

DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS STATISTICS DIVISION UNITED NATIONS

# Framework for the Development of Environment Statistics (FDES) 2013

# **Final Draft Subject to Official Editing**

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## Acronyms

AEI:	Agri-environmental indicator
BOD:	Biochemical Oxygen Demand
CBD:	Convention on Biological Diversity
CEA:	Classification of Environmental Activities
CEPA:	Classification of Environmental Protection Activities
CES:	Conference of European Statisticians
CICES:	Common International Classification of Ecosystem Services
CIESIN:	Center for International Earth Science Information Network
CITES:	Convention on International Trade in Endangered Species of Wild Fauna
	and Flora
CMS:	Convention on Migratory Species
COD:	Chemical Oxygen Demand
COP:	Conference of the Parties
CPC:	Central Product Classification
CRED EMDAT:	Centre for Research on the Epidemiology of Disasters Emergency Disasters
	Database
CSD:	Commission on Sustainable Development
DDT:	Dichlorodiphenyltrichloroethane
DPSIR:	Driving force-Pressure-State-Impact-Response framework
DSR:	Driving force-State-Response framework
ECOWAS:	Economic Community of West African States
EEA:	European Environment Agency
EEZ:	Exclusive Economic Zone
EGSS:	Environmental Goods and Services Sector
EMEP:	European Monitoring and Evaluation Programme
ESM:	Environmentally Sound Management
FAO:	Food and Agriculture Organization of the United Nations
FDES:	Framework for the Development of Environment Statistics
FRA:	Forest Resources Assessment
GEO:	Global Environment Outlook
GHG:	Greenhouse Gas
GIS:	Geographic Information System
GLASOD:	Global Assessment of Human-induced Soil Degradation
GPS:	Global Positioning System
HS:	Harmonized Commodity Description and Coding System
IEA:	International Energy Agency
IEMO:	International Emergency Management Organization
IIASA:	International Institute for Applied Systems Analysis
IISD:	International Institute for Sustainable Development
IMO:	International Maritime Organization
IPCC:	Intergovernmental Panel on Climate Change
	10

IRES:	International Recommendations for Energy Statistics		
IRWS:	International Recommendations for Water Statistics		
ISIC:	International Standard Industrial Classification of All Economic Activities		
ISRIC:	International Soil Reference and Information Centre		
ISSCAAP:	International Standard Statistical Classification for Aquatic Animals and		
	Plants		
ITTO:	International Tropical Timber Organization		
IUCN:	International Union for Conservation of Nature		
IUU	Illegal, unreported and unregulated		
IWRM	Integrated Water Resources Management		
LCCS:	Land Cover Classification System		
MAR:	Monitoring, Assessment and Reporting		
MDGs:	Millennium Development Goals		
MEA:	Multilateral Environmental Agreement		
NASA:	National Aeronautics and Space Administration		
NGO:	Non-governmental organization		
NOAA:	National Oceanic and Atmospheric Administration		
NSO:	National Statistical Office		
ODS:	Ozone Depleting Substances		
OECD:	Organisation for Economic Co-operation and Development		
PCB:	Polychlorinated Biphenyl		
PM:	Particulate Matter (also known as Suspended Particulate Matter)		
POP:	Persistent Organic Pollutant		
PSR:	Pressure-State-Response framework		
SDGs:	Sustainable Development Goals		
SDIs:	Sustainable Development Indicators		
SEEA:	System of Environmental-Economic Accounting		
SEEA-CF:	System of Environmental-Economic Accounting Central Framework		
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		
TEEB:	The Economics of Ecosystems and Biodiversity		
TFSD:	OECD Task Force on Measuring Sustainable Development		
UNCCD:	United Nations Convention to Combat Desertification		
UNCED:	United Nations Conference on Environment and Development		
UNCSD:	United Nations Conference on Sustainable Development		
UNCEEA:	United Nations Committee of Experts on Environmental-Economic		
	Accounting		
UNCLUS:	United Nations Convention on the Law of the Sea		
UN-DESA: UNFCA:	United Nations Department of Economic and Social Affairs		
UNECE.	United Nations Economic Commission for Europe		
UNECE.	United Nations Economic Commission for Europe		

UNECLAC:	United Nations Economic Commission for Latin America and the Caribbean
UNEP:	United Nations Environment Programme
UNEP GEMS:	United Nations Environment Programme Global Environment Monitoring System
UNEP-WCMC:	United Nations Environment Programme-World Conservation Monitoring Centre
UNESCAP:	United Nations Economic and Social Commission for Asia and the Pacific
UNESCO:	United Nations Educational, Science and Cultural Organization
UNFC:	United Nations Framework Classification for Fossil Energy and Mineral
	Reserves and Resources
UNFCCC:	United Nations Framework Convention on Climate Change
UNFF:	United Nations Forum on Forests
UNFPA:	United Nations Population Fund
UNGA:	United Nations General Assembly
UNICEF:	United Nations Children's Fund
UNISDR:	The United Nations Office for Disaster Risk Reduction
UNSD:	United Nations Statistics Division
UV:	Ultraviolet
WCPA:	World Commission on Protected Areas
WHO:	World Health Organization
WMO:	World Meteorological Organization
WRI:	World Resources Institute
WSSD:	World Summit on Sustainable Development

#### Preface

This publication presents the Framework for the Development of Environment Statistics (FDES) 2013, which is the revised version of the original FDES that was published in 1984 by the United Nations Statistics Division (UNSD). 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 and the development of a Core Set of Environment Statistics, taking into account the scientific, political, technological, statistical and experience-based developments of recent decades.

The United Nations Conference on Sustainable Development (Rio+20, June 2012) outcome document "The Future We Want"<sup>1</sup> contains several references to the importance of environmental data, information and indicators. The FDES 2013 is expected to contribute significantly to improved monitoring and measurement of the environmental dimension of sustainable development and the post-2015 development agenda. The use of the FDES 2013 in national statistical systems will enhance developments in this field of statistics, as it is a multipurpose and flexible tool that can be tailored to specific environmental policy concerns and priorities of countries, and it can be accommodated to their different levels of statistical development.

The FDES 2013 covers issues and aspects of the environment that are relevant for analysis, policy and decision making. It is designed to assist all countries in 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.

The revision of the FDES was undertaken as part of UNSD's work programme on environment statistics. The Expert Group on the Revision of the FDES assisted UNSD in implementing the revision process. The United Nations Statistical Commission at its 44<sup>th</sup> session (28 February - 1 March 2013) endorsed the FDES 2013, including the Core Set of Environment Statistics.

<sup>&</sup>lt;sup>1</sup> United Nations (2012). Rio+20 outcome document, "The Future We Want". Available from <u>http://www.uncsd2012.org/thefuturewewant.html</u> (accessed 9 November 2013).

#### Acknowledgements

The revised Framework for the Development of Environment Statistics (FDES) 2013 consolidates the experience of countries and international organizations in the field of environment statistics. It has been developed in close collaboration with the Expert Group on the Revision of the FDES, which reviewed successive drafts of the FDES 2013 and commented on the issue papers drafted by the United Nations Statistics Division (UNSD); other experts who provided advice on specific subjects; as well as countries and organizations that took part in the Pilot test of the Core set of Environment Statistics and responded to the Global Consultation of the final draft of the FDES 2013. The revision was a complex process that entailed organizing the substantive contributions and participation of experts, countries and organizations from around the world, at different stages of the process, over a three year period.

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### Introduction

#### Why is a framework needed?

- 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 inform about 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 thus cover a wide range of information and are multi- and 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 an appropriate framework to guide its development, coordination and organization.
- 1.4. This environment statistics framework: (i) marks out the scope of environment statistics; (ii) facilitates a synthesized presentation of data from various subject areas and sources; (iii) suitably simplifies the complexity of the environment so as to render its measurement tractable; (iv) helps identify the range of statistics relevant to societal decision-making regarding the environment; (v) is coherent with statistical frameworks already used in other domains in order to facilitate the integration of environment statistics; and (vi) is conceptually based.

#### Background

- A Framework for the Development of Environment Statistics<sup>2</sup> (FDES) was first published 1.5. in 1984 by the United Nations Statistics Division (UNSD), along with its subsequent publications, Concepts and Methods of Environment Statistics: Human Settlements Statistics<sup>3</sup> (1988) and Concepts and Methods of Environment Statistics: Statistics of the *Natural Environment*<sup>4</sup> (1991). The 1984 FDES and subsequent publications have been a useful framework for guiding countries in the development of their environment statistics programmes. During the time since its publication there have been many 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 and the development of a Core Set of Environment Statistics. 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 several international organizations, specialized agencies and non-governmental organizations (NGOs).<sup>5</sup>

#### The revision process

The revision was based on an agreed set of criteria and has been supported by extensive 1.7. 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 issues and concepts, including the outcome of the Rio+20 Conference and the work on Sustainable Development Goals (SDGs). 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

<sup>&</sup>lt;sup>2</sup> United Nations Statistics Division (1984). "A Framework for the Development of Environment Statistics". Available from http://unstats.un.org/unsd/publication/SeriesM/SeriesM\_78e.pdf (accessed 18 October 2013).

United Nations Statistics Division (1988). "Concepts and Methods of Environment Statistics: Human Settlements Statistics – A Technical Report". Available from http://unstats.un.org/unsd/publication/SeriesF/SeriesF\_51e.pdf (accessed 18 October 2013).

<sup>&</sup>lt;sup>4</sup> United Nations Statistics Division (1991). "Concepts and Methods of Environment Statistics: Statistics of the Natural Environment – A Technical Report". Available from <u>http://unstats.un.org/unsd/publication/SeriesF/SeriesF\_57E.pdf</u> (accessed 18 October 2013). <sup>5</sup> United Nations Statistics Division, Expert Group on the Revision of the UN FDES. Available from

http://unstats.un.org/unsd/environment/fdes/fdes\_egm.htm (accessed 18 June 2013).

on developments since 1984 and on MEAs see Annex B: Developments since 1984 and Annex C: Multilateral Environmental Agreements).

1.8. The revision was undertaken as part of UNSD's work programme on environment statistics, supported by the Expert Group on the Revision of the FDES. The drafts were reviewed in four face-to-face meetings of the Expert Group and in several rounds of electronic discussion. The Basic Set of Environment Statistics was tested by 25 countries and two organizations. The final draft of the FDES was subjected to a Global Consultation, yielding feedback from 76 countries, areas and organizations. The present document is the result of this wide consultation process.

#### The FDES 2013

- 1.9. The FDES 2013 is a multi-purpose conceptual and statistical framework that is comprehensive and integrative in nature. It marks out the scope of environment statistics and provides an organizing structure to guide their collection and compilation and to synthesize data from various subject areas and sources, covering the issues and aspects of the environment that are relevant for analysis, policy and decision making.
- 1.10. The FDES 2013 targets a wide user community including environmental statisticians in national statistical offices (NSOs), environmental ministries and agencies as well as other producers of environment statistics. It helps to mark out the roles of the different data producers, thus facilitating coordination at different levels.
- 1.11. The FDES 2013 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 the System of Environmental-Economic Accounting (SEEA), the Driving force Pressure State Impact Response (DPSIR) framework, and the Millennium Development Goals (MDGs), SDGs and the sustainable development indicator (SDI) frameworks. It is based, when applicable, on existing statistical classifications. As such, the FDES facilitates data integration within environment statistics and with economic and social statistics.
- 1.12. The FDES 2013 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 residuals and related human activities; extreme events and disasters; human settlements and environmental health; and social and economic measures for the protection and

management of the environment. 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 2013 sets out a comprehensive (though not exhaustive) list of statistics (the Basic Set of Environment Statistics) that can be used to measure the statistical topics. The Basic Set is organized in three tiers, based on the level of relevance, availability and methodological development of the statistics.
- 1.14. 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 of high priority and relevance to most 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.
- 1.15. The FDES 2013 is relevant to, and recommended for use by, countries at any stage of development. However, it is particularly useful 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 relevant for them; (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.

#### Structure of the document

- 1.16. Chapter 1 of the FDES 2013 gives an overview of the main characteristics of environment statistics. It identifies the main uses and user groups, and the relationship between environmental data, statistics, accounts and indicators. The typical sources of data and the most important temporal and spatial considerations are also introduced. A brief description of existing classifications, categorizations and other groupings widely used in environment statistics is also presented. Particular attention is paid to the institutional aspects of environment statistics.
- 1.17. Chapter 2 presents the conceptual foundation and scope of the FDES, explains the underlying fundamental concepts, and how those concepts have been translated into the six components that constitute the Framework. It introduces the hierarchical layers of components, sub-components and statistical topics that provide the organizational structure

for environment statistics. Finally, Chapter 2 explores the relationship between the FDES and other frameworks, particularly with the SEEA and the DPSIR analytical framework.

- 1.18. Chapter 3 provides an expanded discussion of the components, sub-components and statistical topics of the FDES. It describes the relevance of the statistical topics, the typical data sources and institutional partners. It sets out relevant statistics that are needed to describe the statistical topics and their relationships and provides information on the most important aspects of temporal and spatial aggregation as well as on existing methodology. These statistics constitute the Basic Set of Environment Statistics.
- 1.19. Chapter 4 presents how the Basic Set of Environment Statistics is organized in three tiers based on the relevance, availability and methodological development of the statistics, and introduces the Core Set of Environment Statistics (Tier 1 of the Basic Set), describing the criteria and process for their selection.
- 1.20. Chapter 5 gives examples of the application of the FDES to selected cross-cutting environmental and socio-economic issues (such as climate change) as well as to specific sectoral or thematic analytical needs (such as agriculture and the environment; water management; the energy sector and the environment). These examples illustrate the flexibility and adaptability of the FDES to different user and policy needs.
- 1.21. Annex A contains the full Basic Set of Environment Statistics. Annex B provides supporting information on the conceptual and policy developments since the publication of the FDES in 1984. Annex C describes the major MEAs relevant to environment statistics. Annex D presents some of the most important classifications and other groupings used in environment statistics.

#### Future work

1.22. Following the endorsement of the FDES 2013, work will focus on its implementation at the national level. Detailed methodological guidance and training material for the FDES, the Core and Basic Sets of Environment Statistics will be developed, including classifications, definitions and data collection and compilation methods, building on existing methodologies as well as on ongoing methodological work in environment and sectoral statistics, as well as in environmental-economic accounting.

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

- 1.23. 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, bearing in mind the Fundamental Principles of Official Statistics (see box below). These characteristics are the base of the FDES 2013. The FDES, as a tool to organize the contents and the production of environment statistics, will be described in depth in Chapter 2.
- 1.24. Environment statistics cut across several disciplines and draw data from a wide range of different sources. Besides the NSOs and environmental ministries and agencies, several other institutions are key players in the production of data used in environment statistics. To effectively produce environment statistics, statistical and environmental expertise, scientific knowledge, institutional development capabilities, and adequate resources are equally necessary. Within this relatively new statistical domain, methodological resources, tools and good practices are being developed and systematized progressively. Consequently, many countries still require substantial technical assistance and capacity building in developing their national environment statistics programmes.

#### **Fundamental Principles of Official Statistics**

**Principle 1**. Official statistics provide an indispensable element in the information system of a democratic society, serving the Government, the economy and the public with data about the economic, demographic, social and environmental situation. To this end, official statistics that meet the test of practical utility are to be compiled and made available on an impartial basis by official statistical agencies to honour citizens' entitlement to public information.

**Principle 2.** To retain trust in official statistics, the statistical agencies need to decide according to strictly professional considerations, including scientific principles and professional ethics, on the methods and procedures for the collection, processing, storage and presentation of statistical data.

**Principle 3**. To facilitate a correct interpretation of the data, the statistical agencies are to present information according to scientific standards on the sources, methods and procedures of the statistics.

Principle 4. The statistical agencies are entitled to comment on erroneous interpretation and misuse of statistics.

**Principle 5**. Data for statistical purposes may be drawn from all types of sources, be they statistical surveys or administrative records. Statistical agencies are to choose the source with regard to quality, timeliness, costs and the burden on respondents.

**Principle 6**. Individual data collected by statistical agencies for statistical compilation, whether they refer to natural or legal persons, are to be strictly confidential and used exclusively for statistical purposes.

Principle 7. The laws, regulations and measures under which the statistical systems operate are to be made public.

**Principle 8**. Coordination among statistical agencies within countries is essential to achieve consistency and efficiency in the statistical system.

**Principle 9**. The use by statistical agencies in each country of international concepts, classifications and methods promotes the consistency and efficiency of statistical systems at all official levels.

**Principle 10**. Bilateral and multilateral cooperation in statistics contributes to the improvement of systems of official statistics in all countries.

#### 1.1 Objective of environment statistics

1.25. 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. 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

- 1.26. The scope of environment statistics covers biophysical aspects of the environment and those aspects of the socio-economic system that directly influence and interact with the environment.
- 1.27. 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 users of environment statistics

- 1.28. 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, researchers and academia; and
  - iv. International agencies.
- 1.29. 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 at the highest levels and the general public would tend to use environmental indicators and more aggregated statistics. Environmental administration, researchers, analysts and academia

may be more inclined to look at extensive and detailed environment statistics. International agencies typically have well-articulated environmental data needs based on environmental agreements or international data collection processes.

1.30. 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 and environmental indicators both of which can be stored in multi-purpose databases and disseminated in the form of on-line databases as well as different types of publications such as compendia, yearbooks, thematic reports, and analytical publications such as state of the environment reports.

#### 1.4 Environmental information, data, statistics and indicators

- 1.31. Environmental information includes quantitative and qualitative facts describing the state of the environment and its changes. Quantitative environmental information is generally produced in the form of data, statistics and indicators, and is generally disseminated through databases, spreadsheets, compendia and yearbook type products. Qualitative environmental information consists of descriptions (e.g., textual, pictorial) of the environment or its constituent parts that cannot be adequately represented by accurate quantitative descriptors.
- 1.32. <u>Environmental data</u> are large amounts of unprocessed observations and measurements about the environment and related processes. They can be collected or compiled through statistical surveys (censuses or sample surveys) by the national statistical system, or through geographic databases within the earth sciences sector. They may originate from administrative records, registers, inventories, monitoring networks, thematic mapping, remote sensing, scientific research, and field studies.
- 1.33. <u>Environment statistics</u> structure, synthesize and aggregate 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

identifies environmental and other data that fall within its scope and then contributes to structuring, synthesizing and aggregating the data into statistical series and indicators.

- 1.34. Environmental indicators are used to synthesize and present complex environment statistics to summarize, simplify and communicate relevant information in this domain. Given that 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. Environmental indicators have the purpose of defining objectives, assessing present and future direction with respect to goals and targets, evaluating specific programmes, monitoring 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 MDGs or the SDI frameworks are typically used for the identification and structuring of indicators.
- 1.35. Environmental indices are composite or more complex measures that combine and synthesize more than one environmental indicator or statistic that are weighted according to different methods. 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, the subjectivity of weighting and the quality of the underlying statistics.
- 1.36. Environment statistics primarily organised within the FDES may be structured for specific analytical purposes according to different analytical frameworks, such as the DPSIR framework, issue-based frameworks which focus on specific environmental problems (e.g., climate change, 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.
- 1.37. Accounting frameworks, such as the SEEA, reorganize the relevant environment statistics according to the principles of the System of National Accounts (SNA) into stocks and flows within and between the environment and the economy, thus linking environment statistics with the SNA and facilitating the analysis of relationships between the economy and the environment.
- 1.38. These types of environment statistics 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 should be produced and used as a multi-purpose

information system which would increase synergy and consistency, as well as efficiency in the use of limited financial resources.

#### 1.5 Sources of environment statistics

- 1.39. Environment statistics synthesize data originating from a wide range of source types. 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. Source types include:
  - i. Statistical surveys (e.g., censuses or sample surveys of population, housing, agriculture, enterprises, households, employment, and different aspects of environment management);
  - ii. Administrative records of government and non-government agencies in charge of natural resources as well as other ministries and authorities;
  - iii. Remote sensing and thematic mapping (e.g., satellite imaging and mapping of land use and land cover, water bodies or forest cover);
  - iv. Monitoring systems (e.g., field-monitoring stations for water quality, air pollution or climate);
  - v. Scientific research;
  - vi. Special projects undertaken to fulfil domestic or international demand.
- 1.40. These source types are usually used in combination. For instance, statistical surveys and scientific research involving remote sensing and mapping are involved in the estimation of some types of emissions to the air. While statistical surveys and administrative records are commonly used in all areas of statistics (economic, social and environment) and the use of remote sensing data has become widespread, the use of data from monitoring networks, scientific research and special projects are mostly specific to the production of environment statistics.
- 1.41. Environment statistics rely to a high extent on data that are collected by direct measurements using a variety of methods, including the use of remote sensing and field-monitoring stations. Most countries have agencies that are primarily responsible for the monitoring of environmental resources and conditions. They can be entities in their own right, or can be government agencies with other primary functions that have departments that deal with environmental matters. These agencies typically have two main types of data: (i) measured data (direct observations, field measurements, remote sensing data); and (ii) calculated data (derived using estimates and modelling).

- 1.42. The use of estimates and modelling to generate environmental data can improve overall data quality, including accuracy and coverage, especially when models draw upon two or more sets of observations, such as field observations coupled with global satellite-based observations. Models may also incorporate administrative data or data resulting from statistical surveys or special projects.
- 1.43. The main characteristics, advantages and disadvantages of the aforementioned environment statistics source types are discussed below.<sup>6</sup>

#### Statistical surveys

- 1.44. There are two types of surveys: (i) censuses; and (ii) sample surveys. A census is a survey that collects data from the entire population of interest. A sample survey is a survey carried out using a sampling method, in which data are collected from a representative portion of the population of interest and not the whole population.<sup>7</sup>
- 1.45. Environment statistics can be collected from surveys by: (i) adding environment-related questions to surveys primarily intended to collect data on other topics; and (ii) using surveys primarily intended to collect environment statistics. 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.
- 1.46. Adding environment-related questions to other surveys is less expensive than collecting data through a separate survey, the response burden is minimized, and the environmental data can be directly linked to other data collected. However, challenges of adding questions to existing surveys include that: (i) there can be limited space available for additional questions in existing surveys; (ii) the survey frame and stratification of the population and sampling selection may not be ideal for environment statistics; (iii) the data may need to be reorganized or reclassified in order to be used in environment statistics; and (iv) respondents may not be familiar with environmental terms nor the information needed to answer environment-related questions.

<sup>&</sup>lt;sup>6</sup> United Nations Statistics Division (2012). "International Recommendations for Water Statistics". Available from

http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf (accessed 24 October 2013).

<sup>&</sup>lt;sup>7</sup> International Statistical Institute (2003), "The Oxford Dictionary of Statistical Terms", Yadolah Dodge ed. Oxford University Press.

1.47. Environment-specific surveys can be censuses or sample surveys. The advantages of using environment-specific surveys are that: (i) the survey frame and sampling used can be selected according to the requirements of environment statistics; (ii) consistent concepts and definitions can be used in survey questions; and (iii) the most suitable type of survey mode for collecting environment statistics can be selected. On the other hand, environment-specific surveys create additional response burden; are expensive in terms of finance, human resources and time; and in many cases there is no suitable register, list or map readily available to use as a survey frame.

#### Administrative records

- 1.48. Administrative data kept by government agencies or NGOs may be used for environment statistics purposes. Government agencies keep administrative records of the population, households and establishments in response to legislation, regulations or for internal management purposes. While most administrative data have traditionally been obtained from government agencies, administrative records kept by NGOs (e.g., industry or services associations, environmental associations and groups, etc.) may also be of use in environment statistics.
- 1.49. The main advantage of administrative data sources is that the cost of collecting such data is usually much less than establishing and conducting a survey. The level of response burden is minimized, and complete coverage is assured of units under administration. However, there are usually differences between administrative and statistical terms and definitions; there is the risk of deliberate misreporting; data may not be checked or validated for statistical purposes; there may be restriction of access to the data; and the coverage, though complete for administrative purposes, might not match statistical requirements.

#### Remote sensing and thematic mapping

1.50. Remote sensing is the science of obtaining information about objects or areas from a distance, typically from aircraft or satellites. Sensors are able to detect and classify objects on, above or below the Earth's surface. Remote sensing makes it possible to collect data on dangerous or inaccessible areas or to replace costly and slow data collection on the ground, ensuring in the process that areas or objects are not disturbed. Using satellite, aircraft, spacecraft, buoy, ship, balloon and helicopter images, data are created to analyze and compare, for example, the impact of natural disasters, changes in the area of soil erosion, the extension of pollution, changes in land cover, or population estimates of different animal species. These can be mapped, imaged, tracked and observed. Remote sensing, combined with thematic mapping

data and sufficient validation using actual measurements in the field, usually provides consistent and high quality data for environment statistics.

1.51. Environmental geographic data are geographically referenced (geo-referenced) information that include digital maps, satellite and aerial imagery, and other sources of data that are linked to a location, coordinate or a map feature, and all structured in databases. This data provides much of the visualisation and contextual elements that add significantly to the quantity and quality of information that is organized within the framework of environment statistics, particularly when stored in Geographic Information Systems (GIS). GIS is an integrating technology that helps to capture, manage, analyze, visualize and model a wide range of data with a spatial or locational component. In essence, such systems enable environmental conditions to be mapped, measured and modelled.

#### Monitoring systems

- 1.52. Monitoring systems for the production of environment statistics are typically comprised of field-monitoring stations which are used to describe the qualitative and quantitative aspects of the environmental media (e.g., air, water or soil quality; hydrological or meteorological characteristics; etc.). The main advantages of these data are that they: (i) are usually collected using verifiable scientific methods; (ii) are usually validated; (iii) are often available as time series; and (iv) frequently use models to improve data quality.
- 1.53. The disadvantages of data from monitoring systems are the consequences of the fact that field-monitoring stations, especially those monitoring concentrations of pollutants in the environmental media, are usually located in "hot-spot" areas, where there are high levels of pollution, where there are highly sensitive areas, or where large numbers of the population are affected. Therefore, the measurements will be location-specific and harder to aggregate over space to arrive at measures of quality over larger territories.

#### Scientific research and special projects

1.54. Scientific research programmes focus on specific scientific areas, therefore the data collected and produced will depend on the focus of the research. Many such special projects can be relevant to environment statistics, such as studies on glacier retraction, global CO<sub>2</sub> concentration, and biological assays to measure environmental pollutants. Special projects which are undertaken to fulfil domestic or international demand often produce research data that are collected by universities as well as other research agencies and organizations that can be governmental or non-governmental. Their main purpose is usually to fill gaps in knowledge, assess effectiveness of different measures, and develop alternative policies.

- 1.55. The main advantages of using data from scientific research and special projects are that: (i) these data are usually available for free or for low cost; (ii) they minimize response burden; (iii) they can be used to fill in data gaps; and (iv) they are useful for developing coefficients for models. Disadvantages of using these sources include that: (i) they often use terms and definitions that differ from those used in statistics; (ii) access to microdata may be limited; (iii) metadata may be missing; (iv) often data are available only for case examples (i.e., limited areas or industries); and (v) often data are available on a one-time basis.
- 1.56. A special category of data used in environment statistics comes from process-specific technological parameters of different production and consumption processes relating to the input of natural resources and the output of residuals. These data are used to produce per unit factors or coefficients that support the calculation and estimation of the resource and emission intensity of production and consumption processes.
- 1.57. Table 1.1: Types of sources of environment statistics and main characteristics<sup>8</sup> below shows the main types of sources from which environment statistics are usually derived. Some examples of these statistics, general advantages and disadvantages of each type of source, as well as challenges to countries with regard to these sources are given.

<sup>&</sup>lt;sup>8</sup> United Nations Economic Commission for Latin America and the Caribbean (2009). "Methodological Guide for developing Environmental and Sustainable Development Indicators in Latin American and Caribbean Countries". Serie Manuales No. 61. Available from <a href="http://www.eclac.org/cgi-bin/getProd.asp?xml=/publicaciones/xml/3/46043/P46043.xml&xsl=/deype/tpl-i/p9f.xsl&base=/ilpes/tpl/top-bottom.xslt">http://www.eclac.org/cgi-bin/getProd.asp?xml=/publicaciones/xml/3/46043/P46043.xml&xsl=/deype/tpl-i/p9f.xsl&base=/ilpes/tpl/top-bottom.xslt</a> (accessed 19 January 2013).

Type of source	Examples of source	Examples of statistics	Examples of advantages	Examples of disadvantages	Challenges for developing countries
Statistical surveys (i) Censuses	Censuses such as population and housing, economic, agricultural or other sectoral censuses may include environmental aspects. Specific environmental censuses may cover establishments engaged in activities such as water management or waste management.	Drinking water supply Basic sanitation Waste management Housing quality Use of fertilizers and pesticides in agriculture	More representative of the universe of informants, more accurate data outcomes	Periodicity is low Expensive	Refining sectors of the instrument to capture more and better environmental information
(ii) Sample surveys	Includes general purpose instruments (which may cover environmental issues) such as household surveys, business surveys and other sectoral surveys. Also includes emerging surveys specifically designed to gather environmental information, i.e., environmental management surveys for business establishments (industry, tourism, agriculture, etc.), municipal environmental management surveys and public opinion polls on the environment, among others.	Drinking water Basic sanitation Housing quality Establishments with environmental management systems Production and handling of solid waste Opinion barometers on environmental policies and management	Greater periodicity and therefore more frequent updating of data series	Sampling and representativene ss of sample may be a concern in case of surveys designed for other than environmental purposes	Refining sectors of recurrent instruments to capture more and better environmental information Developing and maintaining specialized environmental surveys of different sectors and on different levels
Administr ative records	Statistical exploitation of records maintained by different government and non-governmental agencies for administrative purposes, at various levels (national, regional, provincial, municipal, and so on) such as: Customs records (imports), sectoral ministry records, public finance and budget records, tax returns records, environmental authority records.	Number of motor vehicles Environmental licensing Designation of protected area Environmental education actions Public spending on environment protection	High periodicity of production (annual, quarterly and even monthly) and thus high frequency of updating	Terms and definitions may differ from those used in statistics; access to microdata may be limited; metadata may be missing	Building statistical capacities in sectoral ministries and public services Requires stable national inter- institutional coordination

Table 1.1: Types	s of sources	of environment	statistics and	main char	acteristics
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Remote sensing and thematic mapping	All kinds of remote sensing and atmospheric measuring tools that produce images and their interpretation: satellite imaging, aerial photography, geodata, geodesy, geomatics.	Satellite imaging to inventory forests Remote imaging of urban sprawl (city surface) Land cover and land use (types) Level, height or retract of principal glaciers	Very accurate Costs of imaging have declined considerably	High cost of interpreting images Many national statistical offices and Ministries of the Environment do not have specialists in geomatics	Requires geo- spatial literacy among officials responsible for environment statistics Requires sufficient resources to interpret images and build geospatial representations of data
<b>Monitoring</b> systems	Includes various quality and pollution monitoring stations and networks such as: Urban air pollution monitoring stations, surface water quality monitoring systems, glacier monitoring systems, seawater or coastal water quality monitoring systems, and so on. Meteorological, hydrological monitoring networks.	Various parameters sampled to establish: Quality of drinking water Urban air quality Coastal - marine pollution Temperature, precipitation, water flows of rivers	In general, good to excellent quality and more accurate data and microdata	High cost of installing and maintaining monitoring systems and thus of producing microdata Usually point specific measurements don't allow for aggregation over space unless the network is dense enough	Need to coordinate the flow of data from primary source in terms of periodicity, aggregation and format required for feeding into statistical production (series, indicators)
Scientific research and special projects	Data collected by universities, research agencies and organizations to fill in gaps in knowledge, assess effectiveness of or develop alternative policies etc.	Ecosystem health; Diversity and population trends of selected species; Characteristics of solid waste; Process specific technological parameters of residuals	Low cost; minimize response burden; can be used to fill in data gaps; useful to developing coefficients	Terms and definitions may differ from those used in statistics; access to microdata may be limited; metadata may be missing Often have limited scope and often produced on a one-time basis	Require close collaboration of statisticians with experts of the different scientific fields

#### **1.6 Classifications and other groupings relevant to environment statistics**

- 1.58. Statistical classifications are sets of discrete categories which may be assigned to specific variables registered in a statistical survey or an administrative file and used in the production and presentation of statistics.<sup>9</sup>
- 1.59. The field of environment statistics has no single, overarching, internationally agreed classification of the environment for statistical purposes, such as the International Standard Industrial Classification of All Economic Activities (ISIC)<sup>10</sup>. Instead, there are a number of co-existing and emerging classifications and categorizations for specific subject areas. 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.
- 1.60. Standard economic and social-demographic statistical classifications, such as ISIC and the Central Product Classification (CPC)<sup>11</sup>, or the International Classification of Diseases (ICD)<sup>12</sup>among others, are relevant for and used in environment statistics. The use of these classifications facilitates the integration of environment statistics with economic and social-demographic statistics.
- 1.61. The pioneering environment statistics classifications adopted by the Conference of European Statisticians (CES) have been used extensively for international data collection. These environment statistics classifications developed by the United Nations Economic Commission for Europe (UNECE) are heterogeneous and most of them include more than one single hierarchical classification. They also include recommendations for definitions, measurement methods and tabulations. The UNECE Standard Statistical Classifications for the environment include classifications of Water Use (1989), Land Use (1989), Wastes (1989), Ambient Air Quality (1990), Surface 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). These classifications have been widely used by the UNECE, the Organisation for Economic Co-operation and Development (OECD), Eurostat, UNSD, and various regional and national bodies for international data collection.

<sup>&</sup>lt;sup>9</sup> United Nations Statistics Division (1999). "Standard Statistical Classifications: Basic Principles". Available from <u>http://unstats.un.org/unsd/class/family/bestprac.pdf</u> (accessed 14 June 2013).

<sup>&</sup>lt;sup>10</sup> United Nations Statistics Division (2008). "International Standard Industrial Classification of All Economic Activities, Rev. 4". Available from http://unstats.un.org/unsd/cr/registry/isic-4.asp (accessed 14 June 2013).

<sup>&</sup>lt;sup>11</sup> United Nations Statistics Division (2008). <sup>4</sup>Central Product Classification, Ver. 2<sup>4</sup>. Available from <u>http://unstats.un.org/unsd/cr/registry/cpc-2.asp</u> (accessed 15 June 2013).

<sup>&</sup>lt;sup>12</sup> World Health Organization (2011). "International Classification of Diseases". Available from <u>http://www.who.int/classifications/icd/en/</u> (accessed 19 June 2013).

- 1.62. More recent statistical classifications as well as less-formalized categorizations which pertain to specific sub-domains of environment statistics have been developed by different international organizations, specialized agencies, intergovernmental organizations or nongovernmental organizations. Examples are the Food and Agriculture Organization of the United Nations (FAO) Land Cover Classification System or the groupings and classifications developed for water statistics and for energy products included in the *International* Recommendations for Water Statistics (IRWS)<sup>13</sup> and the International Recommendations for Energy Statistics (IRES)<sup>14</sup>.
- 1.63. Many of the aforementioned classifications have been revised, adapted and used in the SEEA Central Framework (SEEA-CF), 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 ecosystem services is being carried out as part of the development of the SEEA Experimental Ecosystem Accounting.
- 1.64. 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 Events Database (CRED EMDAT); classifications for protected areas and threatened species by United Nations Environment Programme's World Conservation Monitoring Centre (UNEP-WCMC) and the International Union for Conservation of Nature (IUCN); the ecosystem reporting categories used by the Millennium Ecosystem Assessment; the source categories for greenhouse gas (GHG) emissions from the Intergovernmental Panel on Climate Change (IPCC); or the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources (UNFC). Ensuring harmonization of the different classifications and building bridges among them are among the most important roles of environmental statisticians.
- 1.65. For more information on classifications used in environment statistics see Chapter 3 and Annex A: Basic Set of Environment Statistics which contain the Basic Set of Environment Statistics. The Basic Set includes a column that lists commonly used classifications and

<sup>&</sup>lt;sup>13</sup> United Nations Statistics Division (2012). "International Recommendations for Water Statistics". Available from

http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf (accessed 24 October2013). <sup>14</sup> United Nations Statistics Division (2011). "International Recommendations for Energy Statistics (draft version)". Available from http://unstats.un.org/unsd/statcom/doc11/BG-IRES.pdf (accessed 10 November 2013).

categorization. Annex D contains relevant classifications and groupings in the field of environment statistics.

