of direct greenhouse gases, by gas: 3.1.1.a.1: Carbon dioxide (CO₂) 3.1.1.a.2: Methane (CH₄) 3.1.1.a.3: Nitrous oxides (N₂O) 3.1.1.a.4: Perfluorocarbons (PFCs) 3.1.1.a.5: Hydrofluorocarbons (HFCs) 3.1.1.a.6: Sulphur hexafluoride (SF ₆) 3.1.1.b: Total emissions of indirect greenhouse gases, by gas: 3.1.1.b.1: Sulphur dioxide (SO₂) 3.1.1.b.2: Nitrogen oxides (NO_x) 3.1.1.b.3: Non-Methane Volatile Organic Compounds (NM-VOCs) 3.1.1.b.4: Other 3.1.3.a: Emissions of other substances 3.1.3.a.1: Lead (Pb) 3.1.3.a.2: <i>Other</i>
Sub-component 3.2: Generation and Management of Wastewater
3.2.1.a: Volume of wastewater generated (energy production and use related) 3.2.1.b: Emissions of pollutants to wastewater (energy production and use related)
Sub-component 3.3: Generation and Management of Waste
3.3.1.a: Amount of waste generated by economic activity (energy production and use related) 3.3.1.c: Generation of hazardous waste (energy production and use related) 3.3.1.c.1: Hazardous waste generated
Sub-component 4.2: Technological Disasters
4.2.1.a: Occurrence of technological disaster (energy production and use related) 4.2.1.a.1: Type of disaster 4.2.1.a.2: <i>Location</i> 4.2.1.a.3: <i>Date of occurrence</i> 4.2.1.a.4: <i>Duration</i> 4.2.2.a: People affected by technological disaster (energy production and use related) 4.2.2.a.1: Number of people killed 4.2.2.a.2: <i>Number of people injured</i> 4.2.2.a.3: <i>Number of people homeless</i> 4.2.2.a.4: <i>Number of people affected</i> 4.2.2.b: Economic loss due to technological disaster (energy production and use related) 4.2.2.c: Effects of disasters on integrity of ecosystem (energy production and use related) 4.2.2.c.1: <i>Area affected by anthropogenic/technological disasters</i> 4.2.2.c.2: <i>Loss of vegetation cover</i> 4.2.2.c.3: <i>Effect on watershed area</i> 4.2.2.c.4: <i>Other (e.g., for oil spills: volume of oil released into the environment, impact on ecosystem)</i> 4.2.2.d: <i>External assistance received</i> (energy production and use related)
Sub-component 5.1: Human Habitat
5.1.4.a: Population exposed to air pollution in main cities
Sub-component 5.2: Environmental Health
5.2.1.a: Airborne diseases and conditions (energy production and use related) 5.2.1.a.1: Incidence 5.2.1.a.2: Morbidity 5.2.1.a.3: Mortality 5.2.1.a.4: <i>Loss of work days</i> 5.2.1.a.5: <i>Estimates of economic cost in monetary terms</i> 5.2.5.a: Toxic substance related diseases and conditions, including nuclear radiation related health problems (energy production and use related) 5.2.5.a.1: Incidence 5.2.5.a.2: Morbidity 5.2.5.a.3: Mortality 5.2.5.a.4: <i>Loss of work days</i> 5.2.5.a.5: <i>Estimates of economic cost in monetary terms</i>