#### 1.7 Temporal and spatial considerations

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

#### Temporal considerations

- 1.67. While it is important to align the temporal aggregations of environmental data with those used in economic and social statistics to ensure their proper integration, often a uniform calendar or fiscal year do not fit the diversity of natural phenomena; therefore the use of different time scales, longer or shorter time periods is also necessary for the aggregation of environmental data over time.
- 1.68. The environmental data used in environment statistics are measured or monitored at different frequencies. 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), or processes such as change in land cover or soil erosion, do not justify or require assiduous monitoring of their status, since the most relevant changes can be observed on an annual or even much 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 quality<sup>15</sup> in urban settings.
- 1.69. Determining the appropriate temporal aggregation of 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 are not restricted to a sum or an average over a longer period. In addition, it should be noted that even when environmental data are produced at irregular intervals, environment statistics based on these

 $<sup>^{15}</sup>$  Air quality is measured by the concentrations of particulate matter (PM<sub>10</sub>, PM<sub>2.5</sub>) also known as suspended particulate matter (SPM), ground level ozone (O<sub>3</sub>) or other pollutants depending on the specific city.

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

### Spatial considerations

- 1.70. The occurrence and impacts of environmental phenomena are distributed through space without regard for political-administrative boundaries. The most meaningful spatial units for environment statistics are natural units, such as watersheds, ecosystems, eco-zones, landscape or land cover units; or management and planning units based on the natural units, such as protected areas, coastal areas or river basin districts.
- 1.71. Economic and social statistics are traditionally aggregated according to administrative units. This difference can complicate the collection and analysis of environment statistics especially when there is a need to combine them with data originating from 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.
- 1.72. While environment statistics are usually collected and aggregated for natural physical, geographical and administrative areas, for the purposes of environmental-economic accounting the concept of economic territory is used, a geographic boundary that defines the scope of an economy. Economic territory is the area under effective control of a single government. It includes the land area of a country, including islands, airspace, territorial waters and territorial enclaves in the rest of the world. Economic territory excludes territorial enclaves of other countries and international organizations located in the reference country.

#### **1.8** Geospatial information and environment statistics

- 1.73. Geospatial information presents the location and characteristics of different attributes of the atmosphere, surface and sub-surface. It is used to describe, display and analyze data that have discernible spatial aspects, such as land use, water resources and natural disasters. Geospatial information allows for the visual display of different statistics in a map-based layout, which can make it easier for users to work with and understand the data. The ability to overlay multiple data sets using software, for instance on population, environmental quality, and environmental health, allows for a deeper analysis of the relationship among these phenomena.
- 1.74. 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. 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.

- 1.75. 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: natural units (e.g., watersheds, ecosystems, etc.); administrative units (e.g., municipalities, districts, counties, regions, etc.); management units (e.g., protected areas, river basin districts, etc.); planning units (e.g., coastal zones, urban areas, etc.); legal property units (e.g., cadastral units, etc.); and analytical units (e.g., land cover units, socio-ecological landscape units, eco-complexes, geo-systems, eco-zones, etc.).
- 1.76. 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.





Source: Government Accountability Office (2004). <sup>16</sup>

<sup>&</sup>lt;sup>16</sup> Government Accountability Office (2004). "Geospatial Information: Better Coordination Needed to Identify and Reduce Duplicative Investments". Available from <u>http://www.gao.gov/assets/250/243133.pdf</u> (accessed 15 June 2013).

- 1.77. Remote sensing gathers 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 sensors on the ground, in aircraft or on orbiting satellites. The information is carried by electromagnetic signals. 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. Through satellite remote sensing, global issues can be addressed by detecting, monitoring and measuring regional and global changes.
- 1.78. 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 are transformed so they are coincident and fit the same coordinates. GIS uses the processing power of a computer, together with geographic mapping techniques (cartography), to transform data from different sources onto one projection and one scale so that the data can be analyzed and modelled together.

#### **1.9 Institutional dimension of environment statistics**

1.79. The institutional dimension of environment statistics refers to the institutional factors necessary for the development and strengthening of the sustained production, dissemination and use of environment statistics. It comprises the legal framework that establishes the mandates and roles of the main partners, the institutional setting and institutional development level of environment statistics units, and the existence and effectiveness of inter-institutional cooperation and coordination mechanisms at the national level and with specialized international agencies. The institutional dimension of environment statistics is fundamental when developing environment statistics at the national level. Given the multi-disciplinary and cross-cutting nature of environment statistics, the production of environmental data and statistics involves numerous stakeholders, actors and producers. The challenges of insufficient institutional development, overlapping mandates and functions, inadequate interagency coordination and other institutional issues are very common in many 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.

- 1.80. 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. The following are four key elements pertaining to the institutional dimension that need to be considered and dealt with simultaneously while developing environment statistics.
- 1.81. <u>The legal framework</u>. In most countries, the legal framework for the production of environment statistics commonly consists of statistical, environmental and other relevant sectoral legislation such as for water, energy and agriculture. Each of these laws defines the mandate and competencies of the institutions in charge of the relevant sectors.
- 1.82. Under national statistical legislation, commonly the NSO is the responsible authority for creating and coordinating the national statistical system. However, in most cases, these laws do 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.
- 1.83. 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 statistic when different agencies produce the same or similar statistics, but with different values.
- 1.84. <u>Institutional development</u>. A well-defined mandate and a specific unit in charge of carrying out the production of environment statistics is critical for the successful organization of a national environment statistics programme within the official institutions responsible for the production of statistics. This unit requires 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.
- 1.85. <u>Inter-institutional collaboration</u>. 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 NSOs, specialized agencies, ministries, provincial and municipal governments and scientific institutions. That necessitates the collaboration of these stakeholders, both at the strategic and technical level.

- 1.86. The collaboration of national and sub-national institutions can take the form of a multistakeholder or inter-agency platform tasked with coordinating the strategic development and production of environment statistics. These inter-agency platforms bring together users and producers of environment statistics to identify users' needs and ensure the production of the necessary environment statistics from a variety of data sources in a coordinated manner. 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.
- 1.87. 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.
- 1.88. <u>Institutional cooperation of national, regional and global bodies</u>. The institutional challenges common in countries are also faced by international organizations that are involved in the production of environmental data and statistics. Notwithstanding the legal requirements mentioned above, it is very important to consider the operational aspects 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.

#### 1.10 The FDES 2013 and the domain of environment statistics

- 1.89. The FDES 2013 addresses the issues related to the multidisciplinary nature of environment statistics by marking out the scope of environment statistics and providing a conceptually based organizing structure to bring together the necessary biophysical data that originate from different sources as well as the relevant social and economic statistics that are needed to describe the activities affecting the conditions of the environment and to estimate their environmental impact.
- 1.90. The sections of this chapter have discussed the nature, scope and specific characteristics pertaining to the domain of environment statistics. The most relevant challenges associated to the work in the field of environment statistics have also been presented in a synthesized way.

The FDES 2013 has been developed to address these precise elements from a current and global perspective, also acknowledging foreseeable developments in the future.

1.91. The next chapter of this document describes the conceptual foundation, the scope and the organizing structure contained in the FDES 2013. Subsequent chapters describe the components, sub-components and topics of the FDES 2013, as well as its most relevant environment statistics, also indicating the corresponding availability of methodologies and classifications, the most common sources of data, and identifying the usual institutional partners to facilitate inter-agency cooperation.

# **Chapter 2: Conceptual Foundation and Structure of the FDES**

2.1. This chapter introduces the FDES, its conceptual framework 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 multi-purpose conceptual and statistical framework that is comprehensive and integrative in nature and marks out the scope of environment statistics. It provides an organizing structure to guide the collection and compilation of environment statistics at the national level. It brings together data from the various relevant subject areas and sources, covering the issues and aspects of the environment that are relevant for policy analysis and decision making.
- 2.3. The primary objective of the FDES 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.
- 2.4. Though the FDES has been designed to guide countries at early stages in the development of their environment statistics programmes, it is relevant to, and recommended for use by countries at any stage of development. It can also be used by international and regional institutions, as well as by other users and producers.

# **2.2** Conceptual foundation of the FDES

2.5. The FDES is based on a conceptual foundation that considers people and their demographic, social and economic activities (the human sub-system) as integral parts of, and interacting with, the environment. Figure 2.1 illustrates this concept with the arrows representing a

variety of complex natural, demographic, 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* 

2.6. Human wellbeing depends upon the living and non-living elements of the 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 residuals. 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).



Figure 2.2: Environmental conditions and their changes

2.7. 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

2.8. The Millennium Ecosystem Assessment and the Convention on Biological Diversity define an ecosystem as "a dynamic complex of plant, animal and microorganism communities and their non-living environment interacting as a functional unit."<sup>17, 18</sup> Ecosystems are systems of interacting and interdependent relationships among their elements. They perform specific functions such as photosynthesis, biochemical cycling, including the cycling of energy, water, carbon and nutrients and cleansing of air and water.

<sup>17</sup> Millennium Ecosystem Assessment (2005). "Ecosystems and Human Well-being: Synthesis". Available from http://www.millenniumassessment.org/documents/document/docu

http://www.millenniumassessment.org/documents/document.356.aspx.pdf (accessed 12 June 2013). <sup>18</sup> Convention on Biological Diversity (2003). "Article 2. Use of Terms." Available from <u>http://www.cbd.int/convention/articles/default.shtml?a=cbd-02</u> (accessed 12 June 2013).

- Ecosystems provide a great variety of goods and services upon which people depend.<sup>19</sup> These 2.9. are commonly known as ecosystem services. Ecosystem services are the benefits supplied by the functions of ecosystems and received by humanity $^{20}$ . 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 their extent and conditions. The extent and conditions of ecosystems change both as a result of natural processes and human activities.
- 2.10. There is no internationally adopted standard classification of ecosystem services. Four main types of ecosystem services have been commonly distinguished<sup>21</sup>:
  - i. Provisioning services that provide goods and services which humans require to meet basic necessities like food and raw materials;
  - ii. <u>Regulating services that keep the planet habitable like the regulation of climate and</u> hydrological systems;
  - iii. <u>Supporting services that arise from the continuous cycling of energy and materials</u> 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.
- In the SEEA Experimental Ecosystem Accounting, ecosystem services are the contributions 2.11. of ecosystems to benefits used in economic and other human activity.<sup>22</sup> As can be seen in Figures 2.1 and 2.2 this definition excludes some flows that are considered ecosystem services in other contexts, in particular intra- and inter- ecosystem flows that relate to ongoing ecosystem processes, commonly referred to as supporting services. While these flows are not considered ecosystem services in the SEEA, they are considered as part of the measurement of ecosystem assets. A Common International Classification of Ecosystem Services (CICES) is emerging within the frame of the ongoing work on the SEEA Experimental Ecosystem Accounting. For accounting purposes, the draft CICES distinguishes three main types of ecosystem services, namely provisioning, regulating and cultural services. The CICES lists those ecosystem services where a direct connection to humans can be established, therefore

<sup>&</sup>lt;sup>19</sup> Millennium Ecosystem Assessment (2005). "Ecosystems and Human Well-being: Synthesis". Available from

http://www.millenniumassessment.org/documents/document.356.aspx.pdf (accessed 12 June 2013).

United Nations, European Union, Food and Agriculture Organization of the United Nations, International Monetary Fund, Organisation for Economic Co-operation and Development, and the World Bank (2014). "System of Environmental-Economic Accounting 2012 - Central Framework". Available from <u>http://unstats.un.org/unsd/envaccounting/seeaRev/SEEA\_CF\_Final\_en.pdf</u> (accessed 30 September 2014). <sup>21</sup> Millennium Ecosystem Assessment (2005). "Ecosystems and Human Well-being: Synthesis". Available from

http://www.millenniumassessment.org/documents/document.356.aspx.pdf (accessed 12 June 2013). <sup>22</sup> In this context, "use" includes both the transformation of materials (e.g., use of timber to build houses or for energy) and the passive receipt of nonmaterial ecosystem services (e.g., amenity from viewing landscapes).

supporting services are considered embodied in the provisional, regulating and cultural services that they underpin.<sup>23</sup>

2.12. 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 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.

# **2.3 Scope of the FDES**

- 2.13. The scope of the FDES covers biophysical aspects of the environment, those aspects of the human sub-system that directly influence the state and quality of the environment, and the impacts of the changing environment on the human sub-system. It includes the interactions within the environment, and among the environment, human activities, and natural events.
- 2.14. The environment is the biophysical, biotic and abiotic surroundings in which humans live. Changes in the conditions and quality of the environment are at the centre of the FDES. These changes show the balance of the negative and positive impacts of human activities and natural processes. It should be noted that in many cases it is not possible to establish direct causeeffect relationships between changes in environmental quality and the individual human activities or natural processes, as the impact is the result of combined and cumulative processes and effects 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.
- 2.15. The elements of the environment that are affected by human use are ecosystems, land, and sub-soil resources. <u>Ecosystems</u> offer provisioning, regulating, supporting and cultural services that are essential for life and human wellbeing. Healthy 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 their capacity to continue to provide services.

<sup>&</sup>lt;sup>23</sup> European Commission, Organisation for Economic Co-operation and Development, United Nations and World Bank (2013). "System of Environmental-Economic Accounting 2012: Experimental Ecosystem Accounting". White cover publication, pre-edited text subject to official editing; page ix. Available from <u>http://unstats.un.org/unsd/envaccounting/eea\_white\_cover.pdf</u> (accessed 10 September 2014).

- 2.16. <u>Land</u> 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.
- 2.17. <u>Sub-soil resources</u> are underground deposits of various minerals that provide raw materials and sources of energy for humans. These sub-soil 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.
- 2.18. The factors affecting the conditions and quality of the environment can be both natural and anthropogenic.
- 2.19. 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.
- 2.20. 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.
- 2.21. 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.
- 2.22. 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 mitigating environmentally harmful effects, managing environmental resources 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 - the organization of the contents of the FDES

- 2.23. The FDES organizes environment statistics into a structure consisting of components, subcomponents, statistical topics, and individual statistics using a multi-level approach. The first level of the structure consists of six fundamental components that follow the FDES conceptual framework.
- 2.24. The first component, *Environmental conditions and quality*, brings together statistics related to the conditions and quality of the natural environment and their changes. The second component, *Environmental resources and their use*, groups together statistics related to availability and use of environmental resources (ecosystem provisioning services, land and sub-soil resources). The third component, *Residuals*, 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 technological) and their impacts are covered by the fourth component. The fifth component brings together statistics related to *Human settlements and environmental health*. The sixth component, *Environment protection, management and engagement*, groups statistics relevant to societal responses and economic measures aimed at protecting the environment and managing environmental resources.
- 2.25. Environmental conditions and quality (Component 1) are 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 2.3, all six components are intrinsically related to each other.
- 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.



2.27. 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). The statistical topics represent the measurable aspects of the components of the FDES. The components, sub-components, statistical topics and individual statistics 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. Each level uses numbering conventions as shown below in Table 2.1. The final level contains the actual individual environment statistics.

	<i>Table 2.1:</i>	Hierarc	hical	levels	of the	<b>FDES</b>
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1 digit	2 digits	3 digits	4 or 5 digits
Component	Sub-component	Statistical Topic	Statistics

2.28. 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.

- 2.29. 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.
- 2.30. 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.
- 2.31. In line with the need to maintain the framework's flexibility and applicability, the levels can be adapted and enriched according to each country's requirements, priorities and circumstances. Some countries may need more or less detailed information; other countries may wish to exclude some topics completely.

# 2.5 Components and sub-components of the FDES

2.32. In the following table the main structure of the FDES (2 digit level) is presented. Chapter 3 provides a detailed description of the relevance and contents of the components, sub-components and statistical topics of the FDES as well as the most common statistics that are recommended for their measurement.

$\mathbf{T}$			
Component 1:	Sub-component 1.1: Physical Conditions		
<b>Environmental Conditions</b>	Sub-component 1.2: Land Cover, Ecosystems and Biodiversity		
and Quality	Sub-component 1.3: Environmental Quality		
Component 2:	Sub-component 2.1: Mineral Resources		
<b>Environmental Resources</b>	Sub-component 2.2: Energy Resources		

Table 2.2: Components and sub-components of the FDES

and their Use	Sub-component 2.3: Land
	Sub-component 2.4: Soil Resources
	Sub-component 2.5: Biological Resources
	Sub-component 2.6: Water Resources
Component 3:	Sub-component 3.1: Emissions to Air
Residuals	Sub-component 3.2: Generation and Management of Wastewater
	Sub-component 3.3: Generation and Management of Waste
	Sub-component 3.4: Release of Chemical Substances
Component 4: Extreme	Sub-component 4.1: Natural Extreme Events and Disasters
<b>Events and Disasters</b>	Sub-component 4.2: Technological Disasters
Component 5: Human	Sub-component 5.1: Human Settlements
Settlements and	Sub-component 5.2: Environmental Health
Environmental Health	
Component 6: Environment	Sub-component 6.1: Environment Protection and Resource
Protection, Management and	Management Expenditure
Engagement	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

### 2.6 Relationship of the FDES with other frameworks

2.33. 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 the relationship between environmental data, the FDES, the SEEA and the different analytical and indicator frameworks. 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 with the SNA.



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

# Relationship between the FDES and the SEEA

- 2.34. The SEEA-CF describes the interactions between the economy and the environment, and the stocks and changes in stocks of environmental assets. At the heart of the SEEA-CF is a systems approach to the organization of environmental and economic information that covers, as completely as possible, the stocks and flows that are relevant to the analysis of environmental and economic issues. It applies the accounting concepts, structures, rules and principles of the SNA. In practice, environmental-economic accounting includes the compilation of physical supply and use tables, functional accounts (such as the environmental protection expenditure accounts), and asset accounts for natural resources. The United Nations Statistical Commission at its 43<sup>rd</sup> session in 2012 adopted the SEEA-CF as the initial version of the international standard for environmental-economic accounting.
- 2.35. The FDES as an organizing framework for environment statistics has a wider scope than that of the SEEA-CF, as illustrated by Figure 2.5.



Figure 2.5: The FDES and the SEEA Central Framework

- 2.36. The SEEA-CF uses a great part of environment statistics by combining them with economic statistics and reorganizing them according to national accounting principles. One of the objectives of the FDES as a multipurpose framework is to provide, as much as possible, basic environment statistics necessary for the development of environmental-economic accounts. As environmental-economic accounting is considered an important user of environment statistics, consistency of the concepts, terms and definitions used in the FDES and the SEEA was ensured to the extent possible.
- 2.37. The statistics contained in Component 2: Environmental Resources and their Use and Component 3: Residuals 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 functional accounts of the SEEA-CF.
- 2.38. The SEEA Experimental Ecosystem Accounting will be a companion of the SEEA-CF. 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.
- 2.39. The SEEA is based on the definitions and classifications applied in the SNA. The concepts of resident units and centre of economic interest are used to define the boundaries and therefore to decide, which activities should be included in or excluded from the accounts. An institutional unit is resident within the economic territory of a country when it maintains the centre of economic interest in that territory that is, when it engages, or intends to engage, in economic activities or transactions usually over at least one year. In the SEEA and in the SNA 2008<sup>24</sup>, all economic activities of resident institutional units are included in the accounts irrespectively of whether they take place inside or outside the geographic territory of the country. On the other hand, economic activities of non-resident institutional units are not included in the accounts even if they take place within the geographic territory of the country. Using these concepts to define the boundary is different from the practice normally used in environment statistics and thus in the FDES, which use the territorial principle, where all relevant activities and environmental impacts that take place within the geographic area of the

<sup>&</sup>lt;sup>24</sup> European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations and World Bank (2009). "System of National Accounts 2008". Available from http://unstats.un.org/unsd/nationalaccount/docs/SNA2008.pdf (accessed 14 October 2014).

country are included irrespective of the institutional unit's being resident or non-resident. The difference is mainly related to the treatment of international transport and tourism.

# The FDES and its relationship with the Driving force – Pressure – State – Impact – Response (DPSIR) framework

- 2.40. 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 the United Nations Environment Programme (UNEP), OECD and the European Environment Agency (EEA) for assessment and reporting purposes and for the categorization of indicators.
- 2.41. The DPSIR is an analytical framework that is based on the causal relationship between its D-P-S-I-R components. Driving forces are the socio-economic and socio-cultural forces driving human activities, which increase or mitigate pressures on the environment. Pressures are the stresses that human activities place on the environment. State, or state of the environment, is the condition of the environment. Impacts are the effects of environmental degradation. Responses refer to the responses by society to the environmental situation.
- 2.42. 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. Nevertheless, the DPSIR framework facilitates consistent handling of information and avoids gaps in assessment and analysis. As such it is useful for grouping and reporting existing data and indicators.
- 2.43. 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 framework.
- 2.44. Table 2.3 below summarizes key attributes of the six components of the FDES. This includes a general description, examples of 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 data refer 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. Monetary data refer to information described in terms of monetary units, such as government expenditure on environment protection. Qualitative data refer to

descriptions that rely primarily on qualitative characterizations, though sometimes including quantitative aspects, such as environmental engagement.

# 2.7 Main attributes of the components of the FDES

2.45. The table below provides a description of the six components and the related types of data, as well as main sources and institutions. It also contains a description of the relationship of each component to the DSPIR framework and the SEEA.

	Description	Types of Data	Main Sources and Institutions	Relation to DPSIR and the SEEA
Component 1: Environmental Conditions and Quality	Meteorological, hydrographical, geological, geographical, biological, physical and chemical conditions and characteristics of the environment that determine ecosystems and environmental quality	<ul> <li>Geospatial</li> <li>Physical</li> <li>Qualitative</li> </ul>	<ul> <li>Monitoring and remote sensing data</li> <li>Environmental, meteorological, hydrological, geological and geographical authorities or institutions</li> </ul>	<ul> <li>State and Impact element in DPSIR</li> <li>Experimental ecosystem accounts of the SEEA</li> </ul>
Component 2: Environmental Resources and their Use	Quantities of environmental resources and their changes; as well as statistics on activities related to their use and management	<ul> <li>Physical</li> <li>Geospatial</li> </ul>	<ul> <li>Statistical surveys, administrative records, field surveys, land registers</li> <li>Sector statistics on production and consumption activities, infrastructure</li> <li>Remote sensing data</li> <li>Statistics databases of respective national authorities and institutions such as mining, energy, agriculture, water and forest</li> </ul>	<ul> <li>Driving force, Pressure and State elements in DPSIR</li> <li>Asset and physical flow accounts of the SEEA-CF</li> </ul>
Component 3: Residuals	Generation, management and discharge of residuals to air, water and soil	• Physical	<ul> <li>Administrative records</li> <li>Estimates based on activity statistics and technical coefficients</li> <li>Sector statistics</li> <li>Monitoring data</li> </ul>	<ul> <li>Pressure and Response elements in DPSIR</li> <li>Physical flow accounts of the SEEA-CF</li> </ul>
Component 4: Extreme Events and Disasters	Occurrence and impact of natural extreme events and disasters, and technological disasters	<ul> <li>Physical</li> <li>Monetary</li> <li>Geospatial</li> <li>Qualitative</li> </ul>	<ul> <li>Administrative records</li> <li>Remote sensing</li> <li>National emergency and disaster authorities</li> <li>Seismic, meteorological monitoring and research centres</li> <li>Industrial complexes that work with hazardous substances and processes</li> <li>Insurance companies</li> </ul>	<ul> <li>Pressure, Impact and Response elements in DPSIR</li> <li>Asset accounts of the SEEA-CF</li> </ul>

Table 2.3: Main attributes of the components of the FDES

Component 5: Human Settlements and Environmental Health	The built environment in which humans live, particularly with regard to population, housing, living conditions, basic services and environmental health	<ul> <li>Geospatial</li> <li>Physical</li> </ul>	<ul> <li>Population and housing censuses, household surveys, administrative records, and remote sensing</li> <li>Housing and urban planning and oversight authorities</li> <li>Cartographic authorities</li> <li>Transport authorities</li> <li>For health, administrative records, the health authority</li> </ul>	• Driving force, Pressure and Impact elements in DPSIR
Component 6: Environment Protection, Management and Engagement	Environment protection and resource management expenditure; environment regulation, both direct and via market instruments; disaster preparedness; environmental perception, awareness and engagement of the society	<ul> <li>Monetary</li> <li>Qualitative</li> </ul>	<ul> <li>Administrative records</li> <li>Surveys</li> <li>Entity producing government expenditure statistics</li> <li>The statistical entity in charge of national or sub-national surveys</li> <li>The environmental authority and other sector authorities</li> </ul>	<ul> <li>Response element in DPSIR</li> <li>Environmental activity accounts and related flows of the SEEA-CF</li> </ul>

# **Chapter 3: Components of the FDES and the Basic Set of Environment Statistics**

- 3.1. In Chapter 2, the conceptual foundation, the six constituent components and the main structure 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.
- 3.2. 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. Each of the 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 taking into consideration the types and sources of the data needed for their description. The final level contains the actual individual environment statistics.
- 3.3. Chapter 3 is organized in six parts describing each of the components of the FDES. The description usually covers the most important aspects including their 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. The relation to other frameworks and areas of statistics is also described, if appropriate. A comprehensive set of environment statistics underlying the topics (the Basic Set of Environment Statistics) is presented after each component description.

3.4. This Basic Set of Environment Statistics is designed with enough flexibility to be adapted to individual countries' environmental concerns, priorities and resources. The Basic Set contains the most important environment statistics in each topic, following a progression of three tiers, with Tier 1 constituting the Core Set of Environment Statistics. A more detailed description of the development of the Basic Set, the description of the three tiers, as well as the statistics in the Core Set are contained in Chapter 4. The full Basic Set of Environment Statistics is contained in Annex A.

# 3.1 Component 1: Environmental Conditions and Quality

- 3.5. Component 1 includes statistics about the physical, biological, as well as chemical characteristics of the environment and their change over time. These fundamental background conditions are strongly interrelated and determine the types, extent, conditions and health 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.
- 3.6. The source of the data is usually remote sensing and monitoring by environmental, meteorological, hydrological, geological and geographical authorities or institutions. Due to the nature of this field, in addition to statistical tabulations, the use of maps and cartographic information is the common way of presentation of the relevant information.
- 3.7. Component 1 contains statistics relevant to the State and Impact elements of the DPSIR framework. It also provides basic statistics for the SEEA Experimental Ecosystem Accounting.
- 3.8. Component 1 contains three sub-components:
  - i. Sub-component 1.1: Physical Conditions;
  - ii. Sub-component 1.2: Land Cover, Ecosystems and Biodiversity; and
  - iii. Sub-component 1.3: Environmental Quality.

# **Sub-component 1.1: Physical Conditions**

3.9. Sub-component 1.1: Physical Conditions, has been designed to capture those physical aspects of the environment which change relatively slowly due to human influence. It contains statistics on meteorological, hydrographical, geological, geographical conditions and soil

characteristics. 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.

3.10. Statistics on these general physical conditions are important as they help determine the scope and influences on 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

- 3.11. This topic covers data on atmospheric, climatic and weather 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. Climate is determined by long-term weather conditions over that territory. Relevant data usually include aspects such as: temperature, precipitation, humidity, pressure, wind speed, solar radiation, ultraviolet (UV) radiation, and the occurrence of El Niño and La Niña events.
- 3.12. 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 long time series of climate and atmospheric information with a very high level of detail. The data that are available in most countries are too dense and detailed for the purposes of environment statistics, so they 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 weather and climate. Time and seasonal variability is crucial when recording and organizing these types of statistics. The territorial reference of the measurements is important, 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.
- 3.13. Statistics on air quality are covered under Sub-component 1.3: Environmental Quality.

Co	Component 1: Environmental Conditions and Quality				
Su	b-component 1.1: Physical Con	ditions			
Tor	bic 1.1.1: Atmosphere, Climate and	Weather			
Sta	atistics and Related Information	Catagory of	Potential	Mathadalagiaal	
(Bo	<b>Id Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance	
a.	Temperature		National	World Meteorological	
	1. Monthly average	Degrees	<ul> <li>Sub-national</li> </ul>	Organization (WMO)	
	2. Minimum monthly average	Degrees		<ul> <li>Intergovernmental Panel on</li> </ul>	
	3. Maximum monthly average	Degrees		Climate Change (IPCC)	
b.	Precipitation (also in 2.6.1.a)			<ul> <li>National Oceanic and</li> </ul>	
	1. Annual average	Height		Atmospheric Administration	
	2. Long-term annual average	Height		(NOAA)/ National Aeronautics	
	3. Monthly average	Height		and Space Administration	
	4. Minimum monthly value	Height		(NASA)	
	5. Maximum monthly value	Height			
с.	Relative humidity				
	1. Minimum monthly value	Number			
	2. Maximum monthly value	Number			
d.	Pressure		<ul> <li>National</li> </ul>		
	1. Minimum monthly value	Pressure unit	<ul> <li>Sub-national</li> </ul>		
	2. Maximum monthly value	Pressure unit	<ul> <li>By station</li> </ul>		
e.	Wind speed		National		
	1. Minimum monthly value	Speed	<ul> <li>Sub-national</li> </ul>		
	2. Maximum monthly value	Speed			
f.	Solar radiation		<ul> <li>National</li> </ul>	• WMO	
	1. Average daily value	Area, Energy unit	<ul> <li>Sub-national</li> </ul>	• IPCC	
	2. Average monthly value	Area, Energy unit		<ul> <li>NOAA / NASA</li> </ul>	
	3. Number of hours with sunshine	Number	<ul> <li>National</li> <li>Sub-national</li> <li>By month and per year</li> </ul>		
g.	UV radiation		<ul> <li>National</li> </ul>	<ul> <li>World Health Organization</li> </ul>	
	1. Maximum daily value	Area, Energy unit	<ul> <li>Sub-national</li> </ul>	(WHO)-UV Radiation Index	
	2. Average daily value	Area, Energy unit		<ul> <li>WMO-UV Radiation</li> </ul>	
	3. Maximum monthly value	Area, Energy unit			
	4. Average monthly value	Area, Energy unit			
h.	Occurrence of El Niño, La Niña events,		<ul> <li>By location</li> </ul>		
	when relevant		National		
	1. Occurrence	Number	<ul> <li>Sub-national</li> </ul>		
	2. Time period	Time period			

Table 3.1.1.1: Statistics and Related Information for Topic 1.1.1

#### Topic 1.1.2: Hydrographical characteristics

3.14. This topic includes hydrographical information on the extent, location and characteristics of lakes, rivers and streams, artificial reservoirs, watersheds, seas, aquifers and glaciers. This information is best presented in the form of maps. The main primary sources are hydrographical and hydrological information systems that are usually managed by national geographical, hydrological institutions and water authorities. The data are usually produced for individual river basins or catchments, for use at national and sub-national levels. Important exclusions from this topic include water quality statistics (contained in Topic 1.3.2: Freshwater quality and Topic 1.3.3: Marine water quality) and water resources and their use (contained in Component 2: Environmental Resources and their Use).

Co	<b>Component 1: Environmental Conditions and Quality</b>			
Su	b-component 1.1: Physical Con	ditions		
Top	bic 1.1.2: Hydrographical Characteri	stics		
St	atistics and Related Information	~ ^	Potential	
( <b>Bo</b> )	<b>Id Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Category of Measurement	Aggregations and Scales	Methodological Guidance
a.	Lakes		<ul> <li>By location</li> </ul>	<ul> <li>United Nations Statistics</li> </ul>
	1. Surface area	Area	• By	Division (UNSD): International
	2. Maximum depth	Depth	watershed/river	Recommendations for Water
b.	Rivers and streams		basin	Statistics (IRWS)
	1. Length	Length	National	• UN-Water
с.	Artificial reservoirs		<ul> <li>Sub-national</li> </ul>	
	1. Surface area	Area		
	2. Maximum depth	Depth		
d.	Watersheds			
	1. Description of main watersheds	Area, Description		
e.	Seas		<ul> <li>By location</li> </ul>	
	1. Coastal waters	Area	<ul> <li>National,</li> </ul>	
	2. Territorial sea	Area	within coastal	
	3. Exclusive Economic Zone (EEZ)	Area	waters or	
	4. Sea level	Depth	Exclusive	
	5. Area of sea ice	Area	Economic Zone (EEZ)	
f.	Aquifers	Depth, Description	<ul> <li>By location</li> <li>By salinity levels</li> <li>By watershed</li> <li>National</li> <li>Sub-national</li> <li>Renewable</li> <li>Non-renewable</li> </ul>	
g.	Glaciers	Area	<ul><li>By location</li><li>National</li><li>Sub-national</li></ul>	

Table 3.1.1.2: Statistics and Related Information for Topic 1.1.2

#### Topic 1.1.3: Geological and geographical characteristics

- 3.15. This topic includes general geological and topographic information on the extent and characteristics of the country's territory and relief. These characteristics typically change slowly over time; as such, the statistics produced are normally static. Because of their nature, these geological (e.g., bedrock, fault lines, volcanoes, etc.), geographical (e.g., territorial borders, area of country, elevation, length of marine coastline) data are often presented in the form of maps. Statistics on stocks of mineral resources and their extraction are included in Component 2: Environmental Resources and their Use.
- 3.16. The main data sources are information systems that are run by national geographical and geological institutions and authorities.

Co	<b>Component 1: Environmental Conditions and Quality</b>			
Sul	b-component 1.1: Physical Cor	ditions		
Top	bic 1.1.3: Geological and geographic	al information		
Sta	atistics and Related Information	Catagony of	Potential	Mathadalagiaal
(Bo	<b>d Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance
a.	Geological, geographical and geomorphological conditions of terrestrial areas and islands		National	<ul><li>UNSD: Demographic Yearbook</li><li>Food and Agriculture</li></ul>
	1. Length of border	Length		Organization of the United
	2. Area of country or region	Area, Location		Nations (FAO)
	3. Number of islands	Number	<ul> <li>By location</li> </ul>	Center for International Earth
	4. Area of islands	Area	<ul> <li>National</li> </ul>	Science Information Network
	5. Main geomorphological characteristics of islands	Description		(CIESIN)
	6. Spatial distribution of land relief	Description, Location		
	7. Characteristics of landforms (e.g.,	Description, Area,		
	plains, hills, plateaus, dunes, volcanoes, mountains, sea mounts, etc.)	Height		
	8. Area by rock types	Area		
	9. Length of fault lines	Length		
b.	Coastal waters (includes area of coral	Area, Description		
	reefs, mangroves, etc.)			
с.	Length of marine coastline	Length		
d.	Coastal area	Area		

Table 3.1.1.3: Statistics and Related Information for Topic 1.1.3

#### Topic 1.1.4: Soil characteristics

- 3.17. Soil is a multi-functional 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. The main environmental concerns about soil pertain to its degradation through, inter alia, soil erosion or nutrient depletion.
- 3.18. Statistics on soil characteristics are an important tool for policy makers, particularly in countries that rely heavily on agriculture and forestry to sustain livelihoods, and for which the quality and amount of soil resources are very relevant.
- 3.19. 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 FAO<sup>25</sup> or the Harmonised World Soil Database<sup>26</sup>) and also many countries have produced a classification of their own soil types for national purposes.<sup>27</sup> 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.
- 3.20. Information on soil degradation and nutrient content for specific types of soil or specific locations should also be included in this topic. Statistics on degradation include measures of erosion, desertification, salinization, waterlogging, acidification and compaction of specific soil types in specific parts of the country. The nutrient content of soil is typically assessed using data on levels of Nitrogen (N), Phosphorous (P), Calcium (Ca), Magnesium (Mg), Potassium (K) and Zinc (Zn). Data sources for soil degradation types and extent, as well as nutrient content, are usually produced by scientific research and monitoring programmes, as well as through estimation and modelling by research institutions and agricultural authorities.

<sup>&</sup>lt;sup>25</sup> FAO has described 30 soil groups: acrisols, albeluvisols, alisols, andosols, anthrosols, arenosols, calcisols, cambisols, chernozems, cryosols, durisols, ferralsols, fluvisols, gleysols, gleysols, histosols, kastanozems, leptosols, lixisols, luvisols, nitisols, phaeozems, planosols, plinthosols, podzols, regosols, solonchaks, solonetz, umbrisols and vertisols. FAO (1998). "World Reference Base for Soil Resources". Available from http://www.foo.org/docrap.0120

http://www.fao.org/docrep/W8594E/w8594e03.htm#elements of the world reference base for soil resources (accessed 7 June 2013).
 <sup>26</sup> 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. Available from <a href="http://webarchive.iiasa.ac.at/Research/LUC/External-World-soil-database/HWSD\_Documentation.pdf">http://webarchive.iiasa.ac.at/Research/LUC/External-World-soil-database/HWSD\_Documentation.pdf</a> (accessed 11 October 2013).

<sup>&</sup>lt;sup>27</sup> For example, the United States Department of Agriculture soil taxonomy includes 12 soil orders: alfisol, andisols, aridisols, entisols, gelisols, histosols, inceptisols, mollisols, oxisols, spodosols, ultisols and vertisols. Available from

http://www.nrcs.usda.gov/Internet/FSE\_DOCUMENTS/nrcs142p2\_051233.pdf (accessed 7 June 2013).

- 3.21. Soil characteristics are measured through a series of inventory processes, known collectively as a soil survey. Typically, a soil survey produces data and maps by soil types, soil suitability for various purposes, hazard and degradation potential and, in some cases, maps of specific soil properties. Data and maps on soil typologies covering the national territory are primarily produced by scientific research institutions as well as by geological, geographical and, sometimes, agricultural authorities.
- 3.22. Soil pollution statistics are included under Topic 1.3.4: Soil pollution.

Co	Component 1: Environmental Conditions and Quality					
Su	Sub-component 1.1: Physical Conditions					
Top	Topic 1.1.4: Soil Characteristics					
St	atistics and Related Information	Catagory of	Potential	Mathadalagiaal		
(Bo	<b>Id Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance		
a.	Soil characterization		<ul> <li>By location</li> </ul>	<ul> <li>FAO and the International</li> </ul>		
	1. Area by soil types	Area	<ul> <li>By soil type</li> </ul>	Institute for Applied Systems		
b.	Soil degradation		<ul> <li>National</li> </ul>	Analysis (IIASA) Harmonized		
	1. Area affected by soil erosion	Area	<ul> <li>Sub-national</li> </ul>	World Soil Database		
	2. Area affected by desertification	Area		International Soil Reference		
	3. Area affected by salinization	Area		and Information Centre (ISRIC)		
	4. Area affected by waterlogging	Area		World Data Centre for Soils		
	5. Area affected by acidification	Area		<ul> <li>United Nations Convention</li> <li>to Combat Description</li> </ul>		
	6. Area affected by compaction	Area		(UNCCD)		
с.	Nutrient content of soil, measured in		<ul> <li>By soil type</li> </ul>	• FAO Global Assessment of		
	levels of:		<ul> <li>By nutrient</li> </ul>	Human-induced Soil		
	1. Nitrogen (N)	Concentration	<ul> <li>National</li> </ul>	Degradation (GLASOD)		
	2. Phosphorous (P)	Concentration	<ul> <li>Sub-national</li> </ul>			
	3. Calcium (Ca)	Concentration				
	4. Magnesium (Mg)	Concentration				
	5. Potassium (K)	Concentration				
	6. <i>Zinc</i> ( <i>Zn</i> )	Concentration				
	7. Other	Concentration				

Table 3.1.1.4: Statistics and Related Information for Topic 1.1.4

# Sub-component 1.2: Land Cover, Ecosystems and Biodiversity

- 3.23. This sub-component organizes environment statistics on land cover, ecosystems and biodiversity, as well as their recordable changes over time and across locations. Land cover is defined by FAO as, "the observed (bio) physical cover on the earth's surface."<sup>28</sup> Changes in land cover are the result of natural processes and changes in land use. 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 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.<sup>29</sup> It is also a measure of ecosystem health. Biodiversity is a fundamental characteristic of ecosystems, while variability among ecosystems is a fundamental driver of biodiversity.
- 3.24. Protected areas and species are included in this sub-component because of their inherent role in maintaining biodiversity and ecosystem health. The main purpose of the designation of protected areas and species is to sustain valuable ecosystems and the biodiversity and survival of threatened or key species that exist in certain zones.
- 3.25. Land cover statistics can be used to systematically record the biophysical characteristics of land. They include 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.
- 3.26. Statistics related to ecosystems and biodiversity are critical given the increasing understanding of the role ecosystems play in human wellbeing and evidence of biodiversity loss across the planet. 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).
- 3.27. Because of the importance of forests worldwide, the most important aspects and statistics required to describe them are organized under a separate topic. Note that as forests constitute particular ecosystem and land cover categories, their characteristics are also contained within the other topics of this sub-component. Presenting forests as a separate topic will depend on

<sup>&</sup>lt;sup>28</sup> Food and Agriculture Organization of the United Nations (2005). "Land Cover Classification System concepts and user manual". Available from <u>http://www.fao.org/docrep/008/y7220e/y7220e00.htm</u> (accessed 21 June 2013).

<sup>&</sup>lt;sup>29</sup> United Nations, "Convention on Biological Diversity", Rio de Janeiro, 5 June 1992. Available from <u>http://treaties.un.org/doc/Treaties/1992/06/19920605%2008-44%20PM/Ch\_XXVII\_08p.pdf</u> (accessed 8 June 2013).

their significance in a given country or area. Similarly, other land cover or ecosystem categories can be presented as separate topics depending on national priorities.

3.28. Statistics on biological resources (timber, fish, etc.) and their harvesting are contained in Component 2: Environmental Resources and their Use.

# Topic 1.2.1: Land cover

- 3.29. This topic includes statistics on the extent, as well as physical and spatial characteristics of land cover. The main source of land cover information is remote sensing data that maps the different categories of land cover.
- 3.30. The Land Cover Classification System (LCCS) has been developed by the FAO.<sup>30</sup> The large number of combinations of land cover features that can be created using the LCCS approach apply to any type of land cover. After a comprehensive global consultation process, an interim classification composed of 14 classes has been developed in the SEEA-CF (included in Annex D).<sup>31</sup> These 14 classes have been generated using the LCCS approach and thus provide a comprehensive set of land cover types, all of which are 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 land cover statistics.

<sup>&</sup>lt;sup>30</sup> Food and Agriculture Organization of the United Nations (2000). "Land Cover Classification System". Available from <u>http://www.fao.org/docrep/003/x0596e/x0596e00.htm</u> (accessed 21 April 2013).

<sup>&</sup>lt;sup>31</sup> United Nations, European Union, Food and Agriculture Organization of the United Nations, International Monetary Fund, Organisation for Economic Co-operation and Development, and the World Bank (2014). "System of Environmental-Economic Accounting 2012 - Central Framework". Available from <a href="http://unstats.un.org/unsd/envaccounting/seeaRev/SEEA\_CF\_Final\_en.pdf">http://unstats.un.org/unsd/envaccounting/seeaRev/SEEA\_CF\_Final\_en.pdf</a> (accessed 30 September 2014).

diversity
<i></i>
Potential
gregations nd Scales Guidance
<ul> <li>y location</li> <li>y FAO Land Cover</li> <li>Classification System</li> <li>System of Environmental- Economic Accounting (SEEA)</li> <li>Central Framework (2012) land cover categories</li> <li>European Environment</li> <li>Agency (EEA)</li> <li>System of Environment</li> <li>Agency (EEA)</li> <li>Age</li></ul>

Table 3.1.2.1: Statistics and Related Information for Topic 1.2.1

#### Topic 1.2.2: Ecosystems and biodiversity

- 3.31. This topic covers physical quantitative as well as qualitative information and statistics about a country's main ecosystems, including the extent, the chemical and physical characteristics and the biological components (biodiversity) of the ecosystems. The extent and conditions of the ecosystems determine their capacity to produce ecosystem services.
- 3.32. 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<sup>32</sup> are forest, cultivated, dryland, coastal, marine, urban, polar, inland water, island and mountain. As recognized by the Millennium Ecosystem Assessment, these ecosystem reporting categories can and do overlap, so countries may want to decide as to the exact composition, inclusions and exclusions of the main ecosystems in accordance with national or existing international definitions.
- 3.33. Ecosystem categories are complicated to describe because of considerations of scale. Ecosystems can be alternatively grouped into biomes, biogeographical regions, habitats, river basins/sub-basins, etc. A biome is a distinctive community of plants, animals, fungi, etc. that occupy a distinct region, and is often referred to as an ecosystem. Depending on the country, ecosystems 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.
- 3.34. For each ecosystem category, sets of statistics and indicators can be produced to capture baselines and trends over time and space. These can be organised into the following categories:
  - 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 characteristics 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).

<sup>&</sup>lt;sup>32</sup> Millennium Ecosystem Assessment, 2005, "Ecosystems and Human Well-being: Synthesis". Available from <u>http://www.millenniumassessment.org/documents/document.356.aspx.pdf</u> (accessed 12 June 2013).

- iii. Statistics on biological components provide information on the diversity and conditions of plants, animals and living habitats (e.g., number of known species or species at risk of extinction).
- iv. Statistics on ecosystem goods and services describe the flows that humanity derives from ecosystems (e.g., amount of timber harvested).<sup>33</sup>

Statistics describing the extent, the chemical and physical characteristics and the biological components (biodiversity) of the ecosystems are included in this topic. Statistics describing the goods and services provided by ecosystems are included in Component 2 (Environmental resources and their use) and Component 3 (Residuals).

- 3.35. Statistics on biodiversity include statistics on the diversity of flora and fauna species (the plant and animal life of a particular region or time, generally regarded as that which is naturally occurring and indigenous). Biota is defined as all animal and plant life of a particular region or time. Biotic (living) factors function with the abiotic (non-living) factors to form a complex unit such as an ecosystem. The typical themes include the number and population trends of known species of flora and fauna (terrestrial, freshwater and marine), their vulnerability status category.
- 3.36. 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 categories and criteria<sup>34</sup> are based on the level of threat. The main categories are extinct; extinct in the wild; threatened (critically endangered, endangered and vulnerable); near threatened; and least concern.
- 3.37. 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.
- 3.38. Statistics on protected areas include physical and descriptive information and statistics on protected terrestrial and marine areas within the country. The IUCN Protected Area Management Categories<sup>35</sup> are based on the strictness of protection and serve as the classification for protected areas. The main categories are strict nature reserve; wilderness

<sup>&</sup>lt;sup>33</sup> Heinz Center (2008). "The State of the Nation's Ecosystems 2008." Measuring the Lands, Waters, and Living Resources of the United States. Washington, D.C.: Island Press. <sup>34</sup> International Union for Conservation of Nature, Species Survival Commission (2010). "Guidelines for Using the IUCN Red List Categories and

Criteria. Available from <u>http://www.iucnredlist.org/documents/reg\_guidelines\_en.pdf</u> (accessed 11 June 2013). <sup>35</sup> United Nations Environment Programme, World Conservation Monitoring Centre, "IUCN Management Categories". Available from

http://www.iucn.org/about/work/programmes/gpap\_home/gpap\_quality/gpap\_pacategories/ (accessed 14 November 2013).

area; national park; natural monument or feature; habitat/species management area; protected landscape/seascape; and protected area with sustainable use of natural resources.

- 3.39. The status of vulnerability of different species at national or local scale often reflected also by administrative and legal measures taken to protect the species; therefore, statistics on protected species are also relevant for this topic. The main source of data on protected areas and species 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.
- 3.40. Although information on ecosystems and biodiversity is well developed and increasingly available from ecosystem science and different disciplines, its use for producing statistics is rather infrequent and non-systematic. Developing meaningful statistics on ecosystems and biodiversity needs the collaboration of scientists and statisticians. Ongoing work on the SEEA Experimental Ecosystem Accounting, inter alia, will improve this situation in the future.
| Component 1: Environmental Conditions and Quality |  |                              |  |   |
|---|--|------------------------------|--|---|
| Sub   | -component 1.2: Land Cover, Ecosy  | stems and Biodiv             | ersity   |   |
| Topic 1.2.2: Ecosystems and biodiversity          |  |                              |  |   |
|   | Statistics and Related Information   |                              | Potential  |   |
| (Bol  | d Text - Core Set/Tier 1: Regular Text -   | Category of                  | Aggregations   | Methodological Guidance   |
| (200  | Tier 2: Italicized Text - Tier 3)  | Measurement                  | and Scales   |   |
| a.  | General ecosystem characteristics, extent and  |                              | By location  | Millennium Ecosystem Assessment   |
|   | pattern  |                              | <ul> <li>By ecosystem</li> </ul>                         | <ul> <li>Convention on Biological</li> </ul>  |
|   | 1. Area of ecosystems  | Area                         | (e.g., Forest,   | Diversity (CBD)   |
|   | 2. Proximity of ecosystem to urban areas and cropland                                | Distance                     | Cultivated, Dryland,<br>Coastal, Marine,                 | <ul> <li>UN Economic Commission for<br/>Europe (UNECE) Standard Statistical</li> </ul>      |
| b.  | Ecosystems' chemical and physical  |                              | Urban, Polar, Inland                                     | Classification of Flora, Fauna and  |
|   | characteristics  |                              | Water, Island,   | Biotopes (1996)   |
|   | 1. Nutrients   | Concentration                | Mountain) <sup>(0)</sup>                                 | Convention on Wetlands of   |
|   | 2. Carbon  | Concentration                |  | International Importance, especially<br>as Waterfowl Habitat (The Pamsar                    |
|   | 3. Pollutants  | Concentration                |  | Convention)   |
| с.  | Biodiversity   |                              | By ecosystem   | Millennium Ecosystem Assessment   |
|   | 1. Known flora and fauna species   | Number                       | (e.g., Forest,   | • CBD   |
|   | 2. Endemic flora and fauna species   | Number                       | Cultivated, Dryland,                                     | • The International Union for   |
|   | 3. Invasive alien flora and fauna species  | Number                       | Coastal, Marine,   | List of Threatened Species  |
|   | 4. Species population  | Number                       | Water, Island  | <ul> <li>UNECE Standard Statistical</li> </ul>  |
|   | 5. Habitat fragmentation   | Area, Description,           | Mountain) <sup>(b)</sup>                                 | Classification of Flora, Fauna and  |
|   |  | Location, Number             | <ul> <li>By status category</li> </ul>                   | Biotopes (1996)   |
|   |  |                              | (e.g., extinct, extinct                                  | <ul> <li>FAO FISHSTAT (Species</li> </ul>   |
|   |  |                              | in the wild,   | population and number of invasive   |
|   |  |                              | threatened, near   | alien species)  |
|   |  |                              | threatened, least  |   |
|   |  |                              | By class (e.g.   |   |
|   |  |                              | mammals fishes   |   |
|   |  |                              | birds, reptiles, etc.)                                   |   |
|   |  |                              | <ul> <li>National</li> </ul>                             |   |
|   |  |                              | <ul> <li>Sub-national</li> </ul>                         |   |
| d.  | Protected areas and species  |                              | <ul> <li>By location</li> </ul>                          | <ul> <li>IUCN Protected Area Management</li> </ul>  |
|   | 1. Protected terrestrial and marine area   | Number, Area                 | <ul> <li>By management</li> </ul>                        | Categories  |
|   | (also in 1.2.3.a)  | ,                            | category <sup>(*)</sup>                                  | <ul> <li>UNSD: Millennium Development</li> <li>Cool (MDC) Indicator 7.6 Matadata</li> </ul> |
|   |  |                              | • By ecosystem   | Goal (MDG) Indicator 7.0 Metadata   |
|   |  |                              | Cultivated, Dryland                                      |   |
|   |  |                              | Coastal, Marine,   |   |
|   |  |                              | Urban, Polar, Inland                                     |   |
|   |  |                              | Water, Island,   |   |
|   |  |                              | Mountain) <sup>(0)</sup>                                 |   |
|   |  |                              | <ul> <li>National</li> <li>Sub national</li> </ul>       |   |
|   | 2 Protected flora and fauna species  | Number                       | <ul> <li>By species</li> </ul>                           | IUCN Red List of Threatened   |
|   | 2. Froteeted from and fauna species  | i tulliooi                   | <ul> <li>By ecosystem</li> </ul>                         | Species   |
|   |  |                              | (e.g., Forest,   | <ul> <li>UNSD: MDG Indicator 7.7</li> </ul>   |
|   |  |                              | Cultivated, Dryland,                                     | Metadata  |
|   |  |                              | Coastal, Marine,   |   |
|   |  |                              | Urban, Polar, Inland                                     |   |
|   |  |                              | Water, Island,   |   |
|   |  |                              | By status category                                       |   |
|   |  |                              | <ul> <li>Dy status category</li> <li>National</li> </ul> |   |
|   |  |                              | <ul> <li>Sub-national</li> </ul>                         |   |
| (b) R   | eporting categories used in the Millennium Ecosystem                                 | Assessment (http://www.r     | nillenniumassessment.org/d                               | ocuments/document.356.aspx.pdf)   |
| (c) IU  | ICN reporting categories: Strict nature reserves; Wilde                              | rness areas; National parks  | s, Natural monuments or fea                              | tures; Habitat/species management areas;  |
| Prote<br>(http:                                   | tieu lanuscapes/seascapes; and Protected areas with su                               | stainable use of natural res | sources  |   |
| (mup.   | http://www.iucn.org/about/work/programmes/gpap_home/gpap_quality/gpap_pacategories/) |                              |  |   |

Table 3.1.2.2:	Statistics a	and Related	Information	for Topic 1	.2.2
1 00000 01112121	Sterrories (		111/01/11/01/01/	joi ropic r	

## Topic 1.2.3: Forests

- 3.41. Forests provide 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, biodiversity protection, and act as carbon sinks. Therefore, it is crucial to understand the extent and characteristics of forests and to produce statistics about their diverse dimensions. The importance of forests is reflected in the Millennium Development Goals (indicator 7.1 Proportion of land area covered by forest).
- 3.42. Forest is defined by FAO as land spanning more than 0.5 hectares with trees higher than 5 metres and a canopy cover of more than 10 per cent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use. Complementarily, FAO defines other wooded land as land not classified as "Forest", spanning more than 0.5 hectares; with trees higher than 5 metres and a canopy cover of 5-10 per cent, or trees able to reach these thresholds in situ; or with a combined cover of shrubs, bushes and trees above 10 per cent. It does not include land that is predominantly under agricultural or urban land use.<sup>36</sup>
- 3.43. The most important statistics in this topic include forest area which can be disaggregated by different forest types (e.g., primary forest, other naturally generated forest, planted forest, etc.). Forest area can also be shown according to dominant tree species, age distribution, productivity, primary use of forest, areas under sustainable forest management, protected forests, etc. 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. Statistics on the forest area affected by fire may also be included. (See also Topic 1.2.2: Ecosystems and biodiversity.)
- 3.44. Data on forest area and its biophysical characteristics may be obtained from remote sensing, field surveys, forest inventories and forestry statistics from forest management agencies (e.g., agricultural and forestry authorities).
- 3.45. Statistics on changes in forest area due to economic activities and natural processes as well as on timber and other forest resources and their use, are contained in Component 2: Environmental Resources and their Use.

<sup>&</sup>lt;sup>36</sup> FAO (2010). "Global Forest Resources Assessment 2010 Main Report". Available from <u>http://www.fao.org/docrep/013/i1757e/i1757e.pdf</u> (accessed 16 April 2013).

Co	<b>Component 1: Environmental Conditions and Quality</b>			
Su	b-component 1.2: Land Cover,	Ecosystems and	Biodiversity	
To	pic 1.2.3: Forests			
St	atistics and Related Information	Catagony of	Potential	Mathadalagiaal
( <b>B</b> 0	<b>Id Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance
a.	Forest area		By forest type	FAO Global Forest
	1. Total	Area	<ul> <li>National</li> </ul>	Resources Assessment (FRA)
	2. Natural	Area	<ul> <li>Sub-national</li> </ul>	<ul> <li>UN Forum on Forests</li> </ul>
	3. Planted	Area	<ul> <li>By dominant</li> </ul>	(UNFF) Monitoring,
	4. Protected forest area (also in 1.2.2.d)	Area	tree species	Assessment and Reporting
	5. Forest area affected by fire	Area	<ul> <li>By ownership</li> </ul>	(MAR)
b.	Forest biomass		category	UNSD: MDG Indicator 7.1
	1. Total	Volume		Montroal Process (Working
	2. Carbon storage in living forest	Mass		• Montreal Process (working Group on Criteria and Indicators
	biomass			for the Conservation and
				Sustainable Management of
				Temperate and Boreal Forests)
				<ul> <li>State of Europe's Forests</li> </ul>
				(Forest Europe/UNECE-FAO
				Forestry and Timber Section)

 Table 3.1.2.3: Statistics and Related Information for Topic 1.2.3

## Sub-component 1.3: Environmental Quality

- 3.46. 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.
- 3.47. 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 environmental media. The importance of the different pollutants can vary when considering the quality of the ecosystem or the health and wellbeing of humans and other living beings.
- 3.48. The spatial implications of pollutant concentration statistics are important especially because of the fluidity of the environmental media (e.g., fresh and marine water, air). Spatial information on the impacts on ecosystems near a pollution source is particularly important. Air and water serve as transporters of pollutants from one medium 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.
- 3.49. 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 per cent 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.
- 3.50. Most countries use 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 statistical series can be produced from these primary sources.

3.51. It should be noted that the emissions of these pollutants are not included here, but in Component 3: Residuals, linked to the activities and processes that generate, manage and finally discharge them to the environment.

# Topic 1.3.1: Air quality

- 3.52. This topic includes statistics on the ambient concentration of the most important air pollutants, including suspended solid particles, gases and other relevant pollutants that can have a negative effect on human and ecosystem health.
- 3.53. 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 near 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 in 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 UNECE 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 D: Classifications and environment statistics). Further information is also available in the WHO Air Quality Guidelines.37,38
- 3.54. The national monitoring of air quality is usually limited to urban settlements where polluting activities and the affected population are concentrated. Air quality in urban settlements is also relevant to Component 5: Human Settlements and Environmental Health. 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.
- 3.55. The statistics pertaining to concentration of gases in the atmosphere that are climate change drivers under this topic also include global concentrations of  $CO_2$  (carbon dioxide) and of  $CH_4$  (methane), which are the two main GHGs.

 <sup>&</sup>lt;sup>37</sup> WHO (2006). "Air Quality Guidelines - Global Update 2005, Particulate matter, ozone, nitrogen dioxide and sulfur dioxide". Available from <a href="http://www.euro.who.int/\_\_\_\_data/assets/pdf\_file/0005/78638/E90038.pdf?ua=1">http://www.euro.who.int/\_\_\_\_data/assets/pdf\_file/0005/78638/E90038.pdf?ua=1</a> (accessed 9 June 2015).
 <sup>38</sup> WHO (2006). "Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide, Global update 2005, Summary of risk

<sup>&</sup>lt;sup>38</sup> WHO (2006). "Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide, Global update 2005, Summary of risk assessment". Available from <u>http://whqlibdoc.who.int/hq/2006/WHO\_SDE\_PHE\_OEH\_06.02\_eng.pdf?ua=1</u> (accessed 9 June 2015).

Co	<b>Component 1: Environmental Conditions and Quality</b>				
Su	b-component 1.3: Environment	al Quality			
То	pic 1.3.1: Air quality				
St	atistics and Related Information		Potential		
( <b>B</b> c	<b>Id Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Category of Measurement	Aggregations and Scales	Methodological Guidance	
a.	Local air quality		<ul> <li>By point</li> </ul>	WHO Air Quality Guidelines	
	1. Concentration level of particulate	Concentration	measurement	- Global Update 2005,	
	matter (PM <sub>10</sub> )		Sub-national	Particulate matter, ozone,	
	2. Concentration level of particulate	Concentration	• Daily	nitrogen dioxide and sulfur	
	matter $(PM_{2,5})$	0:	Monthly	aloxide	
	3. Concentration level of tropospheric $(\mathbf{Q})$	Concentration	- Monuny maximum and	for particulate matter ozone	
	$0$ ozone ( $\mathbf{U}_3$ )	Concentration	average	nitrogen dioxide and sulfur	
	4. Concentration level of carbon monovide (CO)	Concentration	<ul><li>Yearly</li></ul>	dioxide, Global update 2005,	
	5 Concentration level of sulphur	Concentration	maximum and	Summary of risk assessment	
	dioxide (SO <sub>2</sub> )	concentration	average	<ul> <li>UNECE Standard Statistical</li> </ul>	
	6. Concentration levels of nitrogen	Concentration		Classification of Ambient Air	
	oxides (NO <sub>x</sub> )			Quality (1990)	
	7. Concentration levels of heavy metals	Concentration			
	8. Concentration levels of non-methane volatile organic compounds (NMVOCs)	Concentration			
	9. Concentration levels of dioxins	Concentration	-		
	10. Concentration levels of furans	Concentration			
	11. Concentration levels of other	Concentration			
	pollutants				
	12. Number of days where maximum	Number	<ul> <li>By pollutant</li> </ul>	• WMO	
	allowable levels were surpassed per year			-	
b.	Global atmospheric concentrations of		Global		
	greenhouse gases		-		
	1. Global atmospheric concentration	Concentration			
<u> </u>	level of carbon dioxide $(CO_2)$	Company	-		
	2. Global atmospheric concentration	Concentration			
	level of methane $(CH_4)$				

Table 3.1.3.1: Statistics and Related Information for Topic 1.3.1

## Topic 1.3.2: Freshwater quality

- 3.56. Without sufficient quantities of 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 several 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.
- 3.57. The quality of freshwater can be described by concentrations of nutrients and chlorophyll, organic matter, pathogens, metals, and organic contaminants, as well as by physical and chemical characteristics in surface water and groundwater. Pollutants found in groundwater are important but systematic measurements are often difficult.
- 3.58. 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.
- 3.59. The quality and quantity of freshwater are highly inter-related. Highly polluted water may not be usable therefore the actual usable quantity of water is significantly reduced. In addition, there may be high costs involved to treat polluted water.
- 3.60. 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. Most monitoring stations and regular monitoring programmes are aimed at measuring specific pollutants. 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 be relevant for specific local areas or parts of rivers and lakes, and are not representative at the national level.

3.61. The UNECE Standard Statistical Classification of Surface Freshwater Quality for the Maintenance of Aquatic Life (1992) lists the most important substances, parameters and statistics needed to assess freshwater quality (see Annex D: Classifications and environment statistics).

Co	Component 1: Environmental Conditions and Quality				
Su	b-component 1.3: Environment	al Quality			
То	pic 1.3.2: Freshwater quality	- •			
St	atistics and Related Information		Potential		
( <b>B</b> o	<pre>bld Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)</pre>	Category of Measurement	Aggregations and Scales	Methodological Guidance	
a.	Nutrients and chlorophyll		By water body	UNECE Standard Statistical	
	1. Concentration level of nitrogen	Concentration	• By	Classification of Freshwater	
	2. Concentration level of phosphorous	Concentration	watershed/river	Quality for the Maintenance of	
	3. Concentration level of chlorophyll A	Concentration	basin	Aquatic Life (1992)	
b.	Organic matter		• By surface or	UN Environment Programme	
	1. Biochemical oxygen demand (BOD)	Concentration	groundwater	(UNEP) Global Environment	
	2. Chemical oxygen demand (COD)	Concentration	By point	Monitoring System - Water	
с.	Pathogens		Bu turno of	(GEMS-water)	
	1. Concentration levels of faecal coliforms	Concentration	water resource	- who	
d.	Metals (e.g., mercury, lead, nickel, arsenic, cadmium)				
	1. Concentration levels in sediment and freshwater	Concentration			
	2. Concentration levels in freshwater organisms	Concentration	-		
e.	Organic contaminants (e.g., PCBs, DDT, pesticides, furans, dioxins, phenols, and radioactive waste)			• UNECE Standard Statistical Classification of Freshwater Quality for the Maintenance of	
	1. Concentration levels in sediment and freshwater	Concentration		Aquatic Life (1992) <ul> <li>UNEP GEMS-Water</li> </ul>	
	2. Concentration levels in freshwater organisms	Concentration	-	Stockholm Convention	
f.	Physical and chemical characteristics		1	UNECE Standard Statistical	
	1. pH/Acidity/Alkalinity	Level		Classification of Freshwater	
	2. Temperature	Degrees	1	Quality for the Maintenance of	
	3. Total suspended solids (TSS)	Concentration	1	Aquatic Life (1992)	
	4. Salinity	Concentration	1	<ul> <li>UNEP GEMS-Water</li> </ul>	
	5. Dissolved oxygen (DO)	Concentration	1		
g.	Plastic waste and other freshwater debris		1		
Ŭ	1. Amount of plastic waste and other debris	Area, Mass			

Table 3.1.3.2: Statistics and Related Information for Topic 1.3.2

#### Topic 1.3.3: Marine water quality

- 3.62. Oceans cover about 70 per cent of the earth surface. They play a critical role in regulating weather and atmospheric processes, absorb 30 per cent of emitted CO<sub>2</sub>, are a fundamental part of the water cycle, and are home to species and varied ecosystems worldwide. Oceans also provide important ecosystem services for humans, with food being at the forefront. Oceans are under tremendous anthropogenic pressure including both chemical and physical contamination and over-exploitation. Marine water and ecosystems have been increasingly polluted in the last century so that biodiversity has been critically impacted. Degradation is accompanied by depletion of aquatic resources because of human exploitation.
- 3.63. Relevant statistics about marine and coastal water quality and pollutant concentrations can include, but are not restricted to, nutrients and chlorophyll, organic matter, pathogens, metals, organic contaminants, and physical and chemical characteristics, as well as coral bleaching.
- 3.64. The most commonly monitored marine pollutants and associated phenomena, such as eutrophication and red tide, can be analysed as locally, nationally or supranationally relevant, in terms of the type of pollution and effect.
- 3.65. Data sources for marine water quality statistics are typically either national or international monitoring stations, associated with either scientific research or compliance with policy objectives and targets. 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.
- 3.66. 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.
- 3.67. The UNECE 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 D: Classifications and environment statistics).

Component 1: Environmental Conditions and Quality					
Su	Sub-component 1.3: Environmental Quality				
To	pic 1.3.3: Marine water quality				
	Statistics and Related Information	Catagomy of	Potential		
( <b>B</b> o	Id Text - Core Set/Tier 1; Regular Text -	Callegory of Moosurement	Aggregations	Methodological Guidance	
	Tier 2; Italicized Text - Tier 3)	Wieasurement	and Scales		
a.	Nutrients and chlorophyll		<ul> <li>By coastal</li> </ul>	UNECE Standard Statistical	
	1. Concentration level of nitrogen	Concentration	zone, delta,	Classification of Marine Water	
	2. Concentration level of phosphorous	Concentration	estuary or other	Quality (1992)	
	3. Concentration level of chlorophyll A	Concentration	local marine	<ul> <li>NOAA/NASA</li> </ul>	
b.	Organic matter		environment	<ul> <li>UNEP Regional Seas</li> </ul>	
	1. Biochemical oxygen demand (BOD)	Concentration	Sub-national	Programme	
	2. Chemical oxygen demand (COD)	Concentration	• National		
с.	Pathogens		Supranational		
	1. Concentration levels of faecal	Concentration	By point		
	coliforms in recreational marine waters		measurement		
d.	Metals (e.g., mercury, lead, nickel,		• By water		
	arsenic, cadmium)		resource		
	1. Concentration levels in sediment and	Concentration			
	marine water				
	2. Concentration levels in marine	Concentration			
	organisms				
e.	Organic contaminants (e.g., PCBs,			<ul> <li>UNECE Standard Statistical</li> </ul>	
	DDT, pesticides, furans, dioxins,			Classification of Marine Water	
	phenols, and radioactive waste)			Quality (1992)	
	1. Concentration levels in sediment and	Concentration		<ul> <li>NOAA/NASA</li> </ul>	
	marine water			UNEP Regional Seas	
	2. Concentration levels in marine	Concentration		Programme	
	organisms			Stockholm Convention	
f.	Physical and chemical characteristics			<ul> <li>UNECE Standard Statistical</li> </ul>	
	1. pH/Acidity/Alkalinity	Concentration,		Classification of Marine Water	
		Level		Quality (1992)	
	2. Temperature	Degrees		NOAA/NASA     INIED Designed See	
	3. Total suspended solids (TSS)	Concentration	4	<ul> <li>UNEP Kegional Seas</li> </ul>	
	4. Salinity	Concentration	4	Fiogramme	
	5. Dissolved oxygen (DO)	Concentration	4		
	6. Density	Density	4		
g.	Coral bleaching		-		
_	1. Area affected by coral bleaching	Area			
h.	Plastic waste and other marine debris		<ul> <li>By coastal</li> </ul>	UNECE Standard Statistical	
	1. Amount of plastic waste and other	Area, Mass	zone, delta,	Classification of Marine Water	
	debris in marine waters		estuary or other	Quality (1992)	
i.	Red tide		local marine	NUAA/NASA     LINED Degiogral Sees	
	1. Occurrence	Number	environment	UNEP Kegional Seas	
L	2. Impacted area	Area	• Dy location	riogramme	
L	3. Duration	Duration	<ul> <li>Sub-mational</li> <li>National</li> </ul>		
j.	Oil pollution		Supranational		
	1. Area of oil slicks	Area	<ul> <li>Supranational</li> <li>By point</li> </ul>		
	2. Amount of tar balls	Area, Diameter,	measurement		
		Number	mousurement		

Table 3.1.3.3: Statistics and Related Information for Topic 1.3.3

## Topic 1.3.4: Soil pollution

- 3.68. Soil pollution 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, direct discharges of wastewater and industrial residuals to the soil, as well as deposition from air pollution.
- 3.69. Some of the most commonly measured soil pollutants include petroleum hydrocarbons (e.g., oil residuals and solvents), pesticides and heavy metals.
- 3.70. 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.
- 3.71. 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 pollution 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.
- 3.72. Statistics on soil pollution also cover statistics on contaminated sites. The term 'contaminated site' refers to a well-defined area where the presence of soil pollution has been confirmed and this presents a potential risk to humans, water, ecosystems or other receptors. The term 'potentially contaminated site' refers to sites where unacceptable soil contamination is suspected but not verified and detailed investigations need to be carried out to verify whether there is unacceptable risk of adverse impacts on receptors.<sup>39</sup> The relevant statistics include the number and area of contaminated, potentially contaminated, remediated and other sites.

<sup>&</sup>lt;sup>39</sup> European Commission, Joint Research Centre Scientific and Technical Reports (2011). "Soil Protection Activities and Soil Quality Monitoring in South Eastern Europe." Available from <u>http://eusoils.jrc.ec.europa.eu/esdb\_archive/eusoils\_docs/other/EUR24889.pdf</u> (accessed 14 June 2013).