Sub-component 6.1: Environment Protection and Resource Management Expenditure
<p>6.1.1.a: Government environment protection and resource management expenditure (energy production and use related)</p> <p>6.1.1.a.1: Annual government environment protection expenditure</p> <p>6.1.1.a.2: Annual government resource management expenditure</p> <p>6.1.2.a: Private sector environment protection and resource management expenditure</p> <p>6.1.2.a.1: Annual corporate environment protection expenditure</p> <p>6.1.2.a.3: <i>Annual household environment protection expenditure</i></p> <p>6.1.2.a.5: <i>Annual non-profit institution environment protection expenditure</i></p>
Sub-component 6.2: Environmental Governance and Regulation
<p>6.2.2.a: Direct regulation</p> <p>6.2.2.a.1: List of regulated water pollutants and description (e.g., by year of adoption and maximum allowable levels)</p> <p>6.2.2.a.2: Description (e.g., name, year established) of licensing system to ensure compliance with environmental (related to energy production and use) standards for businesses or other new facilities</p> <p>6.2.2.a.3: Number of applications for licenses (related to energy production and use) received and approved per year</p> <p>6.2.2.a.5: Budget and number of staff dedicated to enforcement of environmental regulations (related to energy production and use)</p> <p>6.2.2.b: Economic instruments</p> <p>6.2.2.b.1: <i>List and description (e.g., year of establishment) of green/environmental taxes</i> (related to energy production and use)</p> <p>6.2.2.b.2: <i>List and description (e.g., year of establishment) of environmentally relevant subsidies</i> (related to energy production and use)</p> <p>6.2.2.b.3: <i>List of eco-labelling and environmental certification programmes</i> (related to energy production and use)</p> <p>6.2.2.b.4: Volume of trade of emission permits</p>
Sub-component 6.3: Extreme Event Preparedness and Disaster Management
<p>6.3.2.a: National technological disaster preparedness and management systems</p> <p>6.3.2.a.1: <i>Existence and description of public disaster management plans/programmes</i> (and private when available)</p> <p>6.3.2.a.2: <i>Expenditure on clean-up and rehabilitation after a disaster</i></p>

5.24 Some of the most commonly used energy-related indicators that can be derived from the core set are as follows :

- Share of renewable energy resources in total energy use
- Energy use per capita and by economic activity
- Share of households with/without electricity
- Energy intensity of GDP

5.3 Climate Change

5.25 The United Nations Framework Convention on Climate Change (UNFCCC)⁶⁰ has affirmed that climate change is one of the greatest challenges of our time.⁶¹ The world’s climate system, including the atmosphere, oceans and cryosphere, is changing and will continue to change at rates unprecedented in recent human history. Findings on the scientific basis for climate change suggest that a number of human-induced alterations of the natural world are involved. These alterations are affecting the global energy balance⁶² and ultimately leading to climate change.

5.26 The Kyoto Protocol is an international agreement linked to the UNFCCC. Its major feature is that it sets binding targets for 37 industrialized countries and the European community for reducing GHG emissions, rather than simply encouraging them to attain these goals, as is the case with the Framework Convention. The targets amount to an average of five percent against 1990 levels over the five-year period 2008-2012. These conventions and protocols involve reporting obligations, which in turn create additional data requirements and demand for environment statistics.

5.27 The Rio+20 United Nations Conference on Sustainable Development reaffirmed the pre-eminence of climate change, expressing alarm about the rise of GHG globally. In its outcome document, it called for cooperative action to coordinate effective international response to this challenge to ensure reduction of the emission of GHG. It noted that countries already experience adverse impacts of climate change such as persistent drought, extreme weather events, sea-level rise and threats to food security. In this regard, the Conference indicated adaptation to climate change to be an “urgent global priority”⁶³.

5.28 Climate change occurs through a chain of events and can be observable at all levels, from local to global. The first step is increasing emissions of CO₂ that are produced by current production patterns and a heavy dependence on fossil fuels for energy and transportation. These persistently high emissions lead to high atmospheric CO₂ concentrations, which in turn prevent heat from escaping the Earth and change the climate. The evidence of global warming and climate change include increased global temperatures, changing weather patterns, and rising sea levels, to name just a few.

⁶⁰ The UNFCCC articulates a vision to guide the policies and actions of Parties to the Convention to: address mitigation and adaptation efforts to reduce global emissions; engage in technology development and transfer; and mobilize financial resources and advance capacity building that would enable developing countries to participate fully with regard to their commitments under this Framework Convention. It would also enhance efforts at adaptation, to arrive at the required stabilization levels.