<b>Component 1: Environmental Conditions and Quality</b>					
Su	b-component 1.3: Environment	al Quality			
To	pic 1.3.4: Soil pollution				
St	Statistics and Related Information Cotogory of Potential Mathedological				
( <b>B</b> o	<b>Id Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance	
a.	Sites affected by pollution		<ul> <li>By location</li> </ul>		
	1. Contaminated sites	Area, Number	<ul> <li>Sub-national</li> </ul>		
	2. Potentially contaminated sites	Area, Number	<ul> <li>By type of</li> </ul>		
	3. Remediated sites	Area, Number	pollutant		
	4. Other sites	Area, Number	<ul> <li>By source</li> </ul>		

Table 3.1.3.4: Statistics and Related Information for Topic 1.3.4

## Topic 1.3.5: Noise

- 3.73. 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 ecosystems.
- 3.74. 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 statistics on the levels of noise from specific sources and in specific locations. The resulting statistics, e.g., on noise levels and intensity, 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.
- 3.75. Statistics on noise levels in urban settlements are also relevant to Component 5: Human Settlements and Environmental Health.

<b>Component 1: Environmental Conditions and Quality</b>					
Sub-component 1.3: Environmen	Sub-component 1.3: Environmental Quality				
Topic 1.3.5: Noise					
Statistics and Related Information	Catagory of	Potential	Mathadalagical		
( <b>Bold Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance		
a. Levels of noise from specific sources	Level	By source	• WHO		
b. Levels of noise in specific locations	Level	<ul><li>By location</li><li>Sub-national</li></ul>			

Table 3.1.3.5: Statistics and Related Information for Topic 1.3.5

## 3.2 Component 2: Environmental Resources and their Use

- 3.76. Component 2 is closely related to the asset and physical flow accounts of the SEEA-CF<sup>40</sup> on which, where relevant, the text, terms and definitions are based. Environmental resources (or assets as they are referred to in the SEEA-CF) are the naturally occurring<sup>41</sup> living and non-living components of the Earth, together comprising the biophysical environment, which may provide benefits to humanity. Environmental resources include natural resources (such as subsoil resources (mineral and energy), soil resources, biological resources and water resources) and land. They can be naturally renewable (e.g., fish, timber or water) or non-renewable (e.g., minerals).
- 3.77. 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.
- 3.78. In Component 2, statistics on environmental resources and their use are focused on measuring stocks and changes in stocks of these resources and their use for production and consumption. Changes in the stocks of environmental resources include additions and reductions, from both anthropogenic and natural activities. In the case of non-renewable resources, continued extraction usually leads eventually to the depletion of the resource. For renewable resources, if extraction (e.g., abstraction, removal and harvesting) exceeds natural regeneration and human-made replenishment, the resource is depleted. Depletion, in physical terms, is the decrease in the quantity of the stock of natural resources that is due to the extraction of the natural resource by economic units occurring at a level greater than that of regeneration.
- 3.79. 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

<sup>&</sup>lt;sup>40</sup> United Nations, European Union, Food and Agriculture Organization of the United Nations, International Monetary Fund, Organisation for Economic Co-operation and Development, and the World Bank (2014). "System of Environmental-Economic Accounting 2012 - Central Framework". Available from <u>http://unstats.un.org/unsd/envaccounting/seeaRev/SEEA\_CF\_Final\_en.pdf</u> (accessed 30 September 2014).

<sup>&</sup>lt;sup>41</sup> Naturally occurring includes both wild and cultivated biological resources, since those which are cultivated, although managed by human intervention, grow as part of a natural process.

resources, are included. These activities have additional impacts on the environment beyond the direct use of individual environmental resources. Examples of analyses that bring together all environmental impacts of the individual activities are discussed and presented in Chapter 5: Applications of the FDES to cross-cutting environmental issues.

- 3.80. Statistics on the generation, management and discharge of residuals related to the use of environmental resources are covered in Component 3: Residuals.
- 3.81. The use of the products originating from environmental resources in the economy and by households can be captured in physical and monetary supply and use tables originating from national accounts and also from sectoral statistics. Linking environmental resources after their extraction from the environment to their use as products in the economy and to the SNA is the subject of the SEEA-CF.
- 3.82. Component 2 contains six sub-components that correspond to the main categories of environmental resources:
  - i. Sub-component 2.1: Mineral Resources;
  - ii. Sub-component 2.2: Energy Resources;
  - iii. Sub-component 2.3: Land;
  - iv. Sub-component 2.4: Soil Resources;
  - v. Sub-component 2.5: Biological Resources; and
  - vi. Sub-component 2.6: Water Resources.

#### **Sub-component 2.1: Mineral Resources**

## Topic 2.1.1: Stocks and changes of mineral resources

- 3.83. Minerals are elements or compounds that are a concentration of naturally occurring solid, liquid, or gaseous materials in or on the Earth's crust. Minerals include metal ores (including precious metals and rare earths), non-metallic minerals such as coal, oil, gas, stone, sand and clay, chemical and fertilizer minerals, salt and various other minerals such as gemstones, abrasive minerals, graphite, asphalt, natural solid bitumen, quartz and mica.
- 3.84. Stocks of mineral resources are defined as the amount of known deposits of non-metallic and metallic mineral resources. Classes of known mineral deposits include: commercially recoverable deposits; potential commercially recoverable deposits; as well as non-commercial and other known deposits. While stocks and changes in the stocks are measured in the same way for all minerals, in the FDES mineral resources used for the production of energy (e.g.,

fossil fuels such as oil, coal and natural gas), due to their significance, will be discussed again, under the separate sub-component 2.2 and topic 2.2.1: Energy resources.

- 3.85. Mineral 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.
- 3.86. Mineral resources considered in this sub-component 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 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 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.
- 3.87. Main sources of statistics about stocks of mineral resources are geological surveys and inventories, as well as economic statistics on mining and quarrying. The institutional partners in the data collection will be the mining authorities at the national and sub-national levels. Data are also available from governing commercial bodies such as gemstone and metallic mineral bourses and manufacturers' associations.

Co	<b>Component 2: Environmental Resources and their Use</b>			
Sul	b-component 2.1: Mineral Reso	ources		
Top	bic 2.1.1: Stocks and changes of min	eral resources		
Sta	atistics and Related Information	Cotogory of	Potential	Mathadalagiaal
(Bold Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3) Category Measurem		Measurement	Aggregations and Scales	Guidance
a.	Mineral resources		<ul> <li>By mineral</li> </ul>	<ul> <li>United Nations Framework</li> </ul>
	1. Stocks of commercially	Mass, Volume	(e.g., metal ores	Classification for Energy and
	recoverable resources		including precious	Mineral Resources (UNFC
	2. New discoveries	Mass, Volume	metals and rare	2009)
	3. Upward reappraisals	Mass, Volume	earths, coal, oil,	<ul> <li>SEEA Central Framework</li> </ul>
	4. Upward reclassifications	Mass, Volume	gas, stone, sand	(2012) asset and physical flow
	5. Extraction	Mass, Volume	and clay,	accounts
	6. Catastrophic losses	Mass, Volume	chemical and	<ul> <li>International Standard</li> </ul>
	7. Downward reappraisals	Mass, Volume	fertilizer minerals,	Industrial Classification of All
	8. Downward reclassifications	Mass, Volume	salt, gemstones,	Economic Activities (ISIC) Pay 4 Section P. Divisions 05
	9. Stocks of potentially commercially recoverable resources	Mass, Volume	graphite, asphalt,	09 Harmonized Commodity
	10. Stocks of non-commercial and other	Mass, Volume	hitumen quartz	Description and Coding
	known resources		mica)	Systems (HS) 2012 Section V
			National	Chapters 25 and 26, and Section
			<ul> <li>Sub-national</li> </ul>	VI Chapter 28

Table 3.2.1.1: Statistics and Related Information for Topic 2.1.1

#### Topic 2.1.2: Production and trade of minerals

- 3.88. The contribution of mining and quarrying of minerals to the value of goods and services produced by many countries is substantial. The outputs are minerals such as metal ores (iron and non-ferrous), stone, sand and clay, chemical and fertilizer minerals, and other minerals such as gemstones, abrasive minerals, etc. (classified under Section 1, Divisions 14-16 of the CPC Ver.2). Statistics on the amounts of minerals extracted or produced, their imports and exports are important to measure the pressure on these resources and can be linked to economic statistics to understand the significance of these resources in the national economy.
- 3.89. Main sources of statistics about production and trade of minerals are industrial commodity statistics, sectoral statistics on mining and quarrying, and trade statistics. Activities engaged in the production of minerals are captured under the relevant ISIC Rev. 4 categories in Section B Mining and quarrying. Main partners for primary activity data include the ministry responsible for mining and NSOs.
- 3.90. Production and trade of minerals that are energy sources are discussed under Topic 2.2.2: Production, trade and consumption of energy.

Co	<b>Component 2: Environmental Resources and their Use</b>			
Su	b-component 2.1: Mineral Reso	ources		
Top	bic 2.1.2: Production and trade of mi	nerals		
Sta	atistics and Related Information	Cotogowy of	Potential	Mathadalagiaal
(Bo	<b>Id Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance
a.	Production of minerals	Mass, Volume	<ul> <li>By mineral</li> </ul>	<ul> <li>United Nations Framework</li> </ul>
b.	Imports of minerals	Currency, Mass, Volume	(e.g., metal ores including precious	Classification for Energy and Mineral Resources (UNFC)
с.	Exports of minerals	Currency, Mass, Volume	metals and rare earths coal, oil, gas, stone, sand and clay, chemical and fertilizer minerals, salt, gemstones, abrasive minerals, graphite, asphalt, natural solid bitumen, quartz, mica) National	<ul> <li>SEEA Central Framework (2012) asset and physical flow accounts</li> <li>International Standard Industrial Classification of All Economic Activities (ISIC) Rev. 4, Section B, Divisions 05-09</li> <li>Harmonized Commodity Description and Coding Systems (HS) 2012, Section V, Chapters 25 and 26, and Section VI Chapter 28</li> </ul>

Table 3.2.1.2: Statistics and Related Information for Topic 2.1.2

### **Sub-component 2.2: Energy Resources**

#### Topic 2.2.1: Stocks and changes of energy resources

- 3.91. Energy can be produced from non-renewable or renewable sources. Non-renewable energy resources are the minerals used for energy production. They 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 non-renewable energy resources are defined as the amount of known deposits of mineral energy resources. They include fossil fuels (e.g., 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 mineral energy deposits include: commercially recoverable deposits; potential commercially recoverable deposits; as well as non-commercial and other known deposits.
- 3.93. Extraction of non-renewable 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 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 stocks of non-renewable energy resources 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 non-renewable energy resources are economic statistics on mining as well as energy statistics.
- 3.95. Energy from renewable sources is captured from sources that replenish themselves. Renewable energy includes solar (photovoltaic and thermal), hydroelectric, geothermal, tidal action, wave action, marine (non-tidal currents, temperature differences and salinity gradients), wind and biomass energy, all of which are naturally replenished, even though their flow may be limited.
- 3.96. Stocks of renewable energy resources are not subject to depletion in a similar manner to nonrenewable energy resources. Additionally, their stocks are difficult to accurately define,

except for biomass, and even so it would only make sense measuring them for those resources with slow replenishment rates (such as wood). Furthermore, biomass can have energy and non-energy use, making it hard to distinguish between what would constitute energy resources and non-energy resources. Thus, stocks of renewable energy resources are not included in the FDES. However, the consumption 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 under topic 2.2.2.

Co	<b>Component 2: Environmental Resources and their Use</b>			
Sul	b-component 2.2: Energy Resou	urces		
Top	bic 2.2.1:Stocks and changes of energy	gy resources		
St	atistics and Related Information	Catagony of	Potential	Mathadalagiaal
( <b>B</b> 0	<b>Id Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance
a.	Energy resources		<ul> <li>By resource</li> </ul>	UNSD: International
	1. Stocks of commercially recoverable	Mass, Volume	(e.g., natural gas,	Recommendations for Energy
	resources		crude oil and	Statistics (IRES)
	2. New discoveries	Mass, Volume	natural gas	<ul> <li>International Energy Agency</li> </ul>
	3. Upward reappraisals	Mass, Volume	liquids, oil shale,	(IEA) Energy Statistics Manual
	4. Upward reclassifications	Mass, Volume	and extra heavy	<ul> <li>SEEA Central Framework</li> </ul>
	5. Extraction	Mass, Volume	oil (includes oil	(2012) asset and physical flow
	6. Catastrophic losses	Mass, Volume	extracted from oil	accounts
	7. Downward reappraisals	Mass, Volume	sands), coal and	UNFC 2009     ISIC Days A. Startian D.
	8. Downward reclassifications	Mass, Volume	lignite, peat, non-	• ISIC Rev. 4, Section B,
	9. Stocks of potentially commercially recoverable resources	Mass, Volume	except for coal or	<ul> <li>HS 2012, Section V, Chapter</li> </ul>
	10. Stocks of non-commercial and other known resources	Mass, Volume	<ul> <li>horium ores)</li> <li>National</li> <li>Sub-national</li> </ul>	27

Table 3.2.2.1: Statistics and Related Information for Topic 2.2.1

#### Topic 2.2.2: Production, trade and consumption of energy

- 3.97. Energy production refers to the capture, extraction or manufacture of fuels or other energy products in forms which are ready for general consumption. Energy is produced for human use in a number of different ways, depending on its source. Energy production, transformation, distribution and consumption are processes done with different efficiency rates and which cause distinct environmental impacts (land use change, air pollution, GHG emissions, waste etc.). Therefore producing statistics to describe these activities is key to inform environmental sustainability policy.
- 3.98. Total energy production originates from sources that can be classified as non-renewable or renewable. These constitute key environment statistics that can assist when analysing the sustainability of the energy mix at the national level.
- 3.99. Energy production includes the production of primary and secondary energy. Primary energy refers to energy sources as found in their natural state as opposed to derived or secondary energy, which is the result of the transformation of primary sources. Imports and exports of energy refer to the amount of fuels, electricity and heat obtained from or supplied to other countries. Total energy supply is intended to show flows representing energy entering the national territory for the first time, energy removed from national territory and stock changes. It represents the amount of energy which is available on the national territory during the reference period. Final energy consumption refers to the consumption of primary and secondary energy by households and economic activities.
- 3.100. The main sources of statistics on the production, trade and consumption of energy are energy statistics, foreign trade statistics and energy balances that are available from national energy authorities or NSOs in most countries. The most important statistics on energy production are by the different types of non-renewable and renewable energy sources, production of primary and secondary energy, including the amount of electricity produced. Both total production of primary and secondary energy can be disaggregated by energy resource used or fuel, as regularly produced for national energy balances. Statistics on energy consumption should be broken down by economic activity (based on ISIC) and households. For specific analytical purposes energy consumption by certain sectors (e.g., international transport) or population groups (tourists) can also be estimated.
- 3.101. The production of energy from non-renewable and renewable sources is captured under the economic activities ISIC Rev. 4, Section B, Divisions 05 Mining of coal and lignite and 06 Extraction of crude petroleum and natural gas; 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)<sup>42</sup>.

<sup>&</sup>lt;sup>42</sup> United Nations Statistics Division (2011). "International Recommendations for Energy Statistics (draft version)". Available from <u>http://unstats.un.org/unsd/statcom/doc11/BG-IRES.pdf</u> (accessed 10 November 2013).

<b>Component 2: Environmental Resources and their Use</b>				
Sul	o-component 2.2: Energy Reso	urces		
Tor	bic 2.2.2: Production, trade and cons	umption of energy		
	Statistics and Related Information		Potential	
(Bo	d Text - Core Set/Tier 1; Regular Text -	Category of	Aggregations	Methodological Guidance
	Tier 2; Italicized Text - Tier 3)	Measurement	and Scales     By non-	C
a.	Production of energy		<ul> <li>By non-</li> </ul>	UNSD: IRES
	1. Total production	Energy unit, Mass, Volume	renewable resource (e.g., petroleum,	<ul><li>IEA Energy Statistics Manual</li><li>Joint Wood Energy Enquiry</li></ul>
	2. Production from non-renewable sources	Energy unit, Mass, Volume	natural gas, coal, nuclear fuels, non-	(UNECE-FAO Forestry and Timber Section)
	3. Production from renewable sources	Energy unit, Mass, Volume	<ul> <li>sustainable</li> <li>firewood, waste,</li> <li>other non-</li> <li>renewables)</li> <li>By renewable</li> <li>resource (e.g.,</li> <li>solar,</li> <li>hydroelectric,</li> <li>geothermal, tidal</li> <li>action, wave</li> <li>action, marine,</li> <li>wind and biomass)</li> <li>National</li> </ul>	
	4 Primary energy production	Energy unit Mass	<ul> <li>Sub-national</li> <li>By primary</li> </ul>	
	. Trimary energy production	Volume	energy resource	
	5. Imports of energy	Energy unit, Mass,	(e.g., petroleum,	
	1 00	Volume	natural gas, coal,	
	6. Exports of energy	Energy unit, Mass, Volume	hydroenergy, geothermal,	
	7. Secondary energy production	Energy unit, Mass, Volume	<ul> <li>nuclear fuels, cane</li> <li>products, other</li> <li>primary)</li> <li>By secondary</li> <li>energy resource</li> <li>(e.g., electricity,</li> <li>liquefied</li> <li>petroleum gas,</li> <li>gasoline/alcohol,</li> <li>kerosene, diesel</li> <li>oil, fuel oil, coke,</li> <li>charcoal, gases,</li> <li>other secondary)</li> <li>National</li> <li>Sub-national</li> </ul>	
b.	Total energy supply	Energy unit, Mass,	• By energy	
	Final concumption of an array	Volume	product     Py households	
с.	Final consumption of energy	Energy unit, Mass, Volume	<ul> <li>By households</li> <li>By ISIC</li> <li>economic activity</li> <li>By tourists</li> <li>National</li> </ul>	
			<ul> <li>Sub-national</li> </ul>	

# Table 3.2.2.2: Statistics and Related Information for Topic 2.2.2

## Sub-component 2.3: Land

- 3.102. 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 also Topic 1.2.1: Land cover) and land use. These aspects are strictly related: while land cover describes the biophysical aspects 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 changes. Generally, the total area of a country will remain unchanged from one period to the next<sup>43</sup>. Hence, changes in the stocks of land will comprise changes within and between stocks in different classes of land cover and land use (land restructuring).
- 3.103. The total area of a country is the area enclosed by its inland borders and, if applicable, the sea.<sup>44</sup> The land area of a country is the total area minus inland waters. While inland waters (e.g., rivers, lakes, ponds etc.), are included in land use, 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

- 3.104. 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.
- 3.105. A reference framework for the interim classification of land use is provided in the SEEA-CF<sup>45</sup> as agreed after a comprehensive global consultation process. The development of the land use classification included in the SEEA-CF, 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

<sup>&</sup>lt;sup>43</sup> Unless there are geopolitical changes, border corrections, natural events or catastrophes, or land reclamation.

<sup>&</sup>lt;sup>44</sup> 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). Text of the United Nations Convention on the Law of the Sea. Available from http://www.un.org/Depts/los/convention\_agreements/texts/unclos/unclos\_e.pdf (accessed 17 October 2013).

<sup>&</sup>lt;sup>45</sup> United Nations, European Union, Food and Agriculture Organization of the United Nations, International Monetary Fund, Organisation for Economic Co-operation and Development, and the World Bank (2014). "System of Environmental-Economic Accounting 2012 - Central Framework". Available from <a href="http://unstats.un.org/unsd/envaccounting/seeaRev/SEEA\_CF\_Final\_en.pdf">http://unstats.un.org/unsd/envaccounting/seeaRev/SEEA\_CF\_Final\_en.pdf</a> (accessed 30 September 2014).

needs which have arisen during the global consultation process on this issue. The aim of the land use classification presented in the SEEA-CF 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 D: Classifications and environment statistics.

- 3.106. This topic also includes statistics on land use pertaining to specific agricultural and forest management methods, in particular, land under organic farming, irrigation, agroforestry and land under sustainable forest management as well as on land under different ownership categories. These statistics are important because they describe the way how the use and management of land and biological resources impact the environment.
- 3.107. 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.
- 3.108. Cross-combination of land use and land cover categories show what kind of human 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 1.2.2: Ecosystems and biodiversity).

<b>Component 2: Environmental Resources and their Use</b>							
Sub-component 2.3: Land Topic 2.3.1: Land use							
( <b>Bold Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )		Measurement	Aggregations and Scales	Guidance			
a.	Area under land use categories	Area	By type of land use (e.g., agriculture; forestry; land used for aquaculture; use of built-up and related areas; land used for maintenance and restoration of environmental functions; other uses of land not elsewhere classified; land not in use; inland waters used for aquaculture or holding facilities; inland waters used for maintenance and restoration of environmental functions; other uses of inland waters not elsewhere classified; inland waters not elsewhere classified; inland waters not elsewhere classified; inland waters of coral reefs, mangroves, etc.); Exclusive Economic Zone (EEZ)) - Netimel	<ul> <li>FAO</li> <li>UNECE Standard Classification of Land Use (1989)</li> <li>SEEA Central Framework (2012) Annex 1</li> </ul>			
	1. Area of land under organic farming	Area	Sub-national	FAO Inter-departmental Working Group on Organic Agriculture			
	2. Area of land under irrigation	Area	-				
	3. Area of land under sustainable forest management	Area		Forest Stewardship Council			
	4. Area of land under agroforestry	Area					
c.	Land ownership	Area	<ul><li>By ownership category</li><li>National</li><li>Sub-national</li></ul>	• FAO			

Table 3.2.3.1: Statistics and Related Information for Topic 2.3.1

## Topic 2.3.2: Use of forest land

- 3.109. Changes in forest area in the different categories are the result of economic activities (afforestation, deforestation), reclassifications among the categories, or natural processes (expansion or regression). Afforestation is defined by FAO as the establishment of forest through planting and/or deliberate seeding on land that, until then, was not classified as forest.<sup>46</sup> It implies a transformation from non-forest to forest. In turn, deforestation is defined by FAO as the conversion of forest to another land use or the long-term reduction of the tree canopy cover below the minimum 10 per cent threshold.<sup>47</sup> Reforestation, which is the reestablishment of forest through planting and/or deliberate seeding on land classified as forest, <sup>48</sup> is also included here.
- 3.110. Not all forest land is used primarily for wood production. The primary designated functions of forests are: production; protection of soil and water; conservation of biodiversity; social services; multiple use; and other. To better understand the uses of forest land, statistics on forest land should be broken down according to its primary designated function.

<sup>&</sup>lt;sup>46</sup> FAO (2010). "Global Forest Resources Assessment 2010 Main Report". Available from http://www.fao.org/docrep/013/i1757e/i1757e.pdf (accessed 16 April 2013)

<sup>&</sup>lt;sup>47</sup> FAO continues, deforestation implies the long-term or permanent loss of forest cover and implies transformation into another land use. Such a loss can only be caused and maintained by a continued human-induced or natural perturbation. Deforestation includes areas of forest converted to agriculture, pasture, water reservoirs and urban areas. The term specifically excludes areas where the trees have been removed as a result of harvesting or logging, and where the forest is expected to regenerate naturally or with the aid of silvicultural measures. Unless logging is followed by the clearing of the remaining logged-over forest for the introduction of alternative land uses, or the maintenance of the clearings through continued disturbance, forests commonly regenerate, although often to a different, secondary condition. In areas of shifting agriculture, forest, forest fallow and agricultural lands appear in a dynamic pattern where deforestation and the return of forest occur frequently in small patches. To simplify reporting of such areas, the net change over a larger area is typically used. Deforestation also includes areas where, for example, the impact of disturbance, overutilization or changing environmental conditions affects the forest to an extent that it cannot sustain a tree cover above the 10 percent threshold. FAO (2000). "Global Forest Resources Assessment 2000 Main Report". Available from

<sup>&</sup>lt;u>ftp://ftp.fao.org/docrep/fao/003/Y1997E/FRA%202000%20Main%20report.pdf</u> (accessed 16 April 2013).
<sup>48</sup> FAO (2010). "Global Forest Resources Assessment 2010 Main Report". Available from <u>http://www.fao.org/docrep/013/i1757e/i1757e.pdf</u> (accessed 16 April 2013).

<b>Component 2: Environmental Resources and their Use</b>							
Sub-component 2.3: Land							
Topic 2.3.2: Use of forest land							
Statistics and Related Information		Category of Measurement	Potential Aggregations and Scales	Methodological Guidance			
( <b>Bold Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )							
a.	Use of forest land		<ul> <li>By forest type</li> </ul>	<ul> <li>FAO FRA</li> </ul>			
	1. Area deforested	Area	<ul> <li>National</li> </ul>	<ul> <li>UNFF MAR</li> </ul>			
	2. Area reforested	Area	<ul> <li>Sub-national</li> </ul>	<ul> <li>UNSD: MDG Indicator 7.1</li> </ul>			
	3. Area afforested	Area	<ul> <li>By dominant</li> </ul>	Metadata			
	4. Natural growth	Area	tree species	<ul> <li>Montreal Process (Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests)</li> <li>State of Europe's Forests (Forest Europe/UNECE-FAO Forestry and Timber Section)</li> </ul>			
b.	Forest area by primary designated function	Area	<ul> <li>Production</li> <li>Protection of soil and water</li> <li>Conservation of biodiversity</li> <li>Social services</li> <li>Multiple use</li> <li>Other</li> </ul>	• FAO FRA			

 Table 3.2.3.2: Statistics and Related Information for Topic 2.3.2
 Particular

#### Sub-component 2.4: Soil Resources

- 3.111. Soil resources comprise the top layers (horizons) of soil that form a biological system. Accounting for soil resources can provide information on the area and volume of soil resources lost due to erosion, degradation, or made unavailable by changes in land cover and other sources. Accounting for soil resources in terms of their types, nutrient content, carbon content and other characteristics is relevant for more detailed examination of the health of soil systems, and their connections between soil resources and production in agriculture and forestry.
- 3.112. Additions to the stock of the volume of soil resources may originate from soil formation and deposition, or upwards reappraisals and reclassifications. Reduction in the stock may be the result of extraction, soil erosion, catastrophic losses, and downwards reappraisals and reclassifications. Measuring the changing volume of soil is necessary to assess the extent of soil erosion, the impact of natural disasters, and to assess soil depletion due to economic activities. The flows of individual elements in the soils such as carbon and nutrients (nitrogen, phosphorous and potassium) can be recorded as part of material flow accounting and nutrient balances.
- 3.113. The relevant statistics cover the stocks of soil resources and their changes (additions and reductions) in terms of area and volume, by soil type. Statistics related to the area, and changes in the area under soil types are covered under Topic 1.1.4: Soil characteristics. Changes in the volume of soil resources and other aspects of accounting for soil resources are conceptually included in the FDES but the development of the necessary statistics is subject to further research. For more information, see SEEA-CF, paras. 5.318-5.342, Accounting for Soil Resources<sup>49</sup>.

<sup>&</sup>lt;sup>49</sup> United Nations, European Union, Food and Agriculture Organization of the United Nations, International Monetary Fund, Organisation for Economic Co-operation and Development, and the World Bank (2014). "System of Environmental-Economic Accounting 2012 - Central Framework". Available from <u>http://unstats.un.org/unsd/envaccounting/seeaRev/SEEA\_CF\_Final\_en.pdf</u> (accessed 30 September 2014).

<b>Component 2: Environmental Resources and their Use</b>						
Sub-component 2.4: Soil Resources						
Topic 2.4.1: Soil resources						
<b>Statistics and Related Information</b>	Cotogomy of	Potential	Mathadalagiaal			
( <b>Bold Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance			
The development of the necessary statistics in this topic is subject to further research.						

Table 3.2.4.1: Statistics and Related Information for Topic 2.4.1

## Sub-component 2.5: Biological Resources

- 3.114. Biological resources are renewable resources that are capable of regeneration through natural (non-managed or managed) processes. Biological resources include timber and aquatic resources and a range of other animal and plant resources (such as livestock, orchards, crops and wild animals), fungi and bacteria<sup>50</sup>. 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.
- 3.115. Biological resources can be natural (non-cultivated) or cultivated. Natural biological resources consist of animals, birds, fish and plants that yield both once-only and repeat products for which natural growth and/or regeneration is not under the direct control, responsibility and management of institutional units<sup>51</sup>.
- 3.116. Cultivated biological resources cover animal resources yielding repeat products and tree, crop and plant resources yielding repeat products whose natural growth and regeneration are under the direct control, responsibility and management of an institutional unit<sup>52</sup>. They 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.

# Topic 2.5.1: Timber resources

- 3.117. 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, and they are also a source of fuel. 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.
- 3.118. 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. Timber resources may also change due to the increase of forest land, or changes in management practices (reclassification). Stocks decrease due to removals of timber, natural losses and catastrophic losses. The volume of timber removals can be disaggregated according to the

<sup>&</sup>lt;sup>50</sup> Ibid.

<sup>&</sup>lt;sup>51</sup> Ibid.

<sup>&</sup>lt;sup>52</sup> Ibid.
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.

- 3.119. From a resource accounting perspective, afforestation is defined by SEEA-CF as the increase in the stock of forest<sup>53</sup> and other wooded land<sup>54</sup> due to either the establishment of new forest on land that was previously not classified as forest land, or as a result of silvicultural measures such as planting and seeding. In turn, deforestation is defined by SEEA-CF as the decrease in the stock of forest and other wooded land due to the complete loss of tree cover and transfer of forest land to other uses (as agricultural land, land under buildings, roads, etc.) or to no identifiable use. From a general forest perspective, FAO definitions may be found in Topic 1.2.3: Forests.
- 3.120. The most important economic activity responsible for the extraction, harvesting 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 round wood; 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.
- 3.121. 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.
- 3.122. 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-CF.

 <sup>&</sup>lt;sup>53</sup> As defined in Topic 1.2.3: Forests.
 <sup>54</sup> As defined in Topic 1.2.3: Forests.

Co	<b>Component 2: Environmental Resources and their Use</b>			
Su	b-component 2.5: Biological R	esources		
Top	bic 2.5.1: Timber resources			
Sta	atistics and Related Information	~ ^	Potential	
(Bo	d Text - Core Set/Tier 1: Regular Text -	Category of	Aggregations	Methodological
(20	Tier 2; Italicized Text - Tier 3)	Measurement	and Scales	Guidance
a.	Timber resources		• By type (e.g.,	SEEA Central Framework
	1.Stocks of timber resources	Volume	natural or planted)	(2012)
	2. Natural growth	Volume	<ul> <li>National</li> </ul>	<ul> <li>FAO FRA</li> </ul>
	3. Fellings	Volume	<ul> <li>Sub-national</li> </ul>	<ul> <li>State of Europe's Forests</li> </ul>
	4. Removals	Volume		(Forest Europe/UNECE-FAO
	5. Felling residues	Volume		Forestry and Timber Section)
	6. Natural losses	Volume		UNECE/FAO Joint Working
	7. Catastrophic losses	Volume		Party on Forest Statistics,
	8. Reclassifications	Volume		ISIC Rev 4 Section A
b.	Amount used of:		<ul> <li>National</li> </ul>	Division 02
	1. Fertilizers (also in 3.4.1.a)	Area, Mass, Volume	<ul> <li>Sub-national</li> </ul>	<ul> <li>FAOSTAT database</li> </ul>
	2. Pesticides (also in 3.4.1.b)	Area, Mass,	1	
		Volume		
с.	Forest production	Volume	<ul> <li>By type of product (e.g., timber, industrial roundwood, fuelwood, pulp, chips)</li> <li>National</li> <li>Sub-national</li> </ul>	<ul> <li>Central Product</li> <li>Classification (CPC)</li> <li>Joint Forest Sector</li> <li>Questionnaire</li> <li>(UNECE/FAO/Eurostat</li> <li>International Tropical Timber</li> <li>Organization [ITTO])</li> <li>FAO/ITTO/UNECE/Eurostat</li> <li>Inter-secretariat Working Group</li> <li>on Forest Sector Statistics</li> <li>UNECE Timber Committee</li> <li>UNECE/FAO Joint Working</li> <li>Party on Forest Statistics,</li> <li>Economics and Management</li> <li>ISIC Rev. 4, Section A,</li> <li>Division 02</li> <li>FAOSTAT database</li> </ul>
d.	Fuelwood production	Volume	National	FAO/ITTO/UNECE/Eurostat
e.	Imports of forest products	Currency, Mass,	• By type of	Inter-secretariat Working Group
		Volume	product	on Forest Sector Statistics
f.	Exports of forest products	Currency, Mass, Volume		<ul> <li>State of Europe's Forests (Forest Europe/UNECE-FAO Forestry and Timber Section)</li> <li>HS 2012, Sections IX and X</li> <li>FAOSTAT database</li> </ul>

Table 3.2.5.1: Statistics and Related Information for Topic 2.5.1

## Topic 2.5.2: Aquatic resources

- 3.123. Aquatic resources comprise fish, crustaceans, molluscs, shellfish, aquatic mammals, and other aquatic organisms that are considered to live within the boundaries of the EEZ of a country throughout their lifecycles, including 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.
- 3.124. 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, functions and services provided by the aquatic ecosystems, including the loss of biodiversity and genetic resources. The unsustainable extraction of marine resources is partly caused by illegal, unreported and unregulated (IUU) fishing.
- 3.125. Stocks of aquatic resources are difficult to measure in inland and marine waters, although certain estimation methodologies can be considered for this purpose. Aquaculture stocks can be more frequently estimated.
- 3.126. 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.
- 3.127. Aquaculture is the farming of aquatic organisms, including fish, molluscs, crustaceans and aquatic plants. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Farming also implies individual or corporate ownership of the stock being cultivated. 55 Aquaculture activities may also include the application of colorants, pellets, antibiotics, fungicides, hormones and other substances. Statistics on these aspects of aquaculture are very important to assess their impact on the environment.

<sup>&</sup>lt;sup>55</sup> Food and Agriculture Organization of the United Nations (1997). "Rural Aquaculture: Overview and Framework for Country Reviews". Available from <u>http://www.fao.org/docrep/003/x6941e/x6941e04.htm</u> (accessed 1 June 2013).

- 3.128. The FAO International Standard Statistical Classification for Aquatic Animals and Plants (ISSCAAP) is commonly used for statistics on aquatic resources.<sup>56</sup> The FAO has also developed a set of catch concepts for the different stages of the catch, depending on the inclusion or exclusion of by-catch and by-product.<sup>57</sup> The measurement of discarded catch is an important component in fully understanding the linkages between economic activity and the impact on aquatic resources.
- 3.129. The most important economic activity related to the extraction, harvesting 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.).
- 3.130. 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-CF.

<sup>&</sup>lt;sup>56</sup> Food and Agriculture Organization of the United Nations, "International Standard Statistical Classification for Aquatic Animals and Plants". Available from <u>ftp://ftp.fao.org/fi/document/cwp/handbook/annex/Annex/21istISSCAAP2000.pdf</u> (accessed 20 September 2013). <sup>57</sup> Food and Agriculture Organization of the United Nations, "Coordinating Working Party on Fishery Statistics, Handbook of Fishery Statistical

Standards". Available from ftp://ftp.fao.org/FI/DOCUMENT/cwp/handbook/annex/AnnexB1CatchConcepts.pdf (accessed 20 September 2013).