⁶¹ <http://unfccc.int/2860.php>, See United Nations Framework Convention on Climate Change, Essential Background

⁶² The global energy balance is defined by the Oxford Dictionary of Geography as the difference between the total influx of solar radiation to the earth’s surface and the loss of this energy via terrestrial radiation, evaporation, and the dissipation of sensible heat into the ground

⁶³ The future we want. Paragraph 190.
<http://www.un.org/en/sustainablefuture/>

Impacts from climate change include, among many others, more intense storms, changes in agricultural productivity, water scarcity and coral bleaching. Mitigation and adaptation processes are another important part of the sequence of climate change, because ecosystems and humans continue to adapt to changes in the climate. This sequence of events is currently occurring and is expected to continue unless the global concentrations of CO₂ diminish considerably to pre-climate change levels.

- 5.29 To cite a few recent observations, 2008 CO₂ emissions were 38 percent above the 1990 level. Per capita emissions remain highest in the developed regions, 11.2 metric tons of CO₂ per person per year in 2008, compared to about 2.9 metric tons in the developing regions and 0.8 metric tons in sub-Saharan Africa, the lowest regional value.⁶⁴ Since the beginning of civilization up until about 200 years ago, our atmosphere contained around 275 parts per million of CO₂. As of May 2012, there were 396 parts per million of CO₂ in the atmosphere.⁶⁵ Many scientists, climate change experts and national governments agree that the safe upper limit for humanity is 350 parts per million.
- 5.30 The impacts and risks associated with climate change are real and are already evident in many systems and sectors essential for human livelihood, including water resources, food security, coastal zones and health. In addition, climate change is increasing the frequency and intensity of extreme events and disasters. Adaptation to the adverse effects of climate change is vital in order to reduce future impacts. In this context, there is an urgent need for an integrated policy response to the climate change and development challenge.
- 5.31 Climate adaptation has been identified by the UNFCCC as one of the key building blocks for a coordinated response to climate change. The IPCC describes adaptation as an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.⁶⁶ Adaptation does not take place in response to climatic changes in isolation, but instead is a response to a series of events or to previously existing situations that are exacerbated through climate change. As a consequence, it can be difficult to ascertain what aspects of adaptation are solely or partially driven by change in the climate, as opposed to other factors not related to climate change. This makes the accurate measurement of adaptation to climate change a difficult and challenging task. In addition, there is a significant lack of comprehensive studies on what adaptation to climate change entails as well as the costs and benefits of adaptation measures. Nonetheless, adaptation is an important and

⁶⁴ United Nations, The Millennium Development Goals Report 2012. <http://www.un.org/millenniumgoals/pdf/MDG%20Report%202012.pdf>

⁶⁵ Mauna Loa Observatory, US National Oceanic and Atmospheric Administration, 5 June 2012 release date.

<http://co2now.org/images/stories/data/co2-mlo-monthly-noaa-esrl.xls>

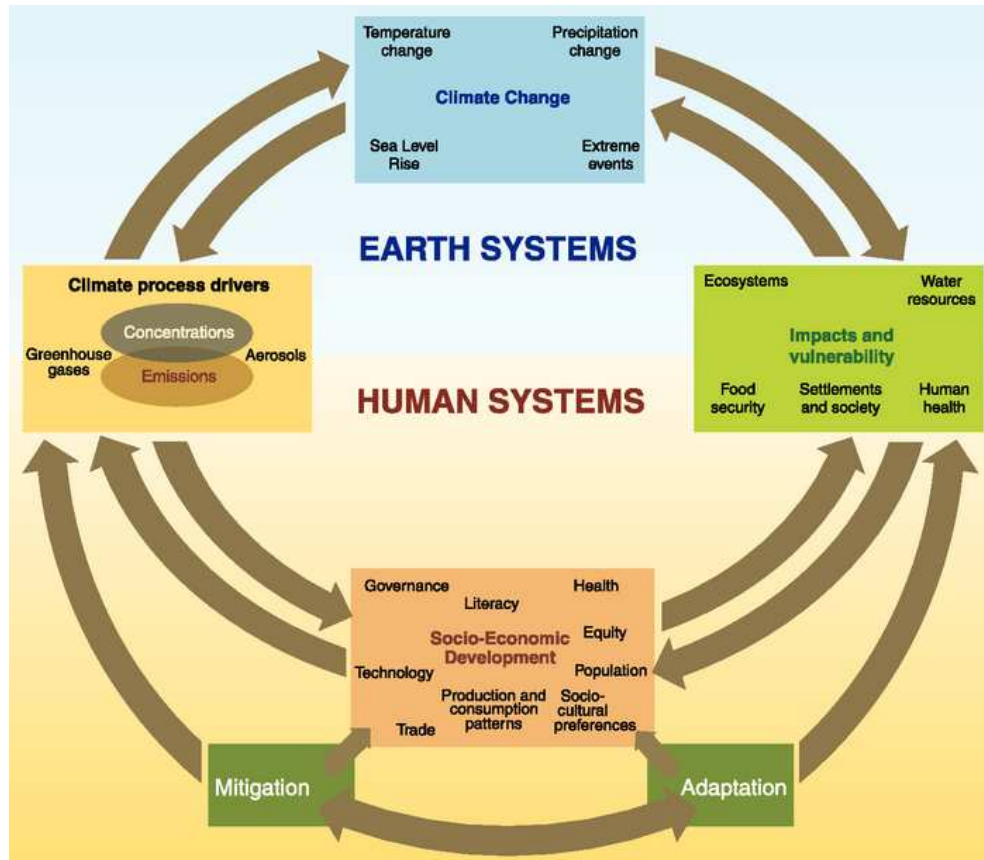
⁶⁶ IPCC Fourth Assessment Report: Climate Change 2007. http://www.ipcc.ch/publications_and_data/ar4/wg2/en/tssts-5.html#ts-5-1

necessary response to climate change and the development of statistics and methodologies for assessing adaptation are needed.

Statistics on Climate Change

- 5.32 Necessarily, a scientific approach to climate change must be supported with the provision of well structured, relevant, reliable and timely statistics. At the same time, the need for underlying data to inform the policy aspects of climate change also remains a pressing requirement. As a cross-cutting issue, climate change statistics are spread over a large proportion of the domain of environment statistics.
- 5.33 The information required to analyze climate change includes economic, social and environmental aspects. The FDES provides a set of environmental topics and individual environment statistics that are of the most importance when informing on climate change in any given country. These statistics should be complemented with both social and economic statistics to provide a comprehensive set of information.
- 5.34 With regard to determining and apportioning the appropriate statistics for measurement of climate change, consideration of a sequence of changes is important. The IPCC has elaborated on the sequence of events described in the preceding paragraphs and usually denotes these stages by Climate Process Drivers, Climate Change Evidence, Impacts and Vulnerability, Mitigation and Adaptation (see *Figure 5.7*). Statistics pertaining to the different steps of the sequence are necessary to monitor climate change and how it is affecting different countries and regions.

Figure 5.7: Schematic framework representing anthropogenic drivers, impacts of and responses to climate change, and their linkages⁶⁷



5.35 The structure of the figures in this section aligns with the IPCC described sequence with one modification - under “Socio-Economic Development” the focus has been put on only those elements that belong to the realm of environment statistics.

5.36 At present, the availability of statistics varies among the stages in the sequence. Data on drivers of climate change, climate change evidence, as well as impacts and mitigation activities are all fairly developed, though impacts from climate change are more difficult to measure because changes in the climate are not the only possible force to which the effects can be attributed. Despite their importance, vulnerability and adaptation statistics are still in a developmental stage. Considerable statistical progress is expected and needed in these two areas in the upcoming years.

5.37 When compiling statistics on climate change at the national level, it is important to assess relevance and policy and legal aspects in the particular country. The relevance of climate change varies by country, given different political dynamics, the characteristics

⁶⁷ IPCC, Climate Change 2007: Synthesis Report, http://www.ipcc.ch/publications_and_data/ar4/syr/en/mainssyr-introduction.html

of the country in terms of its carbon intensity and also in terms of its vulnerability to climate change impact. Climate change policies also vary by country, for example, there can be specific climate change strategies as well as mitigation and adaptation programmes in place, or the country could be participating in a mitigation of carbon emission programme. It is an important step when preparing climate change statistics to first understand the national relevance, conceptual aspects and existing policies and reporting needs so that the appropriate statistics can be compiled to inform these policies. Similarly, on the international level, an understanding of a country's participation⁶⁸ in specific conventions and related MEAs is a necessary step in preparing climate change statistics.