Co	Component 2: Environmental Resources and their Use				
Sul	b-component 2.5: Biological R	esources			
Tor	bic 2.5.2: Aquatic resources				
Sta	atistics and Related Information		Potential		
(Bo	<b>Id Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Category of Measurement	Aggregations and Scales	Guidance	
a.	Fish capture production	Mass	<ul> <li>By relevant</li> </ul>	FAO International Standard	
b.	Aquaculture production	Mass	freshwater and marine species • National • Sub-national	<ul><li>Statistical Classification for Aquatic Animals and Plants (ISSCAAP)</li><li>ISIC Rev. 4, Section A,</li></ul>	
c.	Imports of fish and fishery products	Currency, Mass, Volume	<ul> <li>By relevant freshwater and</li> </ul>	<ul><li>Division 03</li><li>The United Nations</li></ul>	
d.	Exports of fish and fishery products	Currency, Mass, Volume	<ul><li>marine species</li><li>By type of product</li><li>By species</li></ul>	Convention on the Law of the Sea (UNCLOS) • UNSD: MDG Indicator 7.4 Metadata	
e.	Amount used of:		• By type of	• HS 2012, Section I, Chapter	
	1. Pellets (also in 3.4.1.c) 2. Hormones (also in 3.4.1.d)	Mass, Volume Mass, Volume	water (i.e., marine or freshwater)	<ul> <li>03</li> <li>SEEA Central Framework</li> </ul>	
	3. Colourants (also in 3.4.1.e)	Mass, Volume	<ul> <li>National</li> <li>Sub national</li> </ul>	(2012)	
	4. Antibiotics (also in 3.4.1.f)	Mass, Volume	- Sub-fiational		
C	5. Fungicides	Mass, Volume	Devile		
I.	Aquatic resources	Mass	• By relevant		
	2 Additions to aquatic resources	Mass	marine species		
	3. <i>Reductions in aquatic resources</i>	Mass	<ul> <li>By type (e.g., natural or cultivated)</li> <li>National</li> </ul>		
			<ul> <li>Sub-national</li> </ul>		

Table 3.2.5.2: Statistics and Related Information for Topic 2.5.2

### Topic 2.5.3: Crops

- 3.131. Crops refer to plants or agricultural produce grown 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. On the other hand, small-scale agriculture which may be less resource intensive can be more environmentally friendly.
- 3.132. 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.
- 3.133. The application of biotechnology in the agriculture sector has resulted in the increased use of genetically modified organisms (GMOs) and products derived from them. GMOs are organisms that are produced through techniques in which the genetic material has been altered in a way that does not occur naturally by mating and/or natural recombination".<sup>58</sup> They can include genetically modified seeds and grain, plant tubers, spores, plant tissue and cells. Measurement of their use is an important aspect of environment statistics because of their relevance in the maintenance of genetic variability, their possible effect on non-target organisms and their implication in the evolution of pest resistance and loss of biodiversity. Maintaining genetic variability is also interconnected with genetic resources, which should not be confused with genetically modified organisms. Genetic resources are defined as genetic material of plants, animals or microorganisms containing functional units of heredity that are of actual or potential value as a resource for future generations of humanity.<sup>59</sup> Although statistics on genetic resources, which ensures the conservation and sustainable use of genetic resources.

<sup>&</sup>lt;sup>58</sup> Food and Agriculture Organization of the United Nations (2002). "Codex Alimentarius. Joint FAO/WHO Food Standards Programme". Available from <u>http://www.fao.org/docrep/005/y2772e/y2772e04.htm</u> (accessed 11 October 2014).

<sup>&</sup>lt;sup>59</sup> Convention on Biological Diversity (1992). "Article 2 – Use of terms". Available from <u>http://www.cbd.int/convention/articles/default.shtml?a=cbd-02</u> (accessed 11 October 2014).

3.134. For environment statistics, this topic covers statistics about the area used for, and the production of main crop types, annual and perennial crops, different planting methods, monoculture and resource-intensive farming systems, the use of genetically modified organisms as well as organic farming. Area harvested is especially important when measuring sown or planted areas (gross) versus harvested areas (net).<sup>60</sup> 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 chemical fertilizers are also relevant. Because of their effect on biodiversity, invasive pests and pollution, statistics on the use of pesticides (e.g., fungicides, herbicides, insecticides, 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 environment. The main source of data besides the NSO and the key institutional partner is usually the agricultural authority.

<sup>&</sup>lt;sup>60</sup> Food and Agriculture Organization of the United Nations (2011). "Crops Statistics – concepts, definitions and classifications". Available from <a href="http://www.fao.org/fileadmin/templates/ess/ess">http://www.fao.org/fileadmin/templates/ess/ess</a> test folder/documents/Production trade/definitions/Crops statistics concepts definitions classification <a href="statistics.concepts.edu">statistics.concepts.edu</a> definitions and classifications". Available from <a href="http://www.fao.org/fileadmin/templates/ess/ess">http://www.fao.org/fileadmin/templates/ess/ess</a> test folder/documents/Production trade/definitions/Crops statistics concepts definitions classification <a href="statistics.concepts.edu">statistics.concepts.edu</a> definitions <a href="statis

C0	mponent 2: Environmental R	tesources and t	neir Use	
Su	o-component 2.5: Biological Ro	esources		
Top	bic 2.5.3: Crops			
Sta	atistics and Related Information	C - 4	Potential	
(Bo	<b>Id Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Category of Measurement	Aggregations and Scales	Guidance
a.	Main annual and perennial crops		<ul> <li>By crop</li> </ul>	<ul> <li>FAO Indicative Crop</li> </ul>
	1. Area harvested	Area	<ul> <li>By size</li> </ul>	Classification (for 2010 round
	2. Area planted	Area	National	of agricultural censuses)
	3. Amount produced	Mass	<ul> <li>Sub-national</li> </ul>	• FAO/WHO Specifications
	4. Amount of organic production	Mass		for Pesticides (2010)
	5. Amount of genetically modified crops produced	Mass		FAO Specifications for Commonly Used Fertilizers
b.	Amount used of:		• By type of	(2009)
	1. Natural fertilizers (e.g., manure,	Area, Mass,	fertilizer	<ul> <li>ISIC Rev. 4, Section A,</li> <li>Division 1</li> </ul>
	compost, lime) (also in 3.4.1.a)	Volume	<ul> <li>By type of</li> </ul>	• EAOSTAT database
	2. Chemical fertilizers (also in 3.4.1.a)	Area, Mass, Volume	<ul><li>pesticide</li><li>By crop</li></ul>	<ul> <li>HS 2012, Section II</li> </ul>
	3. <b>Pesticides</b> (also in 3.4.1.b)	Area, Mass, Volume	<ul><li>National</li><li>Sub-national</li></ul>	
	4. Genetically modified seeds	Mass	<ul><li>By crop</li><li>National</li><li>Sub-national</li></ul>	
c.	Monoculture/resource-intensive		By crop	
	1 Area baing used for any dusting	A	<ul> <li>By size</li> <li>National</li> </ul>	
	1. Area being used for production	Area	<ul> <li>National</li> <li>Sub national</li> </ul>	
	2. Amount produced	Mass	- Sub-national	
	<i>3. Amount of genetically modified crops produced</i>	Mass		
d.	Imports of crops	Currency, Mass		
e.	Exports of crops	Currency, Mass		

# Table 3.2.5.3: Statistics and Related Information for Topic 2.5.3

# Topic 2.5.4: Livestock

- 3.135. 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, goats 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.<sup>61</sup> Nonetheless, livestock rearing is associated with multiple environmental effects. Livestock production contributes to GHG emissions. Animal husbandry directly or indirectly (grazing and production of feedstock) occupies a large percentage of land. 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 as well as from the inadequate handling of manure.
- 3.136. In a limited number of instances so far genetically modified animals, animal substances, tissues and micro-organisms have been introduced in the production of livestock and fish. The intent is to add economic value through the introduction of specific substances or tissue modifications. This has the potential for unintended environmental effects relating to the place of introduction or the nature of expression of the genetically modified organisms.
- 3.137. 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.
- 3.138. Environmentally relevant statistics on livestock include the number and characteristics 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.
- 3.139. The main source of data for livestock statistics is usually the agricultural authority or the NSO.

<sup>&</sup>lt;sup>61</sup> Food and Agriculture Organization of the United Nations (2006). "Livestock impacts on the environment". Available from <u>http://www.fao.org/ag/magazine/0612sp1.htm</u> (accessed 12 September 2013).

Co	<b>Component 2: Environmental Resources and their Use</b>			
Sul	b-component 2.5: Biological Re	esources		
Тор	bic 2.5.4: Livestock			
Statistics and Related Information			Potential	Mathadalagical
(Bo	<b>d Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance
a.	Livestock		<ul> <li>By type of</li> </ul>	<ul> <li>FAOSTAT database</li> </ul>
	1. Number of live animals	Number	animal	<ul> <li>ISIC Rev. 4, Section A,</li> </ul>
	2. Number of animals slaughtered	Number	<ul> <li>National</li> </ul>	Division 01
b.	Amount used of:		<ul> <li>Sub-national</li> </ul>	<ul> <li>HS 2012, Section I, Chapter</li> </ul>
	1. Antibiotics (also in 3.4.1.f)	Mass		01
	2. Hormones (also in 3.4.1.d)	Mass		
с.	Imports of livestock	Currency, Number		
d.	Exports of livestock	Currency, Number		

Table 3.2.5.4: Statistics and Related Information for Topic 2.5.4

#### Topic 2.5.5: Other non-cultivated biological resources

- 3.140. 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, class 0230) as well as wild animals that are trapped or killed for production, consumption and trade (ISIC Rev. 4, Section A, class 0170). This topic excludes timber and aquatic resources, as they are included in Topics 2.5.1 and 2.5.2 respectively.
- 3.141. The conservation of key habitats and landscapes and the species within them is key in order to prevent further biodiversity loss. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) states that the trade of wild species needs to be managed at national and international levels, to prevent over-exploitation.<sup>62</sup> 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 number of animals killed under these permits.
- 3.142. The main source of data and the institutional partners for these statistics include the environmental, natural resources and wildlife authorities, as well as the government agency responsible for hunting.

<sup>&</sup>lt;sup>62</sup>Convention on International Trade in Endangered Species of Wild Fauna and Flora (2008). "Non-detriment findings". Available from <u>http://www.cites.org/eng/prog/ndf/index.php</u> (accessed 18 September 2013).

Co	<b>Component 2: Environmental Resources and their Use</b>			
Su	b-component 2.5: Biological R	esources		
Top	bic 2.5.5: Other non-cultivated biolo	gical resources		
Sta	atistics and Related Information	Cotogowy of	Potential	Mathadalagiaal
(Bo	<b>Id Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance
a.	Permits for regulated hunting and trapping of wild animals		<ul> <li>By type of animal</li> </ul>	• ISIC Rev. 4, Section A, Class 0170
	1. Number of permits issued per year	Number	<ul> <li>By species</li> </ul>	
	2. Number of animal kills allowed by permits	Number		
b.	Imports of endangered species	Currency, Number		<ul> <li>Convention on International</li> </ul>
c.	Exports of endangered species	Currency, Number		Trade in Endangered Species of Wild Fauna and Flora (CITES)
d.	Reported wild animals killed or trapped for food or sale	Number		• ISIC Rev. 4, Section A, Class 0170
e.	Trade in wildlife and captive-bred	Description, Mass,	<ul> <li>By status</li> </ul>	<ul> <li>CITES</li> </ul>
	species	Number	category • National • Sub-national	
f.	Non-wood forest products and other	Mass, Volume	<ul> <li>By type of</li> </ul>	ISIC Rev. 4, Section A, Class
	plants		product <ul> <li>National</li> </ul>	0230
			<ul> <li>Sub-national</li> </ul>	

Table 3.2.5.5: Statistics and Related Information for Topic 2.5.5

#### **Sub-component 2.6: Water Resources**

- 3.143. 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 returns are needed by policy makers for a number of reasons, which include: estimating the amount of available water resources; monitoring abstraction from key water bodies to prevent overutilization; ensuring equitable usage of abstracted water; and tracking the volume of water returned to the environment.
- 3.144. *The International Recommendations for Water Statistics*<sup>63</sup> provides the definitions and groupings for the purposes of statistics on water resources and their use.

## Topic 2.6.1: Water resources

- 3.145. Water resources consist of fresh and brackish water, regardless of their quality, in inland water bodies including surface water, groundwater and soil water. Inland water stocks are the volume of water contained in surface and groundwater bodies and in the soil at a point in time. Water resources are also measured in terms of flows to and out of the inland water resources during a period of time. Surface water comprises all water that flows over or is stored on the ground's surface regardless of its salinity levels. Surface water includes water in artificial reservoirs, lakes, rivers and streams, snow, ice and glaciers. Groundwater comprises water that collects in porous layers of underground formations known as aquifers. Renewable water resources of a country are generated by precipitation and inflows of water from neighbouring territories and reduced by evapotranspiration.
- 3.146. 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 neighbouring territories, and the outflow of water to neighbouring 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 1.3.2: Freshwater quality and Topic 1.3.3: Marine water quality.

<sup>&</sup>lt;sup>63</sup> United Nations Statistics Division (2012). "International Recommendations for Water Statistics". Available from <u>http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf</u> (accessed 24 October2013).

Co	<b>Component 2: Environmental Resources and their Use</b>			
Sul	b-component 2.6: Water Resou	rces		
Top	bic 2.6.1: Water resources			
Sta	atistics and Related Information	Cata and a f	Potential	
(Bo	<b>Id Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance
a.	Inflow of water to inland water		National	UNSD: IRWS
	resources		<ul> <li>Sub-national</li> </ul>	<ul> <li>UNECE Standard Statistical</li> </ul>
	1. <b>Precipitation</b> (also in 1.1.1.b)	Volume	<ul> <li>By territory of</li> </ul>	Classification of Water Use
	2. Inflow from neighbouring	Volume	origin and	(1989)
	territories		destination	• UNSD: MDG Indicator 7.5
	3. Inflow subject to treaties	Volume		Metadata
b.	Outflow of water from inland water			FAU AQUASIAI
	resources			• SEEA Central Framework
	1. Evapotranspiration	Volume	_	(2012) asset accounts
	2. Outflow to neighbouring territories	Volume		<ul> <li>SEEA water</li> <li>UNSD: Environment</li> </ul>
	3. Outflow subject to treaties	Volume		- UNSD. Environment
	4. Outflow to the sea	Volume		Questionnaire
с.	Inland water stocks		<ul> <li>National</li> </ul>	Questionnane
	1. Surface water stocks in artificial	Volume	<ul> <li>Sub-national</li> </ul>	
	reservoirs			
	2. Surface water stocks in lakes	Volume		
	3. Surface water stocks in rivers and	Volume		
	streams			
	4. Surface water stocks in wetlands	Volume		
	5. Surface water stocks in snow, ice and	Volume		
	glaciers			
	6. Groundwater stocks	Volume		

Table 3.2.6.1: Statistics and Related Information for Topic 2.6.1

#### Topic 2.6.2: Abstraction, use and returns of water

- 3.147. Abstraction, use and returns of water are the flows of water between the environment and the human sub-system and within the human sub-system. Water abstraction is the amount of water that is removed from any source, either permanently or temporarily, in a given period of time. 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 by abstractor (economic activity or households). Water abstraction usually refers to the off-stream use of water. The most important off-stream uses for which water is abstracted are the following: (i) water supply to human settlements; (ii) water for agriculture; (iii) water for industries; and (iv) water for cooling in thermoelectricity generation.
- 3.148. In-stream water use refers to the use of water without moving it from its source or to the use when water is immediately returned with little or no alteration. The most important in-stream water uses are: (i) water for hydroelectricity generation; (ii) water for the operation of navigation locks; and (iii) water for freshwater aquaculture.
- 3.149. Water managers also use the category of in situ water use. The most important in situ water use is the ecological use, that is, the water used as a habitat for living organisms. Human in situ water uses include navigation, fishing, recreation and tourism, and waste loading (pollution dilution).
- 3.150. All human in-stream and in situ water uses, similarly to off-stream uses, have significant effects with regard to the ecological use of the same water resources. In-stream and in situ activities are usually measured in terms of the intensity of the use. In-stream and in situ activities that use water are covered under Topic 2.5.2: Aquatic resources and their use; Topic 2.2.2: Production, trade and consumption of energy; Topic 3.2.3: Discharge of wastewater to the environment and Topic 3.3.2: Management of waste. Statistics on water transport and recreation, while not included in the FDES, can be used to indicate the pressures these activities put on water resources.
- 3.151. 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. To measure the environmental impact of tourism, water use by tourists can also be captured. 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 transport, 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.

- 3.152. 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 generation, treatment and pollutant content of wastewater are discussed under Sub-component 3.2: Generation and Management of Wastewater.
- 3.153. 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 household 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.

Co	<b>Component 2: Environmental Resources and their Use</b>			
Sul	b-component 2.6: Water Resou	rces		
Tor	bic 2.6.2: Abstraction, use and return	is of water		
Sta	atistics and Related Information	Catagory of	Potential	Mathadalasiaal
(Bo	<b>Id Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance
a.	Total water abstraction	Volume	• By type of	UNSD: IRWS
b.	Water abstraction from surface	Volume	source	<ul> <li>UNECE Standard Statistical</li> </ul>
	water		National	Classification of Water Use
с.	Water abstraction from groundwater		• Sub-national	(1989)
	1. From renewable groundwater	Volume		<ul> <li>FAO AQUASTAT</li> <li>SEEA Central Framework</li> </ul>
	2 From non renewable groundwater	Volumo	_	(2012)
	2. From non-renewable groundwater	Volume		SEEA Water
d	Water abstracted for own use	Volume	By ISIC	<ul> <li>UNSD: Environment</li> </ul>
e.	Water abstracted for distribution	Volume	economic activity	Statistics Section - Water
			National	Questionnaire
			<ul> <li>Sub-national</li> </ul>	
f.	Desalinated water	Volume	National	
g.	Reused water	Volume	<ul> <li>Sub-national</li> </ul>	
h.	Water use	Volume	<ul> <li>By ISIC</li> </ul>	
			economic activity	
			By tourists	
			<ul> <li>National</li> <li>Sub national</li> </ul>	
i	Painwater collection	Volumo	Sub-inational	
1. i	Water abstraction from the sea	Volume	<ul> <li>Sub-national</li> </ul>	
J. k	Losses during transport	Volume	By ISIC	
к.	Losses during transport	volume	economic activity	
			<ul> <li>National</li> </ul>	
			<ul> <li>Sub-national</li> </ul>	
1.	Exports of water	Volume	National	
m.	Imports of water	Volume	Sub-national	
n.	Returns of water	Volume	By ISIC	
			economic activity	
			• By destination	
			(e.g., inland	
			water, fallu, sea,	
			National	
			<ul> <li>Sub-national</li> </ul>	

Table 3.2.6.2: Statistics and Related Information for Topic 2.6.2

# 3.3 Component 3: Residuals

- 3.154. Component 3 is closely related to the physical flow accounts (flows from the economy to the environment) of the SEEA-CF on which, where relevant, the terms and definitions are based.<sup>64</sup> 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 flows of solid, liquid and gaseous materials, and energy, that are discarded, discharged or emitted by establishments and households through processes of production, consumption or accumulation. Residuals may be discarded, discharged or emitted directly to the environment or be captured, collected, treated, recycled or reused. The FDES covers the main groups of residuals that are emissions of substances to air, water or soil, wastewater and waste, and the release of residuals from the application of chemical substances (dissipative uses of products in the SEEA-CF).
- 3.155. Emissions, wastewater, waste and residuals from the application of chemicals 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.
- 3.156. Emissions are substances released to the environment by establishments and households as a result of production, consumption and accumulation processes. Emissions can be released to air, water (as part of wastewater) and to soil. Generally, emissions are analysed by the type of receiving environment (air, water or soil) and by type of substance.
- 3.157. Wastewater is discarded water that is no longer required by the owner or user. Wastewater usually (but not always) carries pollution from the processes in which it was used (emissions to water). 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 prior treatment.

<sup>&</sup>lt;sup>64</sup> United Nations, European Union, Food and Agriculture Organization of the United Nations, International Monetary Fund, Organisation for Economic Co-operation and Development, and the World Bank (2014). "System of Environmental-Economic Accounting 2012 - Central Framework". Available from <u>http://unstats.un.org/unsd/envaccounting/seeaRev/SEEA\_CF\_Final\_en.pdf</u> (accessed 30 September 2014).

- 3.158. 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, water or soil.
- 3.159. A special category of residuals results from the dissipative uses of products, which cover products that are deliberately released to the environment as part of production processes. Examples are the application of chemicals such as fertilizers and pesticides, part of which may be absorbed in the production process while the remaining proportion will stay in the environment and may cause pollution.
- 3.160. The SEEA-CF also accounts for residuals in terms of dissipative losses, natural resource residuals and losses. Dissipative losses are material residues that are an indirect result of production and consumption activity. For more detailed discussion see the SEEA-CF, paras. 3.97-3.103.
- 3.161. Statistics on residuals need to be broken down according to the economic activity that generated them based on ISIC. Special attention needs to be paid to the estimation of residuals generated by international transport and tourism for the purposes of the calculation of SEEA physical flow accounts.
- 3.162. Residuals have an impact of the quality of the environment that can be measured in terms of concentrations of residuals in the different media that are covered in Sub-component 1.3: Environmental Quality.
- 3.163. Component 3 contains four sub-components:
  - i. Sub-component 3.1: Emissions to Air;
  - ii. Sub-component 3.2: Generation and Management of Wastewater;
  - iii. Sub-component 3.3: Generation and Management of Waste; and
  - iv. Sub-component 3.4: Release of Chemical Substances.

#### Sub-component 3.1: Emissions to Air

3.164. Air pollution can be caused by natural as well as anthropogenic factors. In the FDES, the focus is on the emission of pollutants from anthropogenic factors that are 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

processes. The statistical description of such emissions covers their sources and the quantities emitted by substances.

- 3.165. 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.
- 3.166. 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 based on ISIC.
- 3.167. 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 (PM). The UNECE 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 (GHGs)

- 3.168. A special category of air emissions is the emissions of GHGs. Emission inventories of GHGs 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. GHGs include both direct and indirect GHGs. The most important direct GHGs are carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O), and the most important indirect GHGs are sulphur dioxide (SO<sub>2</sub>) and nitrogen oxides (NO<sub>x</sub>) and non-methane volatile organic compounds (NM-VOCs).
- 3.169. While the IPCC guidelines prescribe process-based source categories, a breakdown by sources by economic activities based on ISIC is needed, to ensure consistency with and linkages to economic statistics. The estimation of GHGs from international transport and

tourism is necessary to produce emission accounts. To measure the environmental impacts of tourism, air emissions generated by tourists can also be estimated.

Co	Component 3: Residuals			
Su	b-component 3.1: Emissions to	Air		
То	pic 3.1.1: Emissions of greenhouse g	ases		
St	atistics and Related Information	Category of	Potential	Methodological
( <b>B</b> o	<b>Id Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance
a.	Total emissions of direct greenhouse gases (GHGs), by gas:		<ul> <li>By ISIC economic activity</li> </ul>	<ul> <li>IPCC Emission Factor Database</li> </ul>
	1. Carbon dioxide (CO <sub>2</sub> )	Mass	<ul> <li>By tourists</li> </ul>	UN Framework Convention
	2. Methane (CH <sub>4</sub> )	Mass	National	on Climate Change (UNFCCC)
	3. Nitrous oxide (N <sub>2</sub> O)	Mass	<ul> <li>Sub-national</li> <li>By IPCC</li> </ul>	<ul> <li>Reporting Guidelines</li> <li>UNECE Standard Statistical</li> </ul>
	4. Perfluorocarbons (PFCs)	Mass	source categories	Classification of Ambient Air
	5. Hydrofluorocarbons (HFCs)	Mass	0	Quality (1990)
	6. Sulphur hexafluoride (SF <sub>6</sub> )	Mass		• UNSD: MDG Indicator 7.2
b.	Total emissions of indirect greenhouse gases (GHGs), by gas:			• WHO
	1. Sulphur dioxide (SO <sub>2</sub> )	Mass		
	2. Nitrogen oxides (NO <sub>x</sub> )	Mass		
	3. Non-methane volatile organic compounds (NM-VOCs)	Mass		
	4. Other	Mass		

Table 3.3.1.1: Statistics and Related Information for Topic 3.1.1

# Topic 3.1.2: Consumption of Ozone Depleting Substances (ODS)

3.170. 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.

Co	Component 3: Residuals			
Su	b-component 3.1: Emissions to	Air		
То	pic 3.1.2: Consumption of ozone dep	leting substances		
Statistics and Related Information		Category of	Potential	Methodological
( <b>B</b> (	<b>Id Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance
a.	Consumption of ozone depleting substances (ODS), by substance:		By ISIC     economic activity	<ul><li>UNEP Ozone Secretariat</li><li>IPCC Emission Factor</li></ul>
	1. Chlorofluorocarbons (CFCs)	Mass	<ul> <li>By tourists</li> </ul>	Database
	2. Hydrochlorofluorocarbons (HCFCs)	Mass	National	UNECE Standard Statistical
	3. Halons	Mass	<ul> <li>Sub-national</li> <li>By IPCC</li> </ul>	Classification of Ambient Air Quality (1990)
	4. Methyl chloroform	Mass	source categories	<ul> <li>UNSD: MDG Indicator 7.3</li> </ul>
	5. Carbon tetrachloride	Mass		Metadata
	6. Methyl bromide	Mass		• WHO
	7. Other	Mass		

#### Topic 3.1.3: Emissions of other substances

3.171. There are a number of other environmentally important polluting substances that are emitted to air beyond GHGs and ODS. The most important among these are the different fractions of particulate matter (PM), which is an air pollutant consisting of mixed solid (i.e., dust) and liquid particles suspended in the air, and will eventually concentrate in the air and be measured to establish levels of pollution (for instance as PM<sub>2.5</sub> and PM<sub>10</sub>, see Topic1.3.1: Air Quality). Furthermore, the particulate material contain different chemical elements and compounds that can be harmful beyond the potential impact of dust, for instance PM can contain chemical constituents such as sulphates, nitrates and ammonium. PM can be formed by suspension of soil and dust, and also from gaseous precursors such as SO<sub>2</sub>, NO<sub>x</sub>, ammonia and NM-VOCs. Other potentially harmful substances that are linked to environmental and health problems. There are a variety of other emissions that countries may wish to measure or estimate based on national circumstances and priorities.

Co	Component 3: Residuals			
Su	Sub-component 3.1: Emissions to Air			
To	pic 3.1.3: Emissions of other substan	ces		
St	atistics and Related Information	Category of	Potential	Methodological
( <b>B</b>	<b>bld Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance
a.	Emissions of other substances:		By ISIC	<ul> <li>UNECE Standard Statistical</li> </ul>
	1. Particulate matter (PM)	Mass	economic activity	Classification of Ambient Air
	2. Heavy metals	Mass	By tourists	Quality (1990)
	3. Other	Mass	<ul> <li>National</li> <li>Sub-national</li> <li>By IPCC source categories</li> </ul>	• European Monitoring and Evaluation Programme (EMEP) under the Convention on Long- range Transboundary Air Pollution

Table 3.3.1.3: Statistics and Related Information for Topic 3.1.3

#### Sub-component 3.2: Generation and Management of Wastewater

- 3.172. Statistics about the generation, management and discharge of wastewater, as well as the pollutant content of wastewater (emissions of substances to water), 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.
- 3.173. The type of statistical source most commonly used is administrative records, 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 and wastewater authorities or institutions in charge of water supply, collection, treatment and/or final discharge of wastewater to the environment (e.g., water regulating bodies, water authorities, municipalities, water utilities, wastewater treatment plants).

#### Topic 3.2.1: Generation and pollutant content of wastewater

3.174. This topic includes statistics on the volume of water that is no longer required and is therefore discarded by the user and statistics on the amount of pollutants contained in wastewater (emissions to water) before any collection or treatment is applied. Statistics on the generation of wastewater and emissions to water should be broken down by the economic activity and households that generates them. To measure the environmental impact of tourism, the amount of wastewater generated by tourists can also be estimated. Generation of wastewater is usually estimated based on the volume of water used. 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.

Co	Component 3: Residuals				
Su	Sub-component 3.2: Generation and Management of Wastewater				
Toj	pic 3.2.1: Generation and pollutant c	ontent of wastewat	er		
St	atistics and Related Information	Category of	Potential	Methodological	
( <b>Bo</b>	<b>Id Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance	
a.	Volume of wastewater generated	Volume	<ul> <li>By ISIC</li> <li>economic activity</li> <li>By tourists</li> <li>National</li> <li>Sub-national</li> </ul>	<ul> <li>UNSD: IRWS</li> <li>ISIC Rev. 4, Section E, Divisions 35-37</li> <li>SEEA Water</li> <li>UNSD: Environment</li> </ul>	
b.	Pollutant content of wastewater	Mass	<ul> <li>By pollutant or pollution</li> <li>parameter (e.g., biochemical</li> <li>oxygen demand</li> <li>(BOD), chemical</li> <li>oxygen demand</li> <li>(COD), nitrogen,</li> <li>phosphorous, total</li> <li>suspended solids</li> <li>(TSS))</li> <li>By ISIC</li> <li>economic activity</li> <li>National</li> <li>Sub-national</li> </ul>	Statistics Section - Water Questionnaire	

Table 3.3.2.1: Statistics and Related Information for Topic 3.2.1

#### Topic 3.2.2: Collection and treatment of wastewater

- 3.175. 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 (urban, industrial or other). This topic can include 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.
- 3.176. Establishments engaged in the collection and treatment of wastewater are grouped under ISIC Rev.4, Section E, Division 37 Sewerage.

Co	Component 3: Residuals			
Su	b-component 3.2: Generation a	nd Management	of Wastewater	
Top	bic 3.2.2: Collection and treatment o	f wastewater		
St (Be	atistics and Related Information old Text - Core Set/Tier 1; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Category of Measurement	Potential Aggregations and Scales	Methodological Guidance
a.	Volume of wastewater collected	Volume	<ul><li>National</li><li>Sub-national</li></ul>	<ul><li>UNSD: IRWS</li><li>ISIC Rev. 4, Section E,</li></ul>
b.	Volume of wastewater treated	Volume	By treatment	Division 35 and 36
c.	Total urban wastewater treatment capacity		type (e.g., primary,	UNSD: Environment     Statistics Section - Water
	1. Number of plants	Number	secondary,	Questionnaire
	2. Capacity of plants	Volume	tertiary)	
d.	Total industrial wastewater treatment capacity		Sub-national	
	1. Number of plants	Number	]	
	2. Capacity of plants	Volume		

#### Topic 3.2.3: Discharge of wastewater to the environment

- 3.177. 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.
- 3.178. 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.
- 3.179. 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.

Component 3: Residuals							
Sub-component 3.2: Generation and Management of Wastewater							
Topic 3.2.3: Discharge of wastewater to the environment							
Statistics and Related Information		Category of Measurement	Potential	Methodological Guidance			
(Bold Text - Core Set/Tier 1; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )			Aggregations and Scales				
a.	Wastewater discharge		By treatment	• UNSD: IRWS			
	1. Total volume of wastewater discharged to the environment after treatment	Volume	type (e.g., primary, secondary,	<ul> <li>ISIC Rev. 4, Section E, Division 35 and 36</li> <li>UNSD: Environment Statistics Section Water</li> </ul>			
	2. Total volume of wastewater discharged to the environment without treatment	Volume	<ul> <li>tertiary)</li> <li>By recipient</li> <li>(e.g., surface</li> <li>water,</li> <li>groundwater,</li> <li>wetland, sea,</li> <li>land)</li> <li>By ISIC</li> <li>economic activity</li> <li>National</li> <li>By source</li> <li>(point/non-point</li> </ul>	Statistics Section - Water Questionnaire			
b.	Pollutant content of discharged wastewater	Mass	<ul> <li>By pollutant or pollution parameter (e.g., BOD, COD, nitrogen, phosphorous)</li> <li>National</li> <li>Sub-national</li> <li>Net emission by ISIC economic activity</li> <li>By source (point/non-point source)</li> </ul>				

Table 3.3.2.3: Statistics and Related Information for Topic 3.2.3

#### Sub-component 3.3: Generation and Management of Waste

- 3.180. This sub-component includes statistics on the amount and characteristics of waste, that is discarded material for which the owner or user have no further use, generated by human activities in the course of production and consumption processes. To reduce the amount of waste generated and increase the part of waste that is recycled and reused as material or energy source are in the centre of sustainable consumption and production and natural resource management. The final disposal of waste in the environment, even if done in a controlled manner, creates pollution and occupies considerable land areas.
- 3.181. Relevant statistics cover the amount of waste generated by different sources that are economic activities (by ISIC categories) and households. Waste can also be classified based on its material content or other characteristics. Waste is usually collected at the place of generation and transported from there (for recycling and reuse, or to reduce its amount or hazardousness before final disposal) to treatment facilities and (for final disposal) to disposal facilities.
- 3.182. Policy makers, particularly local governments, require statistics on waste in order to assess how its generation change over time. This in turn assists in planning for present and future waste management in terms of transportation and facilities required. Statistics on waste are also needed for developing strategies to encourage waste reduction, reuse and recycling.

# Topic 3.3.1: Generation of waste

- 3.183. This topic includes statistics describing the amount of waste generated before any collection or treatment is applied, by waste type, and by generator: by economic activity (by ISIC) and households. The waste lists used by countries and international organizations for waste statistics are usually based either on the generating process or the material content of the waste, or on the combination of these two aspects. In many cases the origin of the waste (the economic activity) more or less determines the material content of the waste.
- 3.184. Ideally, statistics on the amount and type of waste generated should be reported by the establishments (economic units) that generate it. However, in practice these statistics are usually estimated from the records of the economic units engaged in the collection, treatment and disposal of waste. The wide waste categories frequently used in waste statistics such as municipal, industrial and hazardous waste combine many different waste materials into categories based on the similarity of their collection, treatment and disposal. If and where the waste management system is well developed and cover all waste, the amount of waste generated can be estimated with high reliability.

- 3.185. Hazardous waste is a special group of waste that due to its toxic or other hazardous character needs special management and is controlled by law in many countries. A multilateral environmental agreement, the Basel Convention focuses on the control of transboundary movements of hazardous waste across international borders and sets up criteria for the environmentally sound management of such waste. Reporting needs originating in this convention include the generation of hazardous waste, as well as the imports and exports of hazardous waste covered in Topic 3.3.2: Management of Waste. For additional information, see Annex C: Multilateral Environmental Agreements.
- 3.186. Depending on their priorities and availability of resources, instead of estimating the total amount of waste generation, countries may prefer to focus on certain waste types that are important because they are recyclable or reusable and thus constitute a resource (e.g. paper, glass or metal waste), or because their volume or hazardousness create a specific problem for treatment and disposal. An important aspect of data collection on waste (by type of waste) is food waste. Approximately one-third of food produced globally is lost or wasted<sup>65</sup>. This represents a large portion of the environmental costs of agriculture production. Countries may also wish to estimate the amount of waste generated by specific sectors or population groups such as tourists.

<sup>&</sup>lt;sup>65</sup> FAO (2011). Global food losses and food waste: extent, causes and prevention. Available from <u>http://www.fao.org/docrep/014/mb060e/mb060e00.pdf</u> (accessed 16 September 2014).