5.38 The impacts of climate change most often manifest locally and vary greatly between locations. As such, it is necessary to take into account spatial considerations when assessing climate change and to include spatial aspects to climate change statistics whenever possible. This enables policy makers and researchers to better determine the impacts from climate change and the appropriate mitigation strategies.

Application of the FDES to climate change statistics

5.39 In the following figures an example of the application of the FDES to climate change is shown. A number of topics and individual statistics that belong to different components within the FDES can be used to inform on the different aspects of climate change. The following figures organize the pertinent sub-components, topics and statistics of the Core Set according to the sequence of events relating to climate change per the IPCC, with the modifications noted previously.

5.40 The climate change sequence depicted in Figures 5.8 and 5.9 contains three boxes. Figure 5.8 presents this information at the topic level, while Figure 5.9 goes into more detail and presents the individual environment statistics which can be used to assess climate change. Following the figures, an illustrative, non-exhaustive, list of other commonly used indicators, statistics and statistical themes has also been provided for general reference purposes.

⁶⁸ Participation means the country or area has become party to the agreements under the treaty or convention, which is achieved through a variety of means depending on country circumstances, namely: accession, acceptance, approval, formal confirmation, ratification, and succession. Countries or areas who have signed but not become party to the agreements under a given convention or treaty are not considered to be participating.

Figure 5.8: Topics in the FDES that relate to climate change

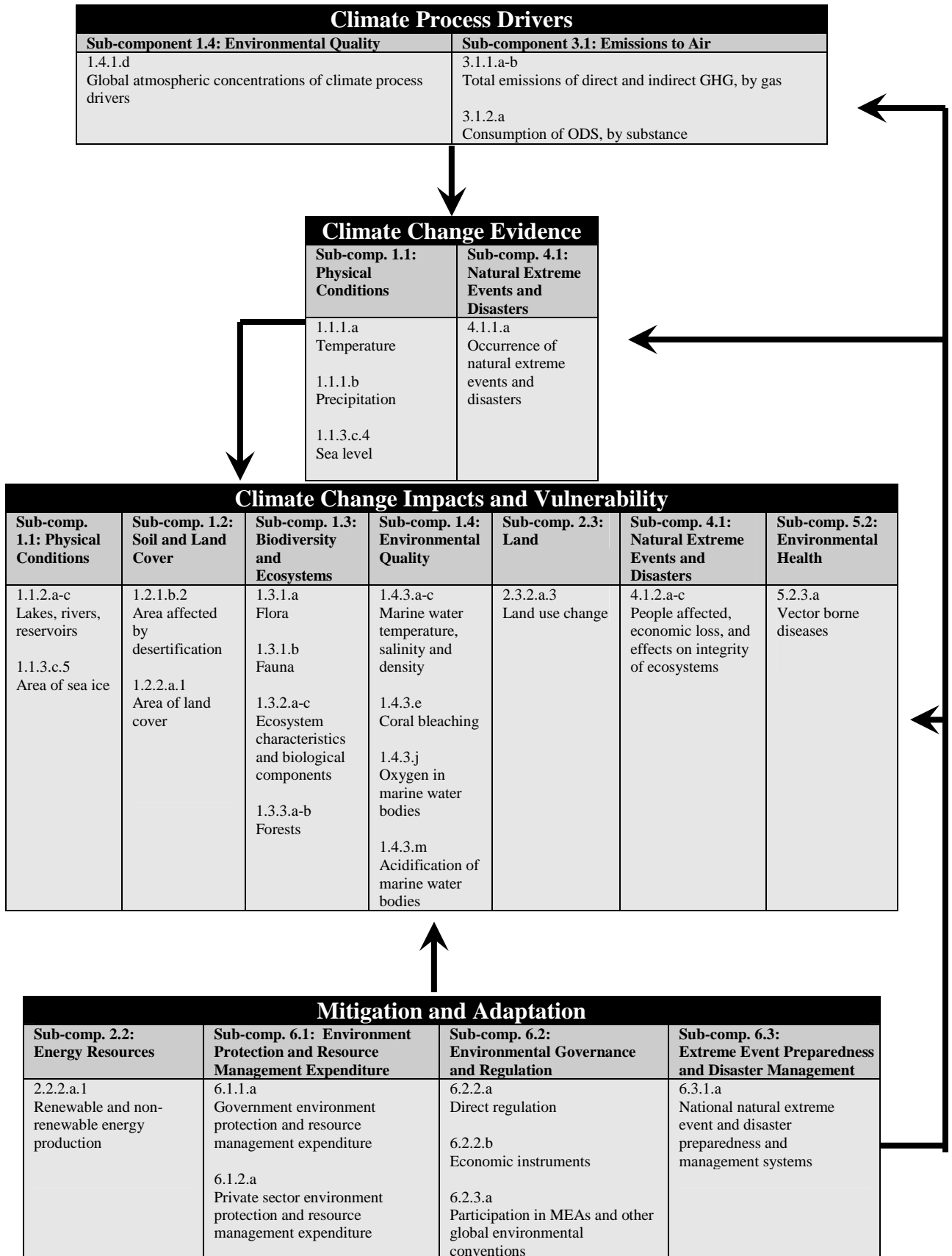


Figure 5.9: Climate change statistics in the Core Set and Basic Set of Environment Statistics
(Bold Text – Core Set/Tier 1; Regular Text – Tier 2; Italicized Text – Tier 3)

Climate Process Drivers
Sub-component 1.4: Environmental Quality
1.4.1.d: Global atmospheric concentrations of climate process drivers 1.4.1.d.1 Global atmospheric concentration levels of carbon dioxide (CO ₂) 1.4.1.d.2 Global atmospheric concentration levels of methane (CH ₄)
Sub-component 3.1: Emissions to Air
3.1.1.a: Total emissions of direct greenhouse gases, by gas: 3.1.1.a.1: Carbon dioxide (CO₂) 3.1.1.a.2: Methane (CH₄) 3.1.1.a.3: Nitrous oxides (N₂O) 3.1.1.a.4: Perfluorocarbons (PFCs) 3.1.1.a.5: Hydroflourocarbons (HFCs) 3.1.1.a.6: Sulphur hexafluoride (SF ₆) 3.1.1.b: Total emissions of indirect greenhouse gases, by gas: 3.1.1.b.1: Sulphur dioxide (SO₂) 3.1.1.b.2: Nitrogen oxides (NO_x) 3.1.1.b.3: Non-Methane Volatile Organic Compounds (NM-VOCs) 3.1.1.b.4: Other 3.1.2.a: Consumption of ozone depleting substances, by substance: 3.1.1.d.1: Chlorofluorocarbons (CFCs) 3.1.1.d.2: Hydrochlorofluorocarbons (HCFCs) 3.1.1.d.3: Bromofluorocarbons (BFCs) 3.1.1.d.4: Methyl chloroform 3.1.1.d.5: Carbon tetrachloride 3.1.1.d.6: Methyl bromide
Climate Change Evidence
Sub-component 1.1: Physical Conditions
1.1.1.a: Temperature 1.1.1.a.1: Annual averages 1.1.1.a.2: Long-term annual averages 1.1.1.a.3: Monthly averages 1.1.1.a.4: Annual minimum and maximum monthly average 1.1.1.b: Precipitation 1.1.1.b.1: Annual averages 1.1.1.b.2: Long-term annual averages 1.1.1.b.3: Monthly averages 1.1.1.b.4: Annual minimum and maximum monthly average 1.1.3.c: Main sea characterization <i>1.1.3.c.4: Sea level</i>
Sub-component 4.1: Natural Extreme Events and Disasters
4.1.1.a: Occurrence of natural extreme events and disasters 4.1.1.a.1: Type of natural disaster (e.g., flood, drought, etc.) 4.1.1.a.2: Location 4.1.1.a.3: Magnitude (where applicable) 4.1.1.a.4: Date of occurrence 4.1.1.a.5: Duration 4.1.1.a.6: Hazard prone areas 4.1.1.a.7: Population living in hazard prone areas