Component 5: Residuais							
Sub-component 3.3: Generation and Management of Waste							
Topic 3.3.1: Generation of waste							
Statistics and Related Information		Category of Measurement	Potential Aggregations and Scales	Methodological Guidance			
( <b>Bold Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )							
a.	Amount of waste generated by	Mass	By ISIC	<ul> <li>European Commission:</li> </ul>			
	source		economic activity	European List of Waste,			
			<ul> <li>By households</li> </ul>	pursuant to European Waste			
			<ul> <li>By tourists</li> </ul>	Framework Directive			
			National	• Eurostat: Environmental Data			
			<ul> <li>Sub-national</li> </ul>	Centre on Waste			
b.	Amount of waste generated by waste	Mass	<ul> <li>By waste</li> </ul>	• Eurostat: European Waste			
	category		category (e.g.,	Classification for Statistics			
			chemical waste,	(EWC-Stat), version 4 (Waste			
			municipal waste,	categories)			
			rood waste,	• Dasel Convention. waste			
			combustion	characteristics			
			• National	<ul> <li>Furostat: Manual on Waste</li> </ul>			
			<ul> <li>National</li> <li>Sub national</li> </ul>	Statistics			
C	Amount of hezerdous weste	Mass	By ISIC	<ul> <li>Eurostat: Guidance on</li> </ul>			
<i>c</i> .	generated	Ivia55	economic activity	classification of waste according			
	Senerana		<ul> <li>National</li> </ul>	to EWC-Stat categories			
			<ul> <li>Sub-national</li> </ul>	<ul> <li>SEEA Central Framework</li> </ul>			
			Suo hunohun	(2012)			
				<ul> <li>UNSD: Environment</li> </ul>			
				Statistics Section - Waste			
				Questionnaire			

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#### Topic 3.3.2: Management of waste

- 3.187. This topic includes statistics on: (i) the amount of waste collected and transported to treatment facilities or to their final disposal; (ii) the amount of waste treated and disposed of by type of treatment and way of disposal (e.g., re-use, recycling, composting, incineration, landfilling, other); (iii) the physical infrastructure for waste treatment and disposal, including the number and capacity of treatment and disposal plants; and (iv) other relevant information.
- 3.188. Relevant statistics will come from the records of the economic units engaged in waste management that fall under ISIC Rev. 4, Section E, Division 38 Waste collection, treatment and disposal activities; materials recovery. Waste collection systems, treatment and disposal facilities can be operated by public or private companies that provide the service for the generator of the waste and keep records of the relevant transactions. However, some industrial establishments may perform part or all of these activities on their own account.
|              | mponent or Residuals   |              |  |  |
|--------------|--|--------------|--|--|
| Su           | b-component 3.3: Generation as   | nd Managemen | t of Waste   |  |
| Тој          | pic 3.3.2: Management of waste   |              |  |  |
|              | Statistics and Related Information   | Category of  | Potential  |  |
| ( <b>B</b> 0 | <b>Id Text - Core Set/Tier 1</b> ; Regular Text -<br>Tier 2; <i>Italicized Text - Tier 3</i> ) | Measurement  | Aggregations<br>and Scales   | Methodological Guidance  |
| a.           | Municipal waste  |              | • By type of   | Eurostat: Environmental Data   |
|              | 1. Total municipal waste collected   | Mass         | treatment and  | • Eurostat metadata:   |
|              | 2. Amount of municipal waste treated   | Mass         | reuse, recycling,  | Organisation for Economic Co-  |
|              | 3. Number of municipal waste<br>treatment and disposal facilities                              | Number       | - composting,<br>incineration,   | operation and Development<br>(OECD)/Eurostat definition of   |
|              | 4. Capacity of municipal waste treatment and disposal facilities                               | Volume       | <ul> <li>Iandfilling, other)</li> <li>By type of</li> <li>waste, when</li> </ul> | UNSD: Environment     Statistics Section - Waste   |
| b.           | Hazardous waste  |              | possible   | Questionnaire  |
|              | 1. Total hazardous waste collected   | Mass         | National   | Basel Convention: Waste  |
|              | 2. Amount of hazardous waste<br>treated by type of treatment and<br>disposal                   | Mass         | • Sub-national   | categories and hazardous<br>characteristics<br>• Eurostat: EWC-Stat, version                               |
|              | 3. Number of hazardous waste treatment and disposal facilities                                 | Number       |  | <ul><li>4 (Waste categories)</li><li>European Commission:</li></ul>  |
|              | 4. Capacity of hazardous waste treatment and disposal facilities                               | Volume       |  | European Waste Framework<br>Directive (Waste treatment   |
| c.           | Other/industrial waste   |              |  | operations)<br>• Eurostat: Manual on Waste   |
|              | 1. Total other/industrial waste collected  | Mass         |  | Statistics   |
|              | 2. Amount of other/industrial waste<br>treated by type of treatment and<br>disposal            | Mass         |  | <ul> <li>Eurostat: Guidance on<br/>classification of waste according<br/>to EWC-Stat categories</li> </ul> |
|              | 3. Number of treatment and disposal facilities   | Number       |  | Rotterdam Convention   |
|              | 4. Capacity of industrial waste treatment and disposal facilities                              | Volume       |  |  |
| d.           | treatment and disposal facilities Amount of recycled waste                                     | Mass         | By specific  |  |
|              |  |              | waste streams  |  |
|              |  |              | packaging waste,<br>end of life  |  |
|              |  |              | vehicles)  |  |
|              |  |              | By waste   |  |
|              |  |              | category   |  |
|              |  |              | <ul> <li>Sub-national</li> </ul>   |  |
| e.           | Imports of waste   | Mass         | By waste   | 1  |
| f.           | Exports of waste   | Mass         | category (e.g.,  |  |
| g.           | Imports of hazardous waste   | Mass         | chemical waste,  |  |
| h.           | Exports of hazardous waste   | Mass         | combustion<br>waste, etc.)   |  |

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### Sub-component 3.4: Release of Chemical Substances

### Topic 3.4.1: Release of chemical substances

- 3.189. This topic deals with chemical fertilizers to enrich soils and pesticide use to protect plants and animals from disease. Other chemicals accelerate the growth of biota and preserve and enhance the quality, size and appearance of biological products. Environmental effects are generated by the diffusion of chemicals through cycling systems and build-up of contaminants in water, land and species (through the food chain). Statistics under this topic include the amount of natural and chemical fertilizers, pesticides and other chemicals (hormones, pellets etc.) used by type of active ingredients (see also Sub-component 2.5: Biological Resources), the area under application, and the method employed. These statistics serve as a proxy or the basis for estimating the part of the chemicals that remain in the environment and affect environmental quality.
- 3.190. The Stockholm Convention on Persistent Organic Pollutants (POPs) aims to eliminate or restrict the production and use of POPs. POPs are defined by the convention as "chemical substances that persist in the environment, bio-accumulate through the food web, and pose a risk of causing adverse effects to human health and the environment".<sup>66</sup> The Stockholm Convention identified an initial 12 chemicals or chemical groups for priority action, including: Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, Hexachlorobenzene, Mirex, Toxaphene, PCBs, Polychlorinated Dioxins and Polychlorinated Furans. In 2009, additional substances were added. For additional information, see Annex C: Multilateral Environmental Agreements.

<sup>&</sup>lt;sup>66</sup> United Nations Environment Programme, "Persistent Organic Pollutants". Available from <u>http://www.chem.unep.ch/pops/</u> (accessed 5 January 2013).

Co	Component 3: Residuals			
Su	b-component 3.4: Release of Cl	hemical Substar	nces	
To	pic 3.4.1: Release of chemical substa	inces		
St (Bo	atistics and Related Information Id Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Category of Measurement	Potential Aggregations and Scales	Methodological Guidance
a.	Total amount of fertilizers used		National	FAOSTAT database
	1. Natural fertilizers (also in 2.5.1.b and 2.5.3.b)	Area, Mass, Volume	<ul> <li>Sub-national</li> <li>By ISIC</li> </ul>	Stockholm Convention
	2. Chemical fertilizers (also in 2.5.1.b and 2.5.3.b)	Area, Mass, Volume	(forestry, agriculture)	
b.	Total amount of pesticides used (also in 2.5.1.b and 2.5.3.b)	Area, Mass, Volume	<ul><li> By type of fertilizer</li><li> By type of pesticide</li></ul>	
с.	Total amount of pellets used (also in 2.5.2.e)	Mass, Volume	<ul> <li>National</li> <li>Sub-national</li> <li>By ISIC economic activity (aquaculture)</li> </ul>	Stockholm Convention
d.	Total amount of hormones used (also in 2.5.2.e and 2.5.4.b)	Mass, Volume	<ul> <li>National</li> <li>Sub-national</li> <li>By ISIC</li> <li>economic activity</li> <li>(aquaculture, livestock</li> <li>production)</li> </ul>	
e.	Total amount of colourants used (also in 2.5.2.e)	Mass, Volume	<ul> <li>National</li> <li>Sub-national</li> <li>By ISIC economic activity (aquaculture)</li> </ul>	
f.	Total amount of antibiotics used (also in 2.5.2.e and 2.5.4.b)	Mass, Volume	<ul> <li>National</li> <li>Sub-national</li> <li>By ISIC</li> <li>economic activity</li> <li>(aquaculture, livestock</li> <li>production)</li> </ul>	

Table 3.3.4.1: Statistics and Related Information for Topic 3.4.1

# 3.4 Component 4: Extreme Events and Disasters

- 3.191. This component organizes statistics regarding the occurrence and impacts of extreme events and disasters on human wellbeing and on the infrastructure of the human sub-system.
- 3.192. The most common data sources are national and sub-national authorities responsible for disaster management and assistance, emergency management and response agencies, insurance companies, optical and radar satellite operators for satellite information, as well as seismic monitoring and research centres.
- 3.193. 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

- 3.194. 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.
- 3.195. An extreme event is an event that is rare within its statistical reference distribution at a particular location. An extreme event is normally as rare or rarer than the 10<sup>th</sup> or 90<sup>th</sup> percentile. The Centre for Research on the Epidemiology of Disasters (CRED) defines a disaster as an "unforeseen and often sudden event that causes great damage, destruction and human suffering."<sup>67</sup> It often surpasses local capacities to respond to it and requires external assistance at the national or international level. A disaster is often described as a result of exposure to an extreme event. For inclusion in this sub-component, a disaster should be categorized using the same criteria as the CRED Emergency Events Database (EMDAT). This means that at least one of the following criteria must be fulfilled:
  - 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

<sup>&</sup>lt;sup>67</sup> Centre for Research on the Epidemiology of Disasters EM-DAT (2009). "Emergency Events Database". Available from <u>http://www.emdat.be</u> (accessed 9 June 2015).

- iv. Call for international assistance.
- 3.196. 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.
- 3.197. In recent decades, because of an increase in extreme events, natural disasters have become more frequent, more intensive, and also more destructive and deadly. Climate change has been associated with the increasing frequency and severity of extreme weather events. It has resulted in increased global temperatures, rising sea levels, increased storms and precipitation, droughts, floods, 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.
- 3.198. The statistics structured in this component will take account of the whole sequence associated with both the occurrence and the impact of each individual event, including its type, 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. Statistics related to disaster preparedness can be found under Topic 6.3.1: Preparedness for Natural Extreme Events and Disasters.
- 3.199. Extreme events and disasters can be categorized and classified using the current classification of the CRED EMDAT. For more information on the full classification of CRED, see Annex D: Classifications and environment statistics.

# Topic 4.1.1: Occurrence of natural extreme events and disasters

3.200. The types of statistics included in this topic can include, but are not restricted to, the type of natural disaster, location, magnitude, date of occurrence and duration.

	Tuble 5.4.1.1. Shutshes and Retailed Information for Topic 4.1.1			
Co	Component 4: Extreme Events and Disasters			
Su	b-component 4.1: Natural Extre	eme Events and I	Disasters	
Toj	pic 4.1.1: Occurrence of natural extre	eme events and disa	asters	
St (Bo	atistics and Related Information Id Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Category of Measurement	Potential Aggregations and Scales	Methodological Guidance
a.	Occurrence of natural extreme events and disasters		<ul><li>By event</li><li>National</li></ul>	<ul> <li>Centre for Research on the Epidemiology of Disasters</li> </ul>
	1. <b>Type of natural extreme event and</b> <b>disaster</b> (geophysical, meteorological, hydrological, climatological, biological)	Description	Sub-national	<ul><li>Emergency Events Database</li><li>(CRED EMDAT)</li><li>UN Economic Commission</li></ul>
	2. Location	Location		for Latin America and the
	3. Magnitude (where applicable)	Intensity		Caribbean (ECLAC) Handbook
	4. Date of occurrence	Date		for Estimating the Socio-
	5. Duration	Time period		<ul> <li>economic and Environmental Effects of Disasters</li> <li>The United Nations Office for Disaster Risk Reduction (UNISDR)</li> </ul>

Table 3.4.1.1: Statistics and Related Information for Topic 4.1.1

#### Topic 4.1.2: Impact of natural extreme events and disasters

- 3.201. 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. Economic loss can refer to damage to buildings and other economic assets, number of transportation networks affected, economic disruption or loss of revenue to commercial services, as well as utility disruption. Physical loss or damage refers to the magnitude of the impact of the event or disaster on the quantity and quality of land, crops, livestock, aquaculture, biomass, etc. The specific impact of each natural disaster on the integrity of the local ecosystem can also be reported on, where statistics exist. In addition, the external assistance received for disaster relief can also be measured.
- 3.202. The United Nations Economic Commission for Latin America and the Caribbean (UNECLAC) has developed a handbook which may be useful to other countries and regions, "UNECLAC: Handbook for Estimating the Socio-economic and Environmental Effects of Disasters".<sup>68</sup> 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.
- 3.203. In February 2014, ECLAC published the third edition of the "Handbook for Disaster Assessment".<sup>69</sup> This edition strengthens the methodology to estimate both the effects and the impacts of disasters, improving its consistency by clearly differentiating concepts of losses and additional costs. It additionally systematizes the linkages among different economic sectors. The document also permeates cross-cutting themes such as gender and the environment.

<sup>&</sup>lt;sup>68</sup> United Nations Economic Commission for Latin America and the Caribbean (2003). "Handbook for Estimating the Socio-economic and Environmental Effects of Disasters". LC/MEX/G.5 ECLAC Mexico Office. Available from <u>http://www.eclac.cl/cgi-</u>

<sup>&</sup>lt;u>bin/getProd.asp?xml=/publicaciones/xml/4/12774/P12774.xml&xsl=/mexico/tpl-i/p9f.xsl&base=/mexico/tpl/top-bottom.xsl</u> (accessed 13 October 2013).

<sup>&</sup>lt;sup>69</sup> United Nations Economic Commission for Latin America and the Caribbean (2014). "Handbook for Disaster Assessment". LC/L.3691. Available from <u>http://www.cepal.org/cgi-</u>

bin/getProd.asp?xml=/publicaciones/xml/4/52674/P52674.xml&xsl=/publicaciones/ficha.xsl&base=/publicaciones/top\_publicaciones.xsl (accessed 13 October 2014).

Co	<b>Component 4: Extreme Events and Disasters</b>			
Su	b-component 4.1: Natural Extra	eme Events and	Disasters	
To	pic 4.1.2: Impact of natural extreme	events and disaster	S	
St	atistics and Related Information	Category of	Potential	Methodological
( <b>B</b> o	<b>Id Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance
a.	People affected by natural extreme events and disasters		<ul><li>By event</li><li>National</li></ul>	Centre for Research on the Epidemiology of Disasters
	1. Number of people killed	Number	<ul> <li>Sub-national</li> </ul>	Emergency Events Database
	2. Number of people injured	Number		(CRED EMDAT)
	3. Number of people homeless	Number		• UN Economic Commission
	4. Number of people affected	Number		Caribbean (ECLAC) Handbook
b. c.	Economic losses due to natural extreme events and disasters (e.g., damage to buildings, transportation networks, loss of revenue for businesses, utility disruption, etc.) Physical losses/damages due to natural extreme events and disasters (e.g., area and amount of crops, livestock, aquaculture, biomass etc.)	Currency Area, Description, Number	<ul> <li>By event</li> <li>By ISIC</li> <li>economic activity</li> <li>National</li> <li>Sub-national</li> <li>By direct and indirect damage</li> </ul>	for Estimating the Socio- economic and Environmental Effects of Disasters • The United Nations Office for Disaster Risk Reduction (UNISDR)
d.	Effects of natural extreme events and disasters on integrity of ecosystems 1. Area affected by natural disasters 2. Loss of vegetation cover 3. Area of watershed affected 4. Other	Area Area Area Description	<ul> <li>By event</li> <li>By ecosystem</li> <li>National</li> <li>Sub-national</li> </ul>	
e.	External assistance received	Currency	<ul><li>By event</li><li>National</li></ul>	

Table 3.4.1.2: Statistics and Related Information for Topic 4.1.2

## Sub-component 4.2: Technological Disasters

- 3.204. 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.
- 3.205. 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.
- 3.206. There are three types of technological disasters recognized by CRED.<sup>70</sup> These are: industrial accidents which cover accidents associated with chemical spill, collapse, explosion, fire, gas leak, poisoning, radiation and other; transport accidents which cover accidents associated with air, road, rail, and water; and miscellaneous accidents which cover accidents associated with collapse, explosion, fire, 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

- 3.207. 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.
- 3.208. 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 precedent for a given disaster. The full impact of such disasters can sometimes neither be fully anticipated nor measured.

<sup>&</sup>lt;sup>70</sup> Centre for Research on the Epidemiology of Disasters EMDAT, "Disaster profiles". Available from <u>http://www.emdat.be/new-classification</u> (accessed 9 June 2015).

- 3.209. This topic should include information on the identification and characterization of the different types of events including information on type of disaster, location, date of occurrence and duration. 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.
- 3.210. It should be noted that information on the environmental media that are impacted is included under Sub-component 1.3: Environmental Quality, covering air, water, soil and noise, as relevant.
- 3.211. For inclusion in this sub-component, a technological disaster should be categorized using the same criteria as the CRED EMDAT (see text in Sub-component 4.1 for criteria).

Co	Component 4: Extreme Events and Disasters				
Su	b-component 4.2: Technologica	al Disasters			
Тој	Topic 4.2.1: Occurrence of technological disasters				
St (Bo	atistics and Related Information Id Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Category of Measurement	Potential Aggregations and Scales	Methodological Guidance	
a.	Occurrence of technological disasters 1. Type of technological disaster (industrial, transportation, miscellaneous)	Description	<ul> <li>By event</li> <li>By ISIC</li> <li>economic activity</li> <li>National</li> </ul>	<ul> <li>CRED EMDAT</li> <li>ECLAC: Handbook for Estimating the Socio-economic and Environmental Effects of</li> </ul>	
	2. Location 3. Date of occurrence 4. Duration	Location Date Time period	Sub-national	Disasters	

Table 3.4.2.1: Statistics and Related Information for Topic 4.2.1

### Topic 4.2.2: Impact of technological disasters

- 3.212. This topic includes the specific impacts on humans and damage to the economy as well as ecosystems, arising from technological disasters. These impacts can include radiation-related conditions and diseases or other health impacts, property damage, loss of livelihoods, services and housing, social and economic disruption, and environmental damage. The statistics in this topic include the number of people killed, injured, rendered homeless, or affected, as well as economic loss. 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. Economic loss can refer to damage to buildings and other economic assets, number of transportation networks affected, economic disruption or loss of revenue to commercial services, and utility disruption. Physical loss or damage refers to the magnitude of the impact of the event or disaster on the quantity and quality of land, crops, livestock, aquaculture, biomass, etc. The specific impact of each technological disaster on the integrity of the local ecosystem can also be reported on, where statistics exist. In addition, the external assistance received for disaster relief can also be measured.
- 3.213. 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.
- 3.214. Statistics on the environmental media that are impacted as a result of technological disasters are included in Sub-component 1.3: Environmental Quality, under the relevant heading (e.g., air, water or soil). Statistics on the health impact of technological disasters can also be found in Topic 5.2.5: Toxic substance- and nuclear radiation-related diseases and conditions.

Co	<b>Component 4: Extreme Events and Disasters</b>			
Su	Sub-component 4.2: Technological Disasters			
Тор	bic 4.2.2: Impact of technological dis	sasters		
St	atistics and Related Information	Category of	Potential	Methodological
(Bo	<b>Id Text - Core Set/Tier 1;</b> Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance
a.	People affected by technological disasters		<ul><li>By event</li><li>National</li></ul>	<ul><li>CRED EMDAT</li><li>ECLAC: Handbook for</li></ul>
	1. Number of people killed	Number	<ul> <li>Sub-national</li> </ul>	Estimating the Socio-economic
	2. Number of people injured	Number		and Environmental Effects of
	3. Number of people homeless	Number		Disasters
	4. Number of people affected	Number		
b.	Economic losses due to technological disasters (e.g., damage to buildings, transportation networks, loss of revenue for businesses, utility disruption, etc.)	Currency	<ul> <li>By event</li> <li>By ISIC</li> <li>economic activity</li> <li>National</li> </ul>	
c.	Physical losses/damages due to technological disasters (e.g., area and amount of crops, livestock, aquaculture, biomass etc.)	Area, Description, Number	<ul> <li>Sub-national</li> <li>By direct and indirect damage</li> </ul>	
d.	Effects of technological disasters on integrity of ecosystems		<ul><li>By event</li><li>National</li></ul>	
	1. Area affected by technological disasters	Area	<ul> <li>Sub-national</li> </ul>	
	2. Loss of vegetation cover	Area		
	3. Area of watershed affected	Area	1	
	4. Other (e.g., for oil spills: volume of oil released into the environment, impact on ecosystem)	Description		
e.	External assistance received	Currency	<ul><li>By event</li><li>National</li></ul>	

Table 3.4.2.2: Statistics and Related Information for Topic 4.2.2

# 3.5 Component 5: Human Settlements and Environmental Health

- 3.215. This component contains statistics on the environment in which humans live and work, particularly with regard to living conditions and environmental health. These statistics are important for the management and improvement of 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.
- 3.216. Human settlements 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 in modern urban settlements pose special challenges to humans as well as to the physical environments in which these settlements are located. Pollution of the air, water or soil due to activities in human settlements continuously causes environmental change that can have damaging effects on agriculture, water resources, the energy sector, as well as on human health. The capacity or the resilience of the environment to cope with the environmental impacts caused by human habitation can influence both the health of the human settlements and that of the natural environment with which it is associated.
- 3.217. 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 human settlements. Several factors can mitigate or increase the effect of environmental and settlement-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 ecosystem health. The existence of these conditions can improve a given human settlement, and the wellbeing and health of humans. Conversely, vulnerable human settlements are often more impacted by the changing environment and recover more slowly from pollution, environmental degradation, and extreme events and disasters.
- 3.218. Component 5 contains two sub-components:
  - i. Sub-component 5.1: Human Settlements; and
  - ii. Sub-component 5.2: Environmental Health.

## Sub-component 5.1: Human Settlements

- 3.219. This sub-component includes relevant statistics on basic services and infrastructure of human settlements. Human settlements refer to the totality of the human community, whether people live in large cities, towns or villages. They encompass the human population that resides in a settlement, the physical elements (e.g., shelter and infrastructure), services (e.g., water, sanitation, waste removal, energy and transport), and the exposure of humans to potentially deleterious environmental conditions.
- 3.220. Statistics on human settlements are required by policy makers, analysts and civil society in order to inform on how humans live and work in these settlements, how they transform the landscape and the supporting ecosystems, and in turn how this affects human wellbeing and health. The extent of human settlements, their ecological footprint (which is closely related to prevailing production and consumption patterns), the supporting and nearby environmental conditions and quality, as well as human access to infrastructure and services, all affect both humans and the environment in a cyclical and iterative way.
- 3.221. The type of sources that are needed to document the state and changes in human settlements 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.
- 3.222. The first topic in this sub-component covers urban and rural population statistics, providing information on the locations where humans construct and maintain their settlements in any given country. The next two topics cover access to water, sanitation, waste removal and energy, 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

3.223. Humans live primarily in 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 settlements and their use of environmental resources will affect environmental conditions, as well as human wellbeing and health.

- 3.224. Statistics on the location of human settlements can be found both in traditional demographic statistics, and increasingly in geospatial information sources. The potential for the use of georeferenced population data 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 settlements and environmental health.
- 3.225. The 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.

<b>Component 5: Human Settlements and Environmental Health</b>					
Su	b-component 5.1: Human Settle	ements			
Тој	Topic 5.1.1: Urban and rural population				
Sta (Bo	atistics and Related Information Id Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Category of Measurement	Potential Aggregations and Scales	Methodological Guidance	
a.	Population living in urban areas	Number	<ul> <li>Urban</li> </ul>	UN Population Division	
b.	Population living in rural areas	Number	<ul> <li>Rural</li> </ul>	UN Population Fund	
c.	Total urban area	Area		(UNFPA)	
d.	Total rural area	Area			
e.	Population living in coastal areas	Number			

#### Topic 5.1.2: Access to selected basic services

- 3.226. This topic includes information about access to water, sanitation, waste removal services and energy in urban and rural areas. Access to these basic services can have a positive effect on human health and wellbeing, thereby contributing to improved environmental quality.
- 3.227. Relevant statistics on this topic include population using an improved drinking water source, as well as population using an improved sanitation facility. The metadata of MDG indicator 7.8 defines an improved drinking water source as the use of one of the following: piped water into dwelling, plot or yard; public tap or standpipe; borehole or tube well; protected dug well; protected spring; rainwater collection and bottled water (if a secondary available source is also improved).<sup>71</sup> The population using an improved drinking water source (at a national, urban and rural level) can be measured, and the proportion with respect to the total population obtained. Additionally, statistics on the price of water being supplied, for example, through pipes or a vendor, should also be collected.
- 3.228. The metadata of MDG indicator 7.9 defines an improved sanitation facility as one that hygienically separates human excreta from human contact, and includes flush or pour flush toilets or latrines connected to a sewer, -septic tank or -pit; ventilated improved pit latrines; pit latrines with a slab or platform of any material which covers the pit entirely, except for the drop hole and composting toilets or latrines.<sup>72</sup> The population using an improved sanitation facility (at a national, urban and rural level) can be measured and the proportion with respect to the total population obtained.<sup>73</sup> Collection of data on this topic is therefore relevant and useful for monitoring progress toward achieving the MDGs, and is required as numerators for MDG indicators 7.8 and 7.9 respectively.
- 3.229. To reduce harmful environmental effects, polluted wastewater should be collected and treated before its discharge to the environment. Statistics on the population's access to wastewater collecting systems and wastewater treatment facilities are an important part of statistics on human settlements. Access to wastewater collecting systems does not necessarily imply that the wastewater is necessarily treated.

 <sup>&</sup>lt;sup>71</sup> United Nations Statistics Division. "Millennium Development Goals Indicators. 7.8 Proportion of population using an improved drinking water source." Available from <u>http://unstats.un.org/unsd/mdg/Metadata.aspx?IndicatorId=0&SeriesId=665</u> (accessed 16 April 2013).
 <sup>72</sup> United Nations Statistics Division. "Millennium Development Goals Indicators. 7.9 Proportion of population using an improved sanitation facility."

 <sup>&</sup>lt;sup>72</sup> United Nations Statistics Division. "Millennium Development Goals Indicators. 7.9 Proportion of population using an improved sanitation facility."
 Available from <a href="http://mdgs.un.org/unsd/mdg/Metadata.aspx?IndicatorId=31">http://mdgs.un.org/unsd/mdg/Metadata.aspx?IndicatorId=31</a> (accessed 16 April 2013).
 <sup>73</sup> The Millennium Development Goal indicator 7.9 is the proportion of population using an improved sanitation facility. This is defined as the

<sup>&</sup>lt;sup>73</sup> The Millennium Development Goal indicator 7.9 is the proportion of population using an improved sanitation facility. This is defined as the percentage of the population (national, urban and rural) with access to an improved sanitation facility with respect to the totality of the population (national, urban and rural).

- 3.230. The generation of large amounts of waste during the normal functioning of households and economic activities in human settlements is also a very important environmental quality and human health concern, particularly in highly dense urban areas. Statistics about the existence of and access to regular, organized waste removal services are therefore considered important to inform about the population's access to basic services.
- 3.231. The last group of statistics under this topic refer to households with access to electricity and its price. Access to electricity is a measure of modern energy services. This term also encompasses access to clean cooking facilities, which includes clean cooking fuels and stoves, advanced biomass cookstoves and biogas systems.
- 3.232. Institutional partners for this topic include NSOs, development, planning, energy and health ministries, utility providers and other agencies. 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. Main data sources include administrative records, population censuses and household surveys that collect the relevant household data on water, sanitation, waste removal and energy.

Co	<b>Component 5: Human Settlements and Environmental Health</b>			
Su	b-component 5.1: Human Settle	ements		
Тор	pic 5.1.2: Access to selected basic se	rvices		
Sta (Bo	atistics and Related InformationId Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Category of Measurement	Potential Aggregations and Scales	Methodological Guidance
a.	Population using an improved	Number	Urban	UNSD: MDG Indicator 7.8
b.	Population using an improved sanitation facility	Number	<ul><li>Rural</li><li>National</li><li>Sub-national</li></ul>	<ul> <li>UN-Water</li> <li>UNSD: Environment</li> </ul>
с.	Population served by municipal waste collection	Number		Statistics Section - Water and Waste Questionnaire • WHO/(United Nations Children's Fund (UNICEF) Joint Monitoring Programme for Water Supply and Sanitation
d.	Population connected to wastewater collecting system	Number	• By treatment type (e.g.,	<ul><li>UNSD: IRWS</li><li>ISIC Rev. 4, Section E,</li></ul>
e.	Population connected to wastewater treatment	Number	primary, secondary, tertiary) • National • Sub-national	Division 35-37 • UNSD: Environment Statistics Section - Water Questionnaire
f.	Population supplied by water supply industry	Number	<ul><li>National</li><li>Sub-national</li></ul>	
g.	Price of water	Currency	• By source (e.g., piped, vendor)	
h.	Population with access to electricity	Number		
i.	Price of electricity	Currency		

### Topic 5.1.3: Housing conditions

- 3.233. 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) and location in either safe or hazard prone areas. Housing access and conditions exert a direct effect on human wellbeing and health, and these data therefore serve as critical measures of those attributes.
- 3.234. 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 in the population and this renders them more vulnerable to disaster and adverse health impacts.
- 3.235. 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. Statistics may also be generated about the homeless population.
- 3.236. Depending on the country, common statistics describing the quality and the location of houses in either safe or hazard prone areas include: urban population living in slums, area of slums or population living 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 the placement of houses in hazard prone areas are commonly used.
- 3.237. Poor or inadequate housing conditions, in urban areas, can be approached using the concept of "slums" and statistics on the area 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.<sup>74</sup>

<sup>&</sup>lt;sup>74</sup> United Nations Statistics Division. "Millennium Development Goals Indicators, Indicator 7.10". Available from <u>http://mdgs.un.org/unsd/mdg/Metadata.aspx</u> (accessed 15 September 2013).

3.238. 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 regulation of building materials of local houses and buildings.

Co	<b>Component 5: Human Settlements and Environmental Health</b>				
Su	b-component 5.1: Human Settle	ements			
Тор	pic 5.1.3: Housing conditions				
Statistics and Related Information Category of Potential			Potential	Methodological	
( <b>Bo</b>	<b>Id Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance	
a.	Urban population living in slums	Number		UN Habitat	
b.	Area of slums	Area		• UNSD: MDG Indicator 7.10	
с.	Population living in hazard prone areas	Number	<ul> <li>Urban</li> </ul>	Metadata	
d.	Hazard prone areas	Area	Rural		
e.	Population living in informal settlements	Number	<ul><li>National</li><li>Sub-national</li></ul>		
f.	Homeless population	Number			
g.	Number of dwellings with adequacy of building materials defined by national or local standards	Number			

Table 3.5.1.3: Statistics and Related Information for Topic 5.1.3

### Topic 5.1.4: Exposure to ambient pollution

3.239. This topic includes spatially described statistics on human populations exposed to different levels of air and noise pollution. This topic 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 or noise pollutants in specific areas and the proportion of the exposed population to the total population of the city or region. Sources include NSOs carrying out censuses and surveys (for demographic statistics), environmental authorities (for point pollution emissions), and geographic or cartographic authorities.

<b>Component 5: Human Settlements and Environmental Health</b>				
Su	b-component 5.1: Human Settle	ements		
Тор	Topic 5.1.4: Exposure to ambient pollution			
Sta (Bo	atistics and Related Information Id Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Category of Measurement	Potential Aggregations and Scales	Methodological Guidance
a.	Population exposed to air pollution in main cities	Number	• By pollutant (e.g., SO <sub>2</sub> , NOx, O <sub>3</sub> )	• WHO
b.	Population exposed to noise pollution in main cities	Number		

Table 3.5.1.4: Statistics and Related Information for Topic 5.1.4

### Topic 5.1.5: Environmental concerns specific to urban settlements

- 3.240. 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.
- 3.241. 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 modes of transportation.
- 3.242. Data sources for this topic include administrative records, and remote sensing, while the common partners of the NSO include municipal authorities, urban planning and housing authorities responsible for zoning, as well as transport authorities and urban research centres.

Co	<b>Component 5: Human Settlements and Environmental Health</b>			
Su	b-component 5.1: Human Settle	ements		
Тор	pic 5.1.5: Environmental concerns sp	becific to urban set	tlements	
St	atistics and Related Information	Category of	Potential	Methodological
( <b>Bo</b>	<b>Id Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance
a.	Extent of urban sprawl	Area		UN Habitat
b.	Available green areas	Area		• WHO
c.	Number of private and public vehicles	Number	• By type of engine or type of fuel	UNEP Urban Environment Unit
d.	Population using public modes of transportation	Number		
e.	Population using hybrid and electric modes of transportation	Number		
f.	Extent of the roadways	Length		
g.	<i>Existence of urban planning and zoning regulations and instruments in main cities</i>	Description		
h.	Effectiveness of urban planning and zoning regulations and instruments in main cities	Description		

#### Sub-component 5.2: Environmental Health

- 3.243. The impacts of changes in environmental conditions and pollution 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. A considerable amount of critical global statistics on environmental health are presented in WHO's publications.<sup>75</sup> WHO states that "Environmental hazards are responsible for as much as a quarter of the total burden of diseases world-wide, and more than one-third of the burden among children. Heading that list are diarrhoea, lower respiratory infections, various forms of unintentional injuries and malaria. The disease burden is much higher in the developing world, although in the case of certain non-communicable diseases, such as cardiovascular diseases and cancers, the per capita disease burden is larger in developed countries. Health impacts of environmental hazards run across more than 80 diseases and types of injury.
- 3.244. Environmental health focuses on how environmental factors and processes impact and change human health. It can be defined as an interdisciplinary field that focuses on analysing the relation between public health and the environment. From the health perspective, WHO states that "environmental health addresses all the physical, chemical, and biological factors external to a person, and all the related factors impacting behaviours. It encompasses the assessment and control of those environmental factors that can potentially affect health. It is targeted towards preventing disease and creating health-supportive environments [...]".<sup>76</sup>
- 3.245. Common measures of health problems of human populations include statistics on morbidity (incidence and prevalence)<sup>77</sup> and mortality associated with specific types of diseases and conditions that are heavily influenced by environmental factors. Also, when available, estimations of premature death, 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 in environmental health statistics.

<sup>&</sup>lt;sup>75</sup> Including: (i) World Health Organization (2010). "10 Facts on Preventing Disease through Healthy Environments". Available from <a href="http://www.who.int/features/factfiles/environmental-health/environmental-health\_facts/en/">http://www.who.int/features/factfiles/environmental-health/environmental-health\_facts/en/</a> (accessed 18 June 2015); (ii) World Health Organization (2013). Fact Sheet 266 "Climate Change and Health". Available from <a href="http://www.who.int/mediacentre/factsheets/fs266/en/index.html">http://www.who.int/mediacentre/factsheets/fs266/en/index.html</a> (accessed 22 March 2013); and (iii) World Health Organization (2009). "The Resilience of Water Supply and Sanitation in the Face of Climate Change. Summary and Policy Implications Vision 2030". Available from <a href="http://www.who.int/water\_sanitation-health/publications/9789241598422\_cdrom/en/">http://www.who.int/water\_sanitation-health/publications/9789241598422\_cdrom/en/</a> (accessed 22 March 2013). "The Resilience of Water Supply and Sanitation in the Face of Climate Change. Summary and Policy Implications Vision 2030". Available from <a href="http://www.who.int/water\_sanitation-health/publications/9789241598422\_cdrom/en/">http://www.who.int/water\_sanitation-health/publications/9789241598422\_cdrom/en/</a> (accessed 22 March 2013). "

<sup>&</sup>lt;sup>76</sup> World Health Organization (2014). "Health topics – Environmental health". Available from <u>http://www.who.int/topics/environmental\_health/en</u> (accessed 22 September 2014).