Climate Change Impacts and Vulnerability	
Sub-component 1.1: Physical Conditions	
1.1.2.a: Lakes	<i>1.1.2.a.1: Surface area</i>
1.1.2.b: Rivers	<i>1.1.2.b.1: Length</i> <i>1.1.2.b.2: Surface area</i>
1.1.2.c: Reservoirs	<i>1.1.2.c.1: Surface area</i>
1.1.3.c: Main sea characterization	<i>1.1.3.c.5: Area of sea ice</i>
Sub-component 1.2: Soil and Land Cover	
1.2.1.b: Degradation	1.2.1.b.2: Area affected by desertification
1.2.2.a: Extent and spatial distribution of main land cover categories	1.2.2.a.1: Area of land cover (Changes in area of forests, vegetative land, glaciers, ice shelves, ice sheets, etc.)
Sub-component 1.3: Biodiversity and Ecosystems	
1.3.1.a: Flora (terrestrial, freshwater and marine) (also in 1.3.2.c)	1.3.1.a.1: Number of known species by status category <i>1.3.1.a.2: Species population</i>
1.3.1.b: Fauna (terrestrial, freshwater and marine) (also in 1.3.2.c)	1.3.1.b.1: Number of known species by status category 1.3.1.b.2: Species population
1.3.2.a: General ecosystem characteristics, extent and pattern	1.3.2.a.1: Area of ecosystem
1.3.2.b: Ecosystem's physical and chemical characteristics	<i>1.3.2.b.2: Carbon</i>
1.3.2.c: Biological components of ecosystems	1.3.2.c.3: Biodiversity
1.3.3.a: Forest area	1.3.3.a.1: Total 1.3.3.a.2: Natural 1.3.3.a.3: Cultivated 1.3.3.a.4: Protected forest area (also in 1.3.1.c) 1.3.3.a.5: Area deforested 1.3.3.a.6: Area reforested 1.3.3.a.7: Area afforested 1.3.3.a.8: Forest area affected by fire <i>1.3.3.a.9: Natural growth</i>
1.3.3.b: Forest biomass	1.3.3.b.1: Total <i>1.3.3.b.2: Carbon storage in living forest biomass</i>
Sub-component 1.4: Environmental Quality	
1.4.3.a: Temperature (marine water)	<i>1.4.3.b: Salinity (marine water)</i> <i>1.4.3.c: Density (marine water)</i>
1.4.3.e: Coral bleaching	1.4.3.e.1: Area affected by coral bleaching
1.4.3.j: Oxygen in marine water bodies	1.4.3.j.1: Biochemical oxygen demand (BOD) in marine water bodies 1.4.3.j.2: Concentration of dissolved oxygen (DO) in marine water bodies 1.4.3.j.3: Chemical oxygen demand (COD) in marine water bodies 1.4.3.j.4: Maximum allowable levels
1.4.3.m: Acidification of marine water bodies	<i>1.4.3.m.1: pH/Acidity/Alkanlinity</i>
Sub-component 2.3: Land	
2.3.2.a: Land use change	2.3.2.a.3: Change of land use category by origin and destination

Sub-component 4.1: Natural Extreme Events and Disasters
<p>4.1.2.a: People affected by natural extreme events and disasters</p> <p>4.1.2.a.1: Number of people killed</p> <p>4.1.2.a.2: Number of people injured</p> <p>4.1.2.a.3: Number of people homeless</p> <p>4.1.2.a.4: Number of people affected</p> <p>4.1.2.b: Economic loss due to natural extreme events and disasters</p> <p>4.1.2.c: Effects of natural extreme events and disasters on integrity of ecosystem</p> <p><i>4.1.2.c.1: Area affected by natural disasters</i></p> <p><i>4.1.2.c.2: Loss of vegetation cover</i></p> <p><i>4.1.2.c.3: Effect on watershed area</i></p> <p><i>4.1.2.c.4: Other</i></p>
Sub-component 5.2: Environmental Health
<p>5.2.3.a: Vector borne diseases</p> <p>5.2.3.a.1: Incidence</p> <p>5.2.3.a.2: Morbidity</p> <p>5.2.3.a.3: Mortality</p> <p><i>5.2.3.a.4: Loss of work days</i></p> <p><i>5.2.3.a.5: Estimates of economic cost in monetary terms</i></p>

Mitigation and Adaptation
Sub-component 2.2: Energy Resources
<p>2.2.2.a: Renewable and non-renewable production of energy</p> <p>2.2.3.a.3: Renewable</p>
Sub-component 6.1: Environment Protection and Resource Management Expenditure
<p>6.1.1.a: Government environment protection and resource management expenditure</p> <p>6.1.1.a.1: Annual government environment protection expenditure (on climate change mitigation activities)</p> <p>6.1.2.a: Private sector environment protection and resource management expenditure</p> <p>6.1.2.a.1: Annual corporate environment protection expenditure (on climate change mitigation activities)</p> <p>6.1.2.a.3: <i>Annual household environment protection expenditure</i> (on climate change mitigation activities)</p> <p>6.1.2.a.5: <i>Annual non-profit institution environment protection expenditure</i> (on climate change mitigation activities)</p>
Sub-component 6.2: Environmental Governance and Regulation
<p>6.2.2.a: Direct regulation</p> <p>6.2.2.a.1: List of regulated pollutants and description (e.g., by year of adoption and maximum allowable levels) (climate change related)</p> <p>6.2.2.a.2: Description (e.g., name, year established) of licensing system to ensure compliance with environmental (climate change related) standards for businesses or other new facilities</p> <p>6.2.2.a.3: Number of applications for licenses (climate change related) received and approved per year</p> <p>6.2.2.a.5: Budget and number of staff dedicated to enforcement of environmental regulations (climate change related)</p> <p>6.2.2.b: Economic instruments</p> <p><i>6.2.2.b.1: List and description (e.g., year of establishment) of green/ environmental taxes</i> (climate change related)</p> <p><i>6.2.2.b.2: List and description (e.g., year of establishment) of environmentally relevant subsidies</i> (climate change related)</p> <p><i>6.2.2.b.3: List of eco-labelling and environmental certification programmes</i> (climate change related)</p> <p>6.2.2.b.4: Volume of trade of emission permits</p> <p>6.2.3.a: Participation in MEAs and other global environmental conventions</p> <p>6.2.3.a.1: List and description (e.g., year of participation⁶⁹ of country) of MEAs and other global environment conventions (climate change related)</p>
Sub-component 6.3: Extreme Event Preparedness and Disaster Management
<p>6.3.1.a: National natural extreme event and disaster preparedness and management systems</p> <p>6.3.1.a.1: Existence of national disaster plans/programmes (and private when available)</p> <p>6.3.1.a.2: Description of national disaster plans/programmes (and private when available)</p>

⁶⁹ Participation means the country or area has become party to the agreements under the treaty or convention, which is achieved through a variety of means depending on country circumstances, namely: accession, acceptance, approval, formal confirmation, ratification, and succession. Countries or areas who have signed but not become party to the agreements under a given convention or treaty are not considered to be participating.

5.41 There are a number of other statistics, indicators and thematic areas, some of which are economic or social in nature, that are used by the IPCC and UNFCCC, as well as other institutions. The list below is a non-exhaustive illustration of some of these additional statistics, indicators and thematic areas:

- Climate Process Drivers
 - Proportion of national versus global CO₂ and CH₄ emissions
 - CO₂ and CH₄ emissions per capita and per GDP
- Climate Change Evidence, Impacts and Vulnerability
 - Rate of snowmelt (Arctic/Antarctic)
 - Flora and fauna species located near the edge or lowest elevation portion of their range
 - Changes in agricultural productivity
 - Changes in water availability
 - Level of exposure of system to impacts of climate change (e.g., population living in areas where elevation is below five metres, proportion of total land area where elevation is below five metres, population living in disaster prone areas, etc.)
 - Resources for which demand exceeds supply
 - Factors which limit a system's ability to change
 - Climate change refugees
- Mitigation and Adaptation
 - Soil conservation schemes
 - Change in crop varieties
 - Change in farming type (from crop to livestock)
 - Changing time of planting and harvesting
 - Existence of national strategy for climate change
 - Budget allocated for programme to assess and address climate change
 - Participation in carbon trade/carbon markets
 - Waste management changes towards more reuse and
 - Investment in Clean Development Mechanisms and Joint Implementation

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