 $<sup>^{77}</sup>$  Statistics on morbidity may include both its incidence and prevalence within the total population. Generally, incidence refers to the rate of occurrence of new cases of disease (number of new cases in a specified population per unit of time), while prevalence is the proportion of population with the disease at a given point in time. Therefore, incidence is the measure of speed, while prevalence is just a proportion – number of individuals with the disease divided by the source population size.

- 3.246. Associated environment statistics such as the emissions of pollutants to the environment can be found in Component 3: Residuals, while statistics on pollution concentration in air, water and soil can be found in Sub-component 1.3: Environmental Quality.
- 3.247. The main partner and source of data on morbidity (incidence and prevalence) and mortality due to 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.
- 3.248. Primary epidemiological data can be selected and further processed for transformation into the environmental health statistics that constitute this sub-component. The resulting statistics are usually produced using national and sub-national data. They include descriptive epidemiological data that can usually be updated on a yearly basis.
- 3.249. WHO is making remarkable progress in the development of methodologies needed for estimating the attributable fraction<sup>78</sup> and the burden of disease attributable to the environment.<sup>79</sup> It has also formulated comprehensive indicators and indexes such as DALY (disability-adjusted life years),<sup>80</sup> which is a summary measure of population health problems combining both morbidity and premature death associated with different factors related to the modifiable environment.<sup>81</sup> However, caution must be exercised when producing these types of environmental health statistics because health and environmental problems are multifaceted and complex. Attributing the proportion of disease cases to a specific environmental or non-environmental factor is a challenging process associated with a degree of uncertainty.

### Topic 5.2.1: Airborne diseases and conditions

3.250. This topic includes all airborne diseases and conditions that are caused or worsened by exposure to unhealthy levels of pollutants (such as PM, SO<sub>2</sub> or O<sub>3</sub>), usually found in urban

<sup>9</sup>World Health Organization (2014). Metrics: Disability-Adjusted Life Year (DALY). Available from http://www.who.int/healthinfo/global\_burden\_disease/metrics\_daly/en/ (accessed 8 September 2014).

http://www.who.int/quantifying\_ehimpacts/publications/preventingdisease.pdf (accessed 22 March 2013). The modifiable environment includes: air, soil and water pollution with chemicals or biological agents; ultraviolet and ionizing radiation; built environment; noise, electromagnetic fields; occupational risks, agricultural methods and irrigation schemes; anthropogenic climate changes and ecosystem degradation; and individual behaviours related to the environment (hand-washing, food contamination with unsafe water or dirty hands). WHO Indicator and Measurement Registry (IMR, version 1.6.0), Indicator : "Mortality and burden of disease attributable to the environment", available from

http://apps.who.int/gho/indicatorregistry/App\_Main/view\_indicator.aspx?iid=2393 (accessed 22 March 2013).

<sup>&</sup>lt;sup>78</sup> The attributable fraction is the proportion of all health problems or deaths in the community that can be attributed to the [environmental] risk factor. This can be estimated by the proportional reduction in the number of health problems or deaths as a result of reducing the [environmental] risk factor. WHO (2006). "Preventing Disease through Healthy Environments. Towards an estimate of the environmental burden of disease", page 25. Available from http://www.who.int/quantifying\_ehimpacts/publications/preventingdisease.pdf (accessed 22 March 2013).

<sup>&</sup>lt;sup>79</sup> The burden of disease attributable to the environment includes: Number of deaths, death rate, number of DALYs, DALYs rate, the percentage of total dearth attributable to the environment, and the percentage of total DALYs attributable to the environment. WHO Indicator and Measurement Registry (IMR, version 1.6.0), Indicator : "Mortality and burden of disease attributable to the environment", available from

http://apps.who.int/gho/indicatorregistry/App\_Main/view\_indicator.aspx?iid=2393 (accessed 22 March 2013).

<sup>&</sup>lt;sup>81</sup> World Health Organization's definition of the modifiable environment aims to cover those parts of the environment that can be modified by environmental management, so as to reduce its impact on human health. WHO (2006): "Preventing Disease through Healthy Environments. Towards an estimate of the environmental burden of disease", page 22. Available from

settlements, 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, allergic rhinitis, lung cancer, ischaemic heart disease and stroke. This topic includes health statistics on morbidity (such as incidence and prevalence) and mortality of these diseases or conditions, as well as measurement of the associated impact on the labour force and on the economic costs. Where available, the attributable portion and burden of diseases, premature deaths and DALYs associated with pollution are to be included in this topic.

Co	<b>Component 5: Human Settlements and Environmental Health</b>			
Su	b-component 5.2: Environment	al Health		
Тор	Topic 5.2.1: Airborne diseases and conditions			
Sta (Bo	atistics and Related Information Id Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Category of Measurement	Potential Aggregations and Scales	Methodological Guidance
a.	Airborne diseases and conditions		<ul> <li>By disease or</li> </ul>	• WHO
	1. Incidence	Number	condition	
	2. Prevalence	Number	<ul> <li>National</li> <li>Sub-national</li> <li>Urban</li> </ul>	
	3. Mortality	Number		
	4. Loss of work days	Number	<ul> <li>Rural</li> </ul>	
	5. Estimates of economic cost in monetary terms	Currency	<ul><li> By gender</li><li> By age group</li><li> By time period</li></ul>	

Table 3.5.2.1: Statistics and Related Information for Topic 5.2.1

#### Topic 5.2.2: Water-related diseases and conditions

3.251. This topic includes all water-related diseases and conditions that result from micro-organisms and chemicals in the water humans drink. Water-related diseases and conditions are still a considerable public health problem in developing countries. They include, but are not limited to diseases caused by biological contamination such as gastroenteritis infections caused by bacteria, viruses and protozoa, and water borne parasite infections. This topic may also include diseases and health problems associated with the (organic or inorganic) chemical contamination of water (e.g., from arsenic, cadmium, chromium, copper, etc.) as prolonged exposure to these chemicals can provoke different health problems including increased risk of cancer, organ damage and malfunction, increased blood cholesterol and pressure, among others. Where available, this topic includes health statistics such as morbidity (incidence and prevalence) and mortality of these diseases or conditions, as well as measures of the associated impact on the labour force and on the economic costs. When possible, the attributable portion and burden of diseases, premature deaths and DALYs associated with water related factors are to be included in this topic.

<b>Component 5: Human Settlements and Environmental Health</b>								
Sub-component 5.2: Environmental Health								
Topic 5.2.2: Water-related diseases and conditions								
Statistics and Related Information (Bold Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)		Category of Measurement	Potential Aggregations and Scales	Methodological Guidance				
a.	Water-related diseases and conditions	Number	<ul> <li>By disease or condition</li> </ul>	• WHO				
	2. Prevalence	Number	<ul> <li>National</li> <li>Sub-national</li> <li>Urban</li> <li>Rural</li> </ul>					
	3. Mortality 4. Loss of work days	Number Number						
	5. Estimates of economic cost in monetary terms	Currency	<ul><li>By gender</li><li>By age group</li><li>By time period</li></ul>					

 Table 3.5.2.2: Statistics and Related Information for Topic 5.2.2
 Statistics and Related Information for Topic 5.2.2

### Topic 5.2.3: Vector borne diseases

3.252. This topic includes vector borne diseases that are transmitted by organisms (e.g., insects and arachnids) that carry viruses, bacteria, protozoa and other pathogens. 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. This topic includes health statistics such as morbidity (incidence and prevalence) and mortality of these diseases or conditions, as well as measures of the associated impact on the labour force and on the economic costs. Where available, the attributable portion and burden of diseases, premature deaths and DALYs associated with vector-borne environmental factors are to be included in this topic.

<b>Component 5: Human Settlements and Environmental Health</b>								
Sub-component 5.2: Environmental Health								
Topic 5.2.3: Vector borne diseases								
Statistics and Related Information		Category of Measurement	Potential Aggregations and Scales	Methodological Guidance				
( <b>Bold Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )								
a.	Vector borne diseases		<ul> <li>By disease or</li> </ul>	• WHO				
	1. Incidence	Number	condition					
	2. Prevalence	Number	<ul> <li>National</li> <li>Sub-national</li> <li>Urban</li> <li>Rural</li> </ul>					
	3. Mortality	Number						
	4. Loss of work days	Number						
	5. Estimates of economic cost in monetary terms	Currency	<ul><li>By gender</li><li>By age group</li><li>By time period</li></ul>					

 Table 3.5.2.3: Statistics and Related Information for Topic 5.2.3

### Topic 5.2.4: Health problems associated with excessive UV radiation exposure

3.253. This topic includes statistics on the incidence and prevalence of melanoma and other skin cancers and also the incidence and prevalence of cataracts associated with excessive and prolonged UV radiation exposure. In addition, this topic includes statistics on work days lost and economic costs in monetary terms. Where available, the attributable portion and burden of diseases, premature deaths and DALYs associated with excessive UV radiation exposure is to be included in this topic.
Co	<b>Component 5: Human Settlements and Environmental Health</b>			
Su	b-component 5.2: Environment	al Health		
Top	pic 5.2.4: Health problems associated	d with excessive U	V radiation exposi	ıre
Statistics and Related Information Category of		Category of	Potential	Methodological
( <b>Bo</b>	<b>Id Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Aggregations and Scales	Guidance
a.	Problems associated with excessive UV radiation exposure		<ul> <li>By disease or condition</li> </ul>	• WHO
	1. Incidence	Number	<ul> <li>National</li> </ul>	
	2. Prevalence	Number	<ul> <li>Sub-national</li> </ul>	
	3. Loss of work days	Number	<ul> <li>Urban</li> <li>Rural</li> </ul>	
	4. Estimates of economic cost in monetary terms	Currency	<ul><li>By gender</li><li>By age group</li><li>By time period</li></ul>	

#### Topic 5.2.5: Toxic substance- and nuclear radiation-related diseases and conditions

- 3.254. 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 and lower respiratory diseases, asthma and chronic obstructive pulmonary diseases), cancer, infertility, and congenital anomalies or malformations.
- 3.255. The exposure to toxic substances is usually the result of poor environmental management in the chemical industry, energy production, mining, agriculture, 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 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 a specific medium such as air, water, etc.
- 3.256. This topic also includes diseases and conditions associated with exposure to nuclear radiation. The related diseases and health conditions can be acute or chronic. They 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.
- 3.257. Exposure to nuclear radiation could occur from a nuclear explosion or from an accident involving a nuclear reactor. In such situations, radioactive material is emitted to surrounding air, water and soil of human settlements and ecosystems. The conditions arising from exposure to humans can range from immediate and mechanical injuries, through long term and delayed effects on organs and tissues. Caution must be exercised in assessing the public heath burden due to exposure to radiation, since some of the health problems such as cancer, can also be caused by other factors.
- 3.258. This topic includes statistics about morbidity (incidence and prevalence) due to toxic substance-related or radiation-related diseases and conditions, as well as measurement of the associated impact on the labour force and on the economic costs. Where available, the

attributable portion and burden of diseases, premature deaths and DALYs associated with toxic substances and radiation is to be included in this topic. These statistics are also relevant in Topic 4.2.2: Impact of technological disasters.

3.259. 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.

Co	<b>Component 5: Human Settlements and Environmental Health</b>			
Su	b-component 5.2: Environment	al Health		
Top	bic 5.2.5: Toxic substance-and nucle	ar radiation-related	diseases and cond	ditions
Sta	atistics and Related Information	Category of	Potential	Methodological
(Bo	<b>Id Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	and Scales	Guidance
a.	Toxic substance-and nuclear radiation-		<ul> <li>By category of</li> </ul>	• WHO
	related diseases and conditions		toxic substance	
	1. Incidence	Number	<ul> <li>By disease or</li> </ul>	
	2. Prevalence	Number	condition	
	3. Loss of work days	Number	<ul> <li>National</li> <li>Sub national</li> </ul>	
	4. Estimates of economic cost in	Currency	<ul> <li>Sub-national</li> <li>Urban</li> </ul>	
	monetary terms		<ul> <li>Rural</li> </ul>	
			<ul> <li>By gender</li> </ul>	
			<ul> <li>By age group</li> </ul>	

#### 3.6 Component 6: Environment Protection, Management and Engagement

- 3.260. 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 participate in 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.
- 3.261. This component organizes information on environment protection and resource management expenditure 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.
- 3.262. 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

3.263. This sub-component is closely related to the environmental activity accounts of the SEEA-CF and it is based on the CEA.<sup>82</sup> Expenditure on environment protection and resource management can be used as one measure of the public and private engagement in protecting, restoring and managing the environment towards its more sustainable use. Monitoring and tracking the level of environment protection and resource management expenditure is important for policy makers, analysts and civil society in order to

<sup>&</sup>lt;sup>82</sup> United Nations, European Union, Food and Agriculture Organization of the United Nations, International Monetary Fund, Organisation for Economic Co-operation and Development, and the World Bank (2014). "Classification of Environmental Activities, contained in the SEEA Central Framework". Available from

http://unstats.un.org/unsd/envaccounting/seeaRev/SEEA\_CF\_Final\_en.pdf (accessed 30 September 2014).

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

- 3.264. 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. These activities include the protection of ambient air and climate, wastewater management, waste management, protection and remediation of soil, groundwater and surface water, noise and vibration abatement, protection of biodiversity and landscapes, protection against radiation, research and development for environmental protection and other environmental protection activities.
- 3.265. 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.
- 3.266. 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 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-CF (for further information see Annex D: Classifications and environment statistics).
- 3.267. 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.

3.268. Closely linked to the Classification of Environmental Activities are the economic statistics of the Environmental Goods and Services Sector (EGSS).<sup>83</sup> EGSS consists of a heterogeneous set of producers of technologies, goods and services that: (i) measure, control, restore, prevent, treat, minimise, research and sensitise environmental damages to air, water and soil as well as problems related to waste, noise, biodiversity and landscapes. This includes 'cleaner' technologies, goods and services that prevent or minimise pollution; and (ii) measure, control, restore, prevent, minimise, research and sensitise resource depletion. This results mainly in resource-efficient technologies, goods and services that minimise the use of natural resources.<sup>84</sup>

# *Topic 6.1.1: Government environment protection and resource management expenditure*

- 3.269. This topic includes government expenditure primarily aimed to protect the environment and manage resources. 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.
- 3.270. The main institutional partners are the official institutions in charge of reporting government expenditure (e.g., internal revenue services) and the national and subnational 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.

<sup>&</sup>lt;sup>83</sup> Eurostat (2009). "The environmental goods and services sector". Eurostat Methodologies and Working Papers. Available from <a href="http://ec.europa.eu/eurostat/documents/3859598/5910217/KS-RA-09-012-EN.PDF/01d1733e-46b6-4da8-92e6-766a65d7fd60?version=1.0">http://ec.europa.eu/eurostat/documents/3859598/5910217/KS-RA-09-012-EN.PDF/01d1733e-46b6-4da8-92e6-766a65d7fd60?version=1.0</a> (accessed 18 June 2015).

<sup>&</sup>lt;sup>84</sup> Eurostat (2009). "The environmental goods and services sector". Eurostat Methodologies and Working Papers. Available from <u>http://ec.europa.eu/eurostat/documents/3859598/5910217/KS-RA-09-012-EN.PDF/01d1733e-46b6-4da8-92e6-766a65d7fd60?version=1.0</u> (accessed 18 June 2015).

Co	<b>Component 6: Environment Protection, Management and Engagement</b>				
Su	b-component 6.1: Environment	Protection and	Resource Mana	gement Expenditure	
Top	pic 6.1.1: Government environment	protection and reso	urce management	expenditure	
Statistics and Related Information Category of		Category of	Potential	Methodological	
(Bo	old Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Measurement	Aggregations and Scales	Guidance	
a.	Government environment protection and resource management expenditure		<ul> <li>By environmental</li> </ul>	Classification of     Environmental Activities (CEA)	
	1. Annual government environment protection expenditure	Currency	activity <ul> <li>By type of</li> </ul>	<ul> <li>SEEA Central Framework</li> <li>(2012) Annex 1</li> </ul>	
	2. Annual government resource management expenditure	Currency	expenditure: current, investment • By ministry • National • Sub-national • By funding	Eurostat - SERIEE     Environmental Protection     Expenditure Accounts     Compilation Guide	

# Table 3.6.1.1: Statistics and Related Information for Topic 6.1.1

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

3.271. Supplementary to the previous topic, this topic includes corporate, non-profit institution and household environmental expenditure whose primary aim is to protect the environment and manage its resources. Statistics on environment protection and resource management expenditure for corporations, non-profit institutions and households usually require 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.

### Table 3.6.1.2: Statistics and Related Information for Topic 6.1.2 Particular

### **Component 6: Environment Protection, Management and Engagement**

### Sub-component 6.1: Environment Protection and Resource Management Expenditure

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

Sta	atistics and Related Information	Category of	Potential	Methodological
(Bo	old Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Measurement	Aggregations and Scales	Guidance
a.	Private sector environment protection and resource management expenditure		<ul> <li>By environmental</li> </ul>	
	1. Annual corporate environment protection expenditure	Currency	activity <ul> <li>By type of</li> </ul>	
	2. Annual corporate resource management expenditure	Currency	expenditure: current,	
	3. Annual non-profit institution environment protection expenditure	Currency	<ul><li>investment</li><li>By ISIC</li><li>economic activity</li><li>National</li></ul>	
	4. Annual non-profit institution resource management expenditure	Currency		
	5. Annual household environment protection expenditure	Currency	• Sub-national	
	6. Annual household resource management expenditure	Currency		

#### Sub-component 6.2: Environmental Governance and Regulation

- 3.272. 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.
- 3.273. 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.
- 3.274. 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 are also included in this sub-component.

#### Topic 6.2.1: Institutional strength

- 3.275. 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 statistics on environmental institutions and their resources organized according to the main government environmental authority (name, budget and staff), and other relevant environmental institutions (names, budget and staff).
- 3.276. The main institutional partners here include the environmental authority (e.g., Ministry of Environment or equivalent institution) and other relevant environmental institutions. 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 levels and natural resources (e.g., rivers, forests).

<b>Component 6: Environment Protection, Management and Engagement</b>				
Sub-component 6.2: Envir	Sub-component 6.2: Environmental Governance and Regulation			
Topic 6.2.1: Institutional streng	gth			
Statistics and Related Inform	nation	Category of	Potential	Methodological
(Bold Text - Core Set/Tier 1; Regula Tier 2; Italicized Text - Tier 2	ar Text - 3)	Measurement	Aggregations and Scales	Guidance
a. Government environmental ins and their resources	titutions		<ul><li>National</li><li>Sub-national</li></ul>	
1. Name of main environmenta authority and year of establishmeters	l nent	Description		
2. Annual budget of the main environmental authority		Currency		
3. Number of staff in the main environmental authority		Number		
4. List of environmental depart other authorities and year of establishment	ments in	Description		
5. Annual budget of environme departments in other authorities	ntal	Currency		
6. Number of staff of environm departments in other authorities	ental	Number		
b. Other environmental institution their resources	s and		<ul><li>National</li><li>Sub-national</li></ul>	
1. Name of institution and year establishment	of	Description		
2. Annual budget of the institut	ion	Currency		
3. Number of staff in the institu	ition	Number		

# Table 3.6.2.1: Statistics and Related Information for Topic 6.2.1

#### Topic 6.2.2: Environmental regulation and instruments

- 3.277. This topic refers to social responses aiming to regulate and establish acceptable limits for protecting the environment and human health. It entails both direct regulation as well as economic instruments. Direct regulation instruments include environmental and related laws, standards, limits and their enforcement capacities. They can be measured through statistics about regulated pollutants, licensing systems, applications for licences, quotas for biological resource extraction, as well as budget and the number of staff dedicated to enforcement of environmental regulations. Economic instruments may be exemplified by the existence and number of green/environmental taxes, environmental subsidies, eco-labelling and certification, as well as emission permits.
- 3.278. 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 descriptive, for example, a list of regulated pollutants and their description, but may also include quantitative data on budgets or emission permits traded.

Co	<b>Component 6: Environment Protection, Management and Engagement</b>			
Su	Sub-component 6.2: Environmental Governance and Regulation			
Top	bic 6.2.2: Environmental regulation	and instruments		
Sta	atistics and Related Information	Category of	Potential Aggregations	Methodological
(Bo	Id Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Measurement	and Scales	Guidance
a.	Direct regulation		• Per media (e.g.,	
	1. List of regulated pollutants and description (e.g., by year of adoption and maximum allowable levels)	Description, Number	water, air, land, soil, oceans) • By ISIC	
	2. Description (e.g., name, year established) of licensing system to ensure compliance with environmental standards for businesses or other new facilities	Description	<ul><li>economic activity</li><li>National</li><li>Sub-national</li></ul>	
	3. Number of applications for licences received and approved per year	Number		
	4. List of quotas for biological resource extraction	Number		
	5. Budget and number of staff dedicated to enforcement of environmental regulations	Currency, Number		
b.	Economic instruments			
	1. List and description (e.g., year of establishment) of green/environmental taxes	Description, Currency		
	2. List and description (e.g., year of establishment) of environmentally relevant subsidies	Description, Currency		
	3. List of eco-labelling and environmental certification programmes	Description		
	4. Emission permits traded	Number, Currency		

Table 3.6.2.2: Statistics and Related Information for Topic 6.2.2

#### Topic 6.2.3: Participation in MEAs and environmental conventions

3.279. This topic includes information on a country's participation<sup>85</sup> 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 descriptive, however, comparable time series can also be derived from these statistics.

<sup>&</sup>lt;sup>85</sup> 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-con	mponent 6.2: Environment	al Governance a	nd Regulation	
Topic 6.2	2.3: Participation in MEAs and	environmental con	ventions	
Statistic	cs and Related Information	Category of	Potential	Methodological
(Bold Tex Tie	xt - Core Set/Tier 1; Regular Text - er 2; Italicized Text - Tier 3)	Measurement	Aggregations and Scales	Guidance
a. Parti envir	cipation in MEAs and other global ronmental conventions			Secretariats of MEAs
1. Li parti and conv	st and description (e.g., year of icipation <sup>(d)</sup> of country) of MEAs other global environmental ventions	Description, Number		
(d) 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: 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.				

### Table 3.6.2.3: Statistics and Related Information for Topic 6.2.3

#### Sub-component 6.3: Extreme Event Preparedness and Disaster Management

- 3.280. Statistics describing extreme event preparedness and disaster management 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 management agency's facilities and infrastructure.
- 3.281. Extreme event preparedness and disaster management 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

- 3.282. Measures of disaster preparedness will vary according to the community and location's characteristics and historical profile for natural extreme events and disasters. Relevant information can include: the existence and description of national disaster plans; the type and number of shelters in place; the type and number of internationally certified emergency and recovery management specialists; the number of volunteers; the quantity of first aid, and emergency supplies and equipment that are stockpiled. The existence of early warning systems for all major hazards, as well as the expenditure on disaster prevention, preparedness, clean-up and rehabilitation are also important data requirements.
- 3.283. 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.

Cor	<b>Component 6: Environment Protection, Management and Engagement</b>			
Sub	-component 6.3: Extreme Eve	nt Preparedness	and Disaster M	lanagement
Topi	ic 6.3.1: Preparedness for natural ex	streme events and o	lisasters	
Sta	tistics and Related Information	Category of	Potential	Methodological
(Bol	d Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Measurement	Aggregations and Scales	Guidance
a.	National natural extreme event and disaster preparedness and management systems		<ul><li>National</li><li>Sub-national</li></ul>	<ul> <li>International Emergency Management Organization (IEMO)</li> </ul>
	1. Existence of national disaster plans/programmes	Description		<ul><li>UNISDR</li><li>Hyogo Framework for Action</li></ul>
	2. Description (e.g., number of staff) of national disaster plans/programmes	Description		
	3. Number and type of shelters in place or able to be deployed	Description, Number		
	4. Number and type of internationally certified emergency and recovery management specialists	Description, Number		
	5. Number of volunteers	Number		
	6. <i>Quantity of first aid, emergency supplies and equipment stockpiles</i>	Number		
	7. Existence of early warning systems for all major hazards	Description		
	8. Expenditure on disaster prevention, preparedness, clean-up and rehabilitation	Currency		

# Table 3.6.3.1: Statistics and Related Information for Topic 6.3.1

#### Topic 6.3.2: Preparedness for technological disasters

- 3.284. Preparedness for technological disasters can be quite different from that of natural extreme events and disasters. This is due to the fact that technological disasters usually arise at an industrial location or on a mode of transportation where it is often the corporate sector which has a vested interest or legal obligation in contributing to preparedness and clean-up. Natural extreme events and disasters usually occur on a larger scale and it is normally the government which is primarily involved in preparedness and clean-up.
- 3.285. Measures of corporate disaster preparedness will vary according to the size of the enterprise, its location and historical profile for technological disasters. The impact of the disaster can vary with the size of the enterprise relative to the local area, as the same disaster may not have a substantial effect on a large industrial complex in a major city, but may reach 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 expenditure on disaster prevention, preparedness, clean-up and rehabilitation.

Co	<b>Component 6: Environment Protection, Management and Engagement</b>			
Su	b-component 6.3: Extreme Eve	nt Preparedness	and Disaster M	lanagement
Top	Topic 6.3.2: Preparedness for technological disasters			
Sta (Bo	atistics and Related Information old Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Category of Measurement	Potential Aggregations and Scales	Methodological Guidance
a.	National technological disaster preparedness and management systems1. Existence and description (e.g., number of staff) of public disaster management plans/programmes (and private when available)2. Expenditure on disaster prevention,	Description	<ul> <li>National</li> <li>Sub-national</li> </ul>	<ul> <li>International Emergency Management Organization (IEMO)</li> <li>UNISDR</li> <li>Hyogo Framework for Action</li> </ul>
	preparedness, clean-up and rehabilitation			

# Table 3.6.3.2: Statistics and Related Information for Topic 6.3.2

#### Sub-component 6.4: Environmental Information and Awareness

- 3.286. This sub-component covers statistics about environmental information and diverse processes that contribute to increasing social awareness of environmental issues, thus promoting pro-environmental engagement and actions by the public and decision-makers at both local and national levels.
- 3.287. 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, 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 local and national environmental policies and programmes.
- 3.288. 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 actions 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 by public policies.
- 3.289. 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 differ.

#### Topic 6.4.1: Environmental information

3.290. Environmental information describes quantitative, qualitative or geographically referenced facts representing the state of the environment and its changes as described in the different components of the FDES. Quantitative environmental information is generally produced in the form of data, statistics and indicators, and is generally disseminated through databases, spreadsheets, compendia and yearbook type products. Qualitative environmental information consists of descriptions (e.g., textual, pictorial) of

the environment or its constituent parts that cannot be adequately represented by accurate quantitative or geographically referenced descriptors. Geographically referenced environmental information provides facts on the environment and its components using digital maps, satellite imagery and other sources linked to a location or map feature.

- 3.291. This topic can include information on the characterization of: (i) national environmental information systems (e.g., existence of publicly accessible systems and number of users); and (ii) environment statistics programmes within national statistical systems (e.g., description of programme, number and type of environment statistics products, interagency platforms or committees).
- 3.292. The production and dissemination of environment statistics within national statistical systems enables the production of robust environmental and sustainable development indicators (SDIs) to substantiate reports on the changing environment, and to guide policy making. Measuring and constructing statistics on information production and dissemination 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.
- 3.293. The main institutional partners in this instance include the environmental authority and the NSO, along with other possible institutions where databases containing environmental information and reports containing environmental statistics and indicators are produced. Information to be produced in this topic is mainly descriptive but can also include quantitative data on budgets. It is usually compiled at the national level.

Co	<b>Component 6: Environment Protection, Management and Engagement</b>			
Su	o-component 6.4: Environment	al Information a	nd Awareness	
Тор	vic 6.4.1: Environmental information	1		
Sta	atistics and Related Information	Category of	Potential	Methodological
(Bo	ld Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Measurement	Aggregations and Scales	Guidance
a.	Environmental information systems		National	
	1. Existence of publicly accessible environmental information system	Description	<ul> <li>Sub-national</li> </ul>	
	2. Annual number of visits/users of specific environmental information programmes or environmental information systems	Number		
b.	Environment statistics			
	1. Description of national environment statistics programmes (e.g., existence, year of establishment, lead agency, human and financial resources)	Description		
	2. Number and type of environment statistics products and periodicity of updates	Description, Number		
	3. Existence and number of participant institutions in interagency environment statistics platforms or committees	Number		

### Table 3.6.4.1: Statistics and Related Information for Topic 6.4.1

#### Topic 6.4.2: Environmental education

- 3.294. Environmental education refers to the process of sharing and constructing environmental information and knowledge, as well as information on how humans interact with the environment. Environmental education is realized through a variety of programmes including formal and informal education and training, directed towards different audiences. It can be curriculum and classroom based or experiential, and provided on-site or in community settings by government agencies or NGOs. Environmental education is an integral part of education for sustainable development.
- 3.295. 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 in terms of the number of people participating in these programmes.
- 3.296. The statistics on environmental education can include the allocation of resources for education, the number and description of the education programmes in schools, and the number of students pursuing environment-related higher education.
- 3.297. The main institutional partners in this case include the ministry of education, ministry of environment or equivalent institution, 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 comes mainly from administrative records and is usually qualitative in nature, but can also include monetary data on resources spent. It is usually compiled at the national and sub-national levels.

Co	<b>Component 6: Environment Protection, Management and Engagement</b>			
Su	o-component 6.4: Environment	al Information a	nd Awareness	
Тор	bic 6.4.2: Environmental education			
Statistics and Related Information Cotogory of Potential Methodological				
(Bo	ld Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Measurement	Aggregations and Scales	Guidance
a.	Environmental education		National	
	1. Allocation of resources by central and local authorities for environmental education	Currency	Sub-national	
	2. Number and description of environmental education programmes in schools	Description, Number		
	3. Number of students pursuing environment-related higher education (e.g., science, management, education, engineering)	Number		

### Table 3.6.4.2: Statistics and Related Information for Topic 6.4.2 Particular

#### Topic 6.4.3: Environmental perception and awareness

- 3.298. Environmental perception refers to the concepts, attitudes and evaluations of persons and groups towards the environment, both as a whole or with respect to specific environmental issues. Decisions, judgments and actions are made by individuals and communities upon subjective perceptions of environmental information and experiences. Information is therefore "filtered" by people's values and attitudes, and transformed into perception in a culturally specific manner. Environmental awareness involves the progressive understanding of environmental issues, and the realization of the connections between human actions, development, sustainability and the human responsibility in these processes. Environmental awareness entails the realization that humans and ecosystems co-exist in a shared environment which is ultimately the biosphere. Awareness fosters pro-environmental attitudes and predispositions for action and changed behaviour.
- 3.299. This topic includes both the general public or a specific group's perceptions and awareness of the environment through the measurement of knowledge, attitudes, values and actions. It also encompasses people's perceptions about governments' environmental policies aimed at addressing pressing environmental concerns. Increasingly, countries and international polling companies have been surveying the public to measure such information across society.
- 3.300. Knowledge about environmental issues influences people's attitudes which are predispositions for participating in pro-environmental activities. Attitudes are also formed according to a given person's or community's underlying values, thus developing general awareness about different environmental concerns.
- 3.301. The main institutional partners in this case include the environmental authority and the NSO, along with other institutions where environmental perception surveys could be carried out (e.g., by local governments or polling companies). These statistics are produced through surveys designed for data collection on this topic. Statistics belonging to this topic are mainly qualitative, and are compiled at both the sub-national and national levels.

Co	<b>Component 6: Environment Protection, Management and Engagement</b>			
Sul	o-component 6.4: Environment	al Information a	nd Awareness	
Top	Topic 6.4.3: Environmental perception and awareness			
Sta (Bo	Atistics and Related Information Id Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Category of Measurement	Potential Aggregations and Scales	Methodological Guidance
a.	Public environmental perception and awareness		<ul><li>National</li><li>Sub-national</li></ul>	
	1. Knowledge and attitudes about environmental issues or concerns	Description		
	2. Knowledge and attitudes about environmental policies	Description		

# Table 3.6.4.3: Statistics and Related Information for Topic 6.4.3

#### Topic 6.4.4: Environmental engagement

- 3.302. Environmental engagement involves the progression of transforming perception and attitudes into concrete, pro-environmental actions. Individual and social participation and engagement in different environmental processes aimed at improving and protecting the local and global environment are a concrete manifestation of understanding, motivation and commitment towards protecting and improving the environment which is expressed through actual behaviour.
- 3.303. This topic is intended to capture any available statistics on pro-environmental activities and programmes in a country. Pro-environmental activities are those activities undertaken by civil societies or community groups to protect, improve and manage the environment. This topic also includes information about environmental programmes (e.g., conservation, energy efficiency, tree planting) and outreach programmes (e.g., efforts to increase public awareness of key environmental issues).
- 3.304. Statistics may include the number and capacity of pro-environmental NGOs, such as number of institutions and the amount of financial and human resources, which are usually available. They also can include statistics on the number of pro-environmental activities and pro-environmental programmes.
- 3.305. 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 institution, municipalities and local governments and NGOs.

<b>Component 6: Environment Protection, Management and Engagement</b>											
Sub-component 6.4: Environmental Information and Awareness											
Topic 6.4.4: Environmental engagement											
Sta	atistics and Related Information	Category of	Potential	Methodological							
(Bold Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)		Measurement	Aggregations and Scales	Guidance							
a.	Environmental engagement		National								
	1. Existence of pro-environmental NGOs (number of NGOs and their respective human and financial resources)	Currency, number	Sub-national								
	2. Number of pro-environmental activities	Number									
	3. Number of pro-environmental programmes	Number									

# Table 3.6.4.4: Statistics and Related Information for Topic 6.4.4

### **Chapter 4: From the Basic Set to the Core Set of Environment Statistics**

4.1. This chapter further elaborates the FDES by presenting the statistics that describe the statistical topics, grouped within the Basic Set of Environment Statistics and the Core Set of Environment Statistics. These Sets have been developed in response to country demand, according to their relevance to environmental issues and to corresponding FDES topics. The statistics contained in these Sets are also useful for calculating environmental indicators and for generating environmental-economic accounts.

#### 4.1 The Basic Set of Environment Statistics

4.2. As seen in Chapter 3, the Basic Set of Environment Statistics is a comprehensive but not exhaustive set of statistics designed to support countries developing national environment statistics programmes by assisting them in making decisions on priorities for statistical development. This Basic Set of Statistics is set up with enough flexibility to be adapted to individual countries' environmental concerns, priorities and resources. In order to do so, the Basic Set of Environment Statistics has been set up following a progression of three tiers (see Figure 4.1). Tier 1 defines the Core Set of Environment Statistics, that is, a set of statistics which countries are recommended to consider producing in the short-term. The scope can be gradually widened to the statistics contained in Tiers 2 and 3 as national priorities require and as data availability and resources permit. (Description of Tiers 2 and 3 follow in the text below)



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 development of the Basic Set of Environment Statistics began in 2010 with a review of the UNSD List of Environmental Indicators, adopted by the United Nations Statistical Commission in 1995, and the lists of environment statistics contained in the two technical reports which accompanied the 1984 FDES.<sup>86,87</sup> 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.
- 4.5. 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 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 environmental 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.
- 4.6. 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 458 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

<sup>&</sup>lt;sup>86</sup> United Nations Statistics Division (1988). "Concepts and Methods of Environment Statistics: Human Settlements Statistics – A Technical Report". Available from <u>http://unstats.un.org/unsd/publication/SeriesF/SeriesF\_51e.pdf</u> (accessed 18 June 2013).

<sup>&</sup>lt;sup>87</sup> United Nations Statistics Division (1991). "Concepts and Methods of Environment Statistics: Statistics of the Natural Environment – A Technical Report". Available from <u>http://unstats.un.org/unsd/publication/SeriesF/SeriesF\_57E.pdf</u> (accessed 18 June 2013).

grouped according to the FDES structure outlined in Chapter 3 consisting of components, sub-components and topics.

- 4.7. The contents of the Basic Set were then subjected to a pilot test that was conducted in 25 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. The countries were also asked to indicate the priority of each statistic for national policy making. 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.
- 4.8. 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 statistics, Tier 2 and Tier 3 are defined as follows:
  - Tier 1 is the Core Set of Environment Statistics which are of high priority and relevance to most countries, and have a sound methodological foundation, so countries are recommended to consider producing them in the short-term.
  - Tier 2 includes environment statistics which are of priority and relevance to most countries but need more significant investment in time, resources or methodological development, so countries are recommended to consider producing them in the medium-term.
  - Tier 3 includes environment statistics which are either of less priority or require significant methodological development, so countries are recommended to consider producing them in the long-term.

The table below provides the number of statistics according to each of the three Tiers and the six components.

	Component 1	Component 2	Component 3	Component 4	Component 5	Component 6	Total
Tier 1	32	30	19	4	12	3	100
Tier 2	58	51	34	11	22	24	200
Tier 3	51	43	5	16	20	23	158
Total	141	124	58	31	54	50	458

 Table 4.1: Distribution of Statistics by Tiers and Components

- 4.9. 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 of 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 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.
- 4.10. Finally, the Basic Set and Core Set were subjected to an analysis of their usefulness to the monitoring and measurement of the SDGs emerging from the discussions around the post-2015 development agenda.

#### 4.2 The Core Set of Environment Statistics

- 4.11. The Core Set of Environment Statistics consists of a limited number of statistics, as well as some non-statistical information on the environment. 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 global levels.
- 4.12. 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.
- 4.13. 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.
- 4.14. The Core Set provides guidance on the statistics to be included in a national environment statistics programme to serve national policy-makers and international agencies with the

most relevant 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.

- 4.15. The Core Set will be accompanied by detailed guidance elaborating on agreed concepts, definitions, classifications and data compilation methods that will be contained in a forthcoming publication. This methodological guidance will be used to train and assist countries that wish to incorporate the Core Set into their national statistical programmes. This will be invaluable in ensuring the availability of a defined set of relevant and internationally comparable environment statistics.
- 4.16. 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 as well as the Core and Basic Sets of 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.

#### 4.3 Contents of the Core Set of Environment Statistics

4.17. Table 4.2 below presents the Core Set which organizes the statistics by the components, sub-components and statistical topics of the FDES. The Basic Set of Environment Statistics, showing where the Core Set is embedded for each statistical topic of the FDES, is contained in Annex A. The numbering and lettering in this table is not necessarily consecutive since the statistics, all of which are Tier 1, are only a selection of the Basic Set.

### **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 in fourth and fifth columns denotes Tier 1 (Core Set) statistics.
- 4. Categories of measurement are shown in the sixth column.
### 4.3.1 The Core Set of Environment Statistics

Table 4.2: The Core Set of Environment Stati	stics	
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Component	Sub component	Topia	<b>Core Set / Tier 1 Statistics</b>		Category of
Component	Sub-component	Topic			Measurement
Component 1:	Sub-component 1.1:	Topic 1.1.1:	a. Temperature	1. Monthly average	Degrees
Environmental	Physical Conditions	Atmosphere, climate		2. Minimum monthly average	Degrees
Conditions and		and weather		3. Maximum monthly average	Degrees
Quality			b. Precipitation (also in 2.6.1.a)	1. Annual average	Height
				2. Long-term annual average	Height
		Topic 1.1.2: Hydrographical characteristics	d. Watersheds	1. Description of main watersheds	Area, Description
		Topic 1.1.3:	a. Geological, geographical and	2. Area of country or region	Area,
		Geological and	geomorphological conditions of		Location
		geographical	terrestrial areas and islands		
		information	b. Coastal waters (includes area of	coral reefs, mangroves, etc.)	Area, Description
			c. Length of marine coastline		Length
			d. Coastal area		Area
		Topic 1.1.4: Soil	a. Soil characterization	1. Area by soil types	Area
		characteristics	b. Soil degradation	1. Area affected by soil erosion	Area
				2. Area affected by desertification	Area
Sub-component 1.2: Land Cover, Ecosyst		Topic 1.2.1: Land cover	a. Area under land cover categories		Area
	and Biodiversity	Biodiversity Topic 1.2.2:	a. General ecosystem	1. Area of ecosystems	Area
		Ecosystems and	characteristics, extent and pattern		
		biodiversity	c. Biodiversity	1. Known flora and fauna species	Number
			d. Protected areas	<b>1. Protected terrestrial (including inland water) and marine area</b> (also in 1.2.3.a)	Area
		Topic 1.2.3: Forests	a. Forest area	1. Total	Area
	Sub-component 1.3:	Topic 1.3.1: Air	a. Local air quality	1. Concentration level of particulate matter (PM <sub>10</sub> )	Concentration
	Environmental Quality	quality		2. Concentration level of particulate matter (PM <sub>2.5</sub> )	Concentration
				3. Concentration level of tropospheric ozone (O <sub>3</sub> )	Concentration
				4. Concentration level of carbon monoxide (CO)	Concentration
				5. Concentration level of sulphur dioxide (SO <sub>2</sub> )	Concentration
				6. Concentration levels of nitrogen oxides (NO <sub>x</sub> )	Concentration
		Topic 1.3.2:	a. Nutrients and chlorophyll	1. Concentration level of nitrogen	Concentration
		Freshwater quality		2. Concentration level of phosphorous	Concentration
			b. Organic matter	1. Biochemical oxygen demand (BOD)	Concentration
			c. Pathogens	1. Concentration levels of faecal coliforms	Concentration
		Topic 1.3.3: Marine	a. Nutrients and chlorophyll	1. Concentration level of nitrogen	Concentration
		water quality		2. Concentration level of phosphorous	Concentration
			b. Organic matter	1. Biochemical oxygen demand (BOD)	Concentration
			g. Coral bleaching	1. Area affected by coral bleaching	Area

Component	Sub-component	Topic		Core Set / Tier 1 Statistics	Category of Measurement
Component 2:	Sub-component 2.1:	Topic 2.1.1: Stocks	a. Mineral resources	1. Stocks of commercially recoverable resources	Mass, Volume
Environmental Resources and their	Mineral Resources	and changes of mineral resources		5. Extraction	Mass, Volume
Use	Sub-component 2.2:	Topic 2.2.1: Stocks	a. Energy resources	1. Stocks of commercially recoverable resources	Mass, Volume
	Energy Resources	and changes of energy resources		5. Extraction	Mass, Volume
		Topic 2.2.2: Production, trade and	a. Production of energy	1. Total production	Energy unit, Mass, Volume
		consumption of energy		2. Production from non-renewable sources	Energy unit, Mass, Volume
				3. Production from renewable sources	Energy unit, Mass, Volume
				4. Primary energy production	Energy unit, Mass, Volume
				7. Secondary energy production	Energy unit, Mass, Volume
			b. Total energy supply		Energy unit, Mass, Volume
			c. Final consumption of energy		Energy unit, Mass, Volume
	Sub-component 2.3: Land Topic 2.3.1: Land u		a. Area under land use categories		Area
		Topic 2.3.2: Use of forest land	a. Use of forest land	1. Area deforested	Area
	Sub-component 2.5: Biological Resources	Topic 2.5.1: Timber resources	a. Timber resources	1. Stocks of timber resources	Volume
		Topic 2.5.2: Aquatic resources	a. Fish capture production		Mass
			b. Aquaculture production		Mass
		Topic 2.5.3: Crops	a. Main annual and perennial crops	1. Area harvested	Area
				2. Area planted	Area
				3. Amount produced	Mass
			b. Amount used of:	<b>1. Natural fertilizers</b> (e.g., manure, compost, lime) (also in 3.4.1.a)	Area, Mass, Volume
				<b>2. Chemical fertilizers</b> (also in 3.4.1.a)	Area, Mass, Volume
				<b>3. Pesticides</b> (also in 3.4.1.b)	Area, Mass, Volume
		Topic 2.5.4: Livestock	a. Livestock	1. Number of live animals	Number
	Sub-component 2.6:	Topic 2.6.1: Water	a. Inflow of water to inland water	<b>1. Precipitation</b> (also in 1.1.1.b)	Volume
	Water Resources	resources	resources	2. Inflow from neighbouring territories	Volume
			b. Outflow of water from inland water resources	1. Evapotranspiration	Volume
		Topic 2.6.2:	a. Total water abstraction		Volume
		Abstraction, use and	b. Water abstraction from surface water		Volume
		returns of water	c. Water abstraction from	1. From renewable groundwater resources	Volume
			groundwater	2. From non-renewable groundwater resources	Volume

### Table 4.2: The Core Set of Environment Statistics (continued)

Component	Sub-component	Topic		Core Set / Tier 1 Statistics	Category of Measurement
Component 3:	Sub-component 3.1:	Topic 3.1.1:	a. Total emissions of direct	1. Carbon dioxide (CO <sub>2</sub> )	Mass
Residuals	Emissions to Air	Emissions of	greenhouse gases (GHGs), by	2. Methane (CH <sub>4</sub> )	Mass
		greennouse gases	gas.	3. Nitrous oxide (N <sub>2</sub> O)	Mass
			b. Total emissions of indirect	1. Sulphur dioxide (SO <sub>2</sub> )	Mass
			greenhouse gases (GHGs), by gas:	2. Nitrogen oxides (NO <sub>x</sub> )	Mass
	Sub-component 3.2: Generation and Management of Wastewater	Topic 3.2.1: Generation and pollutant content of wastewater	a. Volume of wastewater generat	ed	Volume
		Topic 3.2.2:	a. Volume of wastewater collecte	d	Volume
		Collection and treatment of wastewater	b. Volume of wastewater treated		Volume
		Topic 3.2.3: Discharge of	a. Wastewater discharge harge of ronment	1. Total volume of wastewater discharged to the environment after treatment	Volume
Sub-component 3.3:		wastewater to the environment		2. Total volume of wastewater discharged to the environment without treatment	Volume
	Sub-component 3.3: Generation and	Topic 3.3.1: Generation of waste	a. Amount of waste generated by source		Mass
	Management of Waste	Waste Topic 3.3.2: Management of waste	c. Amount of hazardous waste generated		Mass
			Topic 3.3.2:   a. Municipal waste	1. Total municipal waste collected	Mass
				2. Amount of municipal waste treated by type of treatment and disposal	Mass
				3. Number of municipal waste treatment and disposal facilities	Number
			b. Hazardous waste	1. Total hazardous waste collected	Mass
				2. Amount of hazardous waste treated by type of treatment and disposal	Mass
				3. Number of hazardous waste treatment and disposal facilities	Number
			d. Amount of recycled waste		Mass
Component 4:       S         Extreme Events       I         and Disasters       a	Sub-component 4.1: Topi Natural Extreme Events and Disasters Topi of na	b-component 4.1: tural Extreme Events d Disasters Topic 4.1.1: Occurrence of natural extreme events and disasters	Topic 4.1.1:a. Occurrence of natural extremeOccurrence ofevents and disasters:	<b>1. Type of natural extreme event and disaster</b> (geophysical, meteorological, hydrological, climatological, biological)	Description
			xtreme nd disasters	2. Location	Location
		Topic 4.1.2: Impact of natural extreme	a. People affected by natural extreme events and disasters	1. Number of people killed	Number
		events and disasters	<b>b. Economic losses due to natura</b> transportation networks, loss of rev	extreme events and disasters (e.g., damage to buildings, enue for businesses, utility disruption, etc.)	Currency

### Table 4.2: The Core Set of Environment Statistics (continued)

Component	Sub-component	Topic		Core Set / Tier 1 Statistics	Category of Measurement
Component 5:	Sub-component 5.1:	Topic 5.1.2:	a. Population using an improv	ved drinking water source	Number
Human	Human Settlements	Access to selected	b. Population using an improv	ved sanitation facility	Number
Settlements and		basic services	c. Population served by muni	cipal waste collection	Number
Environmental Health			e. Population connected to wa	stewater treatment	Number
Ticattii			f. Population supplied by wate	er supply industry	Number
		Topic 5.1.5: Environmental concerns	c. Number of private and pub	lic vehicles	Number
	Sub-component 5.2:	Topic 5.2.2:	a. Water-related diseases and	1. Incidence	Number
	Environmental Health	Water-related diseases and	conditions	2. Prevalence	Number
		conditions		3. Mortality	Number
		Topic 5.2.3:	a. Vector borne diseases	1. Incidence	Number
		Vector borne		2. Prevalence	Number
		diseases		3. Mortality	Number
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 resource management expenditure	1. Annual government environment protection expenditure	Currency
	Sub-component 6.2: Environmental Governance and Regulation	Topic 6.2.2: Environmental regulation and instruments	a. Direct regulation	<b>1. List of regulated pollutants and description</b> (e.g., by year of adoption and maximum allowable levels)	Description, Number
(a) Participation means	the country or area has become	Topic 6.2.3: Participation in MEAs and environmental conventions party to the agreements und	a. Participation in MEAs and other global environmental conventions	1. List and description (e.g., year of participation <sup>(a)</sup> of country) of MEAs and other global environmental conventions         eved through a variety of means depending on country circumstances, namely: a	Description, Number

#### Table 4.2: The Core Set of Environment Statistics (continued)

# **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 Basic Set of Environment Statistics and the Core 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 Basic Set of Environment Statistics and the Core Set of Environment Statistics, necessary to inform on four selected cross-cutting issues: water, energy, climate change and agriculture. The cross-cutting issues of water and energy apply the contents of the FDES to environmental resource use and management. Climate change utilizes the FDES for informing on a highly relevant scientific and policy issue. Agriculture and the environment focuses on the application of the FDES to a specific economic activity. This 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 is on the national level.
- 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, economic activities 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, climate change and agriculture discussed in this chapter are examples and should be considered illustrative applications of the FDES to selected cross-cutting issues. 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, environmental impacts of specific activities

such as tourism, transport, mining, manufacturing, etc. or issues such as the relationship between poverty and the environment).

- 5.5 The statistics for describing the selected cross-cutting issues are organized based on the relevant policy framework or the sequence of events that can be used to inform about the 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.
- 5.6 The presentation at the topic level includes the name of the topics that are relevant to the cross-cutting issue. The presentation at the level of individual statistics shows which statistics under the relevant topics are necessary for the statistical description of the cross-cutting issue.

#### 5.1 Water and the Environment

- 5.7 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.
- 5.8 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 to the degradation of ecosystems and productivity in inland and coastal waters. The need to monitor the sustainable management of water resources, and the demand for related environment statistics, is increasing worldwide.

- 5.9 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 can cause inefficiency and require higher amounts to be extracted. When the water 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.
- 5.10 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.
- 5.11 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.
- 5.12 International partners in water assessment and management include UN-Water, the UN inter-agency mechanism on all freshwater related issues, including sanitation. 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). FAO has developed a number of

initiatives related to water statistics, notably the AQUASTAT database which serves as a global information system on water and agriculture.<sup>88</sup> It collects, analyses and disseminates data and information by country and by region. Several international and inter-governmental organisations collect data on water statistics (such as through the UNSD/UNEP Questionnaire on Environment Statistics and the OECD/Eurostat Questionnaire on the State of the Environment). In addition, the UN has developed the IRWS in an effort to assist countries to establish and strengthen information systems for water as part of their integrated water resources management (IWRM).<sup>89</sup> IWRM is a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.<sup>90</sup> This publication was adopted by the United Nations Statistical Commission in 2010. With regard to environmental-economic accounts for water, the SEEA-Water is also available.<sup>91</sup> Part I of the SEEA-Water was adopted as an interim international statistical standard by the United Nations Statistical Commission in 2007.

5.13 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"<sup>92</sup>, 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.

<sup>&</sup>lt;sup>88</sup> Food and Agriculture Organization of the United Nations (2014). Aquastat. Available from <u>http://www.fao.org/nr/water/aquastat/main/index.stm</u> (accessed 5 April 2013).

<sup>&</sup>lt;sup>89</sup> United Nations Statistics Division (2012). "International Recommendations for Water Statistics". Available from <u>http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf</u> (accessed 25 November 2013).

 <sup>&</sup>lt;sup>90</sup> Global Water Partnership (2012). What is IWRM? Available from <u>http://www.gwp.org/en/The-Challenge/What-is-IWRM/</u> (accessed 17 September 2014).

<sup>&</sup>lt;sup>91</sup> United Nations Statistics Division (2012). "System of Environmental-Economic Accounts for Water (SEEA-Water)". Available from <u>http://unstats.un.org/unsd/envaccounting/seeaw/seeawaterwebversion.pdf</u> (accessed 25 November 2013).

<sup>&</sup>lt;sup>92</sup> United Nations (2012). Rio+20 outcome document, "The Future We Want", paragraph 119. Available from

http://www.uncsd2012.org/thefuturewewant.html (accessed 26 November 2013).

# **Application of the FDES to water statistics**

- 5.14 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.
- 5.15 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 Figures 5.1 and 5.2.

Component 1: Environmental Conditions and Quality			
Sub-component 1.1: Physical	Sub-component 1.2: Land Cover,	Sub-component 1.3:	
Conditions	Ecosystems and Biodiversity	Environmental Quality	
1.1.1	1.2.1	1.3.2	
Atmosphere, climate and weather	Land cover	Freshwater quality	
1.1.2	1.2.2	1.3.3	
Hydrographical characteristics	Ecosystems and biodiversity	Marine water quality	
1.1.3			
Geological and geographical			
information			

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

<b>Component 2: Environmental Resources and their Use</b>			
Sub-component 2.3: Land	Sub-component 2.5: Biological	Sub-component 2.6: Water	
	Resources	Resources	
2.3.1	2.5.2	2.6.1	
Land use	Aquatic resources	Water resources	
		2.6.2	
		Abstraction, use and returns of	
		water	

Component 3: Residuals
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

<b>Component 4: Extreme Events and Disasters</b>			
Sub-component 4.1: Natural Extreme Events and Sub-component 4.2: Technological Disasters			
Disasters			
4.1.1	4.2.1		
Occurrence of natural extreme events and disasters	Occurrence of technological disasters		
4.1.2	4.2.2		
Impact of natural extreme events and disasters	Impact of technological disasters		

Component 5: Human Settlements and Environmental Health			
Sub-component 5.1: Human Settlements	Sub-component 5.2: Environmental Health		
5.1.2	5.2.2		
Access to selected basic services	Water-related diseases and conditions		
5.1.3			
Housing conditions			

Component 6: Environment Protection, Management and Engagement			
Sub-component 6.1: Environment	Sub-component 6.2: Environmental	Sub-component 6.3: Extreme	
Protection and Resource	Governance and Regulation	Event Preparedness and	
Management Expenditure		Disaster Management	
6.1.1	6.2.1	6.3.1	
Government environment protection	Institutional strength	Preparedness for natural extreme	
and resource management expenditure	6.2.2	events and disasters	
6.1.2	Environmental regulation and instruments	6.3.2	
Corporate, non-profit institution and	6.2.3	Preparedness for technological	
household environment protection and	Participation in MEAs and environmental	disasters	
resource management expenditure	conventions		

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

Component 1: Environmental Conditions and Quality				
Sub-componer	Sub-component 1.1: Physical Conditions			
Topic 1.1.1:	1.1.1.b: Precipitation (also in 2.6.1)			
Atmosphere,	1.1.1.b.1: Annual average			
climate and	1.1.1.b.2: Long-term annual average			
weather	1.1.1.b.3: Monthly average			
	1.1.1.b.4: Minimum monthly value			
	1.1.1.b.5: Maximum monthly value			
	1.1.1.c: Relative humidity			
	1.1.1.c.1: Minimum monthly value			
	1.1.1.c.2: Maximum monthly value			
	1.1.1.h: Occurrence of El Niño, La Niña events, when relevant			
	1.1.1.h.1: Occurrence			
	1.1.1.h.2: Time period			
Topic 1.1.2:	1.1.2.a: Lakes			
Hydrographical	1.1.2.a.1: Surface area			
characteristics	1.1.2.a.2: Maximum depth			
	1.1.2.b: Rivers and streams			
	1.1.2.b.1: Length			
	1.1.2.c: Artificial reservoirs			
	1.1.2.c.1: Surface area			
	1.1.2.c.2: Maximum depth			
	1.1.2.d: Watersheds			
	1.1.2.d.1: Description of main watersheds			
	1.1.2.e: Seas			
	1.1.2.e.1: Coastal waters			
	1.1.2.e.2: Territorial sea			
	1.1.2.e.3: Exclusive Economic Zone (EEZ)			
	1.1.2.e.4: Sea level			
	1.1.2.e.5: Area of sea ice			
	1.1.2.f: Aquifers			
	1.1.2.g: Glaciers			
Topic 1.1.3:	1.1.3.b: Coastal waters (includes area of coral reefs, mangroves, etc.)			

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

Geological and	1.1.3.c: Length of marine coastline
geographical	
information	
Sub-componen	t 1.2: Land Cover, Ecosystems and Biodiversity
Topic 1.2.1:	1.2.1.a: Area under land cover categories
Land cover	
Topic 1.2.2:	1.2.2.a: General ecosystem characteristics, extent and pattern
Ecosystems	1.2.2.a.1: Area of ecosystems
anu biodiversity	1.2.2.a.2. Proximity of ecosystem to urban areas and croptana 1.2.2 b: Ecosystems' chemical and physical characteristics
blourversity	1.2.2.0. Ecosystems chemical and physical characteristics
	1.2.2.0.1. Withenis
	1 2 2 b 3: Pollutants
	1.2.2.c: Biodiversity
	1.2.2.c.1: Known flora and fauna species
	1.2.2.c.2: Endemic flora and fauna species
	1.2.2.c.3: Invasive alien flora and fauna species
	1.2.2.c.4: Species population
	1.2.2.c.5: Habitat fragmentation
	1.2.2.d: Protected areas and species
	<b>1.2.2.d.1: Protected terrestrial and marine area</b> (also in 1.2.3.a)
	1.2.2.d.2: Protected flora and fauna species
Sub-componen	it 1.3: Environmental Quality
Topic 1.3.2:	1.3.2.a: Nutrients and chlorophyll
Freshwater	1.3.2.a.1: Concentration level of nitrogen
quality	1.3.2.a.2: Concentration level of phosphorous
	1.3.2.a.3: Concentration level of chlorophyll A
	1.3.2.b: Organic matter
	1.3.2.b.1: Biochemical oxygen demand (BOD)
	1.3.2.b.2: Chemical oxygen demand (COD)
	1.3.2.c: Pathogens
	1.3.2.c.1: Concentration levels of faecal conforms
	1.5.2.d: Metals (e.g., mercury, lead, nickel, arsenic, cadmium)
	1.3.2.d.1: Concentration levels in frachwater organisms
	1.3.2 e. Organic contaminants (e.g. PCBs, DDT, pasticides, furans, dioxins, phanols and radioactive wasta)
	1.3.2.e. Organic contantinants (e.g., 1 CDs, DD1, pestericles, turans, dioxins, pictors and radioactive waste)
	1.3.2.e. 2: Concentration levels in freshwater organisms
	1.3.2.f: Physical and chemical characteristics
	1.3.2.f.1: pH/Acidity/Alkalinity
	1.3.2.f.2: Temperature
	1.3.2.f.3: Total suspended solids (TSS)
	1.3.2.f.4: Salinity
	1.3.2.f.5: Dissolved oxygen (DO)
	1.3.2.g: Plastic waste and other freshwater debris
	1.3.2.g.1: Amount of plastic waste and other debris
Topic 1.3.3:	1.3.3.a: Nutrients and chlorophyll
Marine water	1.3.3.a.1: Concentration level of nitrogen
quality	1.3.3.a.2: Concentration level of phosphorous
	1.3.3.a.3: Concentration level of chlorophyll A
	1.3.3.b: Organic matter
	<b>1.3.3.b.1:</b> Biochemical oxygen demand (BOD)
	1.3.3.b.2: Chemical oxygen demand (COD)
	1.3.3.0; rainogens
	1.3.3.d. Metals (e.g. mercury lead nickel arsenic cadmium)
	1.3.3.4. Incluis (e.g., incluiry, icau, incket, aisenic, caulilluill)
	1.3.3.d. 2. Concentration levels in parine organisms
	1.3.5.6.4. Concentration revers in marine organisms
	133.e. 1: Concentration levels in sediment and marine water
	1.3.3.e.2: Concentration levels in marine organisms
	1.3.3.f: Physical and chemical characteristics

1.3.3.f.1: pH/Acidity/Alkalinity
1.3.3.f.2: Temperature
1.3.3.f.3: Total suspended solids (TSS)
1.3.3.f.4: Salinity
1.3.3.f.5: Dissolved oxygen (DO)
1.3.3.f.6: Density
1.3.3.g: Coral bleaching
1.3.3.g.1: Area affected by coral bleaching
1.3.3.h: Plastic waste and other marine debris
1.3.3.h.1: Amount of plastic waste and other debris in marine waters
1.3.3.i: Red tide
1.3.3.i.1: Occurrence
1.3.3.i.2: Impacted area
1.3.3.i.3: Duration
1.3.3.j: Oil pollution
1.3.3.j.1: Area of oil slicks
1.3.3.j.2: Amount of tar balls

<b>Component 2: Environmental Resources and their Use</b>	
Sub-component 2.3: Land	
Topic 2.3.1:	2.3.1.a: Area under land use categories [inland water, coastal waters, EEZ]
Land use	
Sub-compone	ent 2.5: Biological Resources
Topic 2.5.2:	2.5.2.a: Fish capture production
Aquatic	2.5.2.b: Aquaculture production
resources	2.5.2.e: Amount used of:
	2.5.2.e.1: Pellets (also in 3.4.1.c)
	2.5.2.e.2: Hormones (also in 3.4.1.d)
	2.5.2.e.3: Colourants (also in 3.4.1.e)
	2.5.2.e.4: Antibiotics (also in 3.4.1.f)
	2.5.2.e.5: Fungicides
	2.5.2.f: Aquatic resources
	2.5.2.f.1: Stocks of aquatic resources
	2.5.2.f.2: Additions to aquatic resources
	2.5.2.f.3: Reductions in aquatic resources
Sub-component 2.6: Water Resources	
Topic 2.6.1:	2.6.1.a: Inflow of water to inland water resources
Water	<b>2.6.1.a.1: Precipitation</b> (also in 1.1.1.b)
resources	2.6.1.a.2: Inflow from neighbouring territories
	2.6.1.a.3: Inflow subject to treaties
	2.6.1.b: Outflow of water from inland water resources
	2.6.1.b.1: Evapotranspiration
	2.6.1.b.2: Outflow to neighbouring territories
	2.6.1.b.3: Outflow subject to treaties
	2.6.1.b.4: Outflow to the sea
	2.6.1.c: Inland water stocks
	2.6.1.c.1: Surface water stocks in artificial reservoirs
	2.6.1.c.2: Surface water stocks in lakes
	2.6.1.c.3: Surface water stocks in rivers and streams
	2.6.1.c.4: Surface water stocks in wetlands
	2.6.1.c.5: Surface water stocks in snow, ice and glaciers
	2.6.1.c.6: Groundwater stocks
Topic 2.6.2:	2.6.2.a: Total water abstraction
Abstraction,	2.6.2.b: Water abstraction from surface water
use and	2.6.2.c: Water abstraction from groundwater
returns of	2.6.2.c.1: From renewable groundwater resources
water	2.6.2.c.2: From non-renewable groundwater resources
	2.6.2.d: Water abstracted for own use
	2.6.2.e: Water abstracted for distribution
	2.6.2.f: Desalinated water
	2.6.2.g: Reused water

2.6.2.h: Water use
2.6.2.i: Rainwater collection
2.6.2.j: Water abstraction from the sea
2.6.2.k: Losses during transport
2.6.2.1: Exports of water
2.6.2.m: Imports of water
2.6.2.n: Returns of water

Component 3: Residuals	
Sub-component 3.2: Generation and Management of Wastewater	
Topic 3.2.1:	3.2.1.a: Volume of wastewater generated
Generation	3.2.1.b: Pollutant content of wastewater
and pollutant	
content of	
wastewater	
Topic 3.2.2:	3.2.2.a: Volume of wastewater collected
Collection	3.2.2.b: Volume of wastewater treated
and treatment	3.2.2.c: Total urban wastewater treatment capacity
of wastewater	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:	3.2.3.a: Wastewater discharge
Discharge of	3.2.3.a.1: Total volume of wastewater discharged to the environment after treatment
wastewater to	3.2.3.a.2: Total volume of wastewater discharged to the environment without treatment
the	3.2.3.b: Pollutant content of discharged wastewater
environment	

Component 4: Extreme Events and Disasters	
Sub-component 4.1: Natural Extreme Events and Disasters	
Topic 4.1.1:	4.1.1.a: Occurrence of natural extreme events and disasters [droughts and floods]:
Occurrence of	4.1.1.a.1: Type of natural extreme event and disaster (geophysical, meteorological, hydrological,
natural	climatological, biological)
extreme	4.1.1.a.2: Location
events and	4.1.1.a.3: Magnitude (where applicable)
disasters	4.1.1.a.4: Date of occurrence
	4.1.1.a.5: Duration
Topic 4.1.2:	4.1.2.a: People affected by natural extreme events and disasters [droughts and floods]
Impact of	4.1.2.a.1: Number of people killed
natural	4.1.2.a.2: Number of people injured
extreme	4.1.2.a.3: Number of people homeless
events and	4.1.2.a.4: Number of people affected
disasters	<b>4.1.2.b: Economic losses due to natural extreme events and disasters</b> [droughts and floods]
	4.1.2.c: Physical losses/damages due to natural extreme events and disasters [droughts and floods]
	4.1.2.d: Effects of natural extreme events and disasters on integrity of ecosystems [droughts and floods]
	4.1.2.d.1: Area affected by natural disasters
	4.1.2.d.2: Loss of vegetation cover
	4.1.2.d.3: Area of watershed affected
	4.1.2.d.4: Other
	4.1.2.e: External assistance received [droughts and floods]
Sub-component 4.2: Technological Disasters	
Topic 4.2.1:	4.2.1.a: Occurrence of technological disasters [only affecting marine and inland water bodies]
Occurrence of	4.2.1.a.1: Type of technological disaster
technological	4.2.1.a.2: Location
disasters	4.2.1.a.3: Date of occurrence
	4.2.1.a.4: Duration
Topic 4.2.2:	4.2.2.a: People affected by technological disasters [only affecting marine and inland water bodies]
Impact of	4.2.2.a.1: Number of people killed
technological	4.2.2.a.2: Number of people injured

disasters	4.2.2.a.3: Number of people homeless
	4.2.2.a.4: Number of people affected
	4.2.2.b: Economic losses due to technological disasters [only affecting marine and inland water bodies]
	4.2.2.c: Physical losses/damages due to technological disasters [only affecting marine and inland water bodies]
	4.2.2.d: Effects of technological disasters on integrity of ecosystems [only affecting marine and inland water
	bodies]
	4.2.2.d.1: Area affected by technological disasters
	4.2.2.d.2: Loss of vegetation cover
	4.2.2.d.3: Area of watershed affected
	4.2.2.d.4: Other (e.g., for oil spills: volume of oil released into the environment, impact on
	ecosystem)
	4.2.2.e: External assistance received

<b>Component 5: Human Settlements and Environmental Health</b>	
Sub-component 5.1: Human Settlements	
Topic 5.1.2:	5.1.2.a: Population using an improved drinking water source
Access to	5.1.2.b: Population using an improved sanitation facility
selected basic	5.1.2.d: Population connected to wastewater collecting system
services	5.1.2.e: Population connected to wastewater treatment
	5.1.2.f: Population supplied by water supply industry
Topic 5.1.3:	5.1.3.c: Population living in hazard prone areas
Housing	5.1.3.d: Hazard prone areas
conditions	
Sub-component 5.2: Environmental Health	
Topic 5.2.2:	5.2.2.a: Water-related diseases and conditions
Water-related	5.2.2.a.1: Incidence
diseases and	5.2.2.a.2: Prevalence
conditions	5.2.2.a.3: Mortality
	5.2.2.a.4: Loss of work days
	5.2.2.a.5: Estimates of economic cost in monetary terms

<b>Component 6: Environment Protection, Management and Engagement</b>	
Sub-component 6.1: Environment Protection and Resource Management Expenditure	
Topic 6.1.1:	6.1.1.a: Government environment protection and resource management expenditure
Government	6.1.1.a.1: Annual government environment protection expenditure [on water]
environment	6.1.1.a.2: Annual government resource management expenditure [on water]
protection and	
resource	
management	
expenditure	
Topic 6.1.2:	6.1.2.a: Private sector environment protection and resource management expenditure [on water]
Corporate,	6.1.2.a.1: Annual corporate environment protection expenditure
non-profit	6.1.2.a.2: Annual corporate resource management expenditure
institution and	6.1.2.a.3: Annual non-profit institution environment protection expenditure
household	6.1.2.a.4: Annual non-profit institution resource management expenditure
environment	6.1.2.a.5: Annual household environment protection expenditure
protection and	6.1.2.a.6: Annual household resource management expenditure
resource	
management	
expenditure	
Sub-compone	nt 6.2: Environmental Governance and Regulation
Topic 6.2.1:	6.2.1.a: Government environmental institutions and their resources
Institutional	6.2.1.a.1: Name of main environmental [water] authority and year of establishment
strength	6.2.1.a.2: Annual budget of the main environmental [water] authority
	6.2.1.a.3: Number of staff of the main environmental [water] authority
	6.2.1.a.4: List of environmental [water] departments in other authorities and year of establishment
	6.2.1.a.5: Annual budget of environmental [water] departments in other authorities
	6.2.1.a.6: Number of staff of environmental [water] departments in other authorities
Topic 6.2.2:	6.2.2.a: Direct regulation

Environmental	6.2.2.a.1: List of regulated [water] pollutants and description (e.g., by year of adoption and
regulation and	maximum allowable levels)
instruments	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
	6.2.2.a.3: Number of applications for licenses [compliance with water standards] received and
	approved per year
	6.2.2.a.4: List of quotas for biological [aquatic] resource extraction
	6.2.2.a.5: Budget and number of staff dedicated to enforcement of environmental [water] regulations
	6.2.2.b: Economic instruments
	6.2.2.b.1: List and description (e.g., year of establishment) of green/environmental [related to water]
	taxes
	6.2.2.b.2: List and description (e.g., year of establishment) of environmentally relevant subsidies
	[related to water]
	6.2.2.b.3: List of [water] eco-labelling and environmental certification programmes
Topic 6.2.3:	6.2.3.a: Participation in MEAs and other global environmental conventions
Participation	6.2.3.a.1: List and description (e.g., year of participation <sup>(a)</sup> of country) of MEAs and other
in MEAs and	global environmental conventions [regulating, managing and affecting water]
environmental	
conventions	
	(a) 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 contrimation, 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	
Topic 6.3.1:	6.3.1.a: National natural extreme events and disaster preparedness and management systems [related to
Preparedness	droughts and floods]
for natural	6.3.1.a.1: Existence of national disaster plans/programmes
extreme	6.3.1.a.2: Description of national disaster plans/programmes
events and	6.3.1.a.7: Existence of early warning systems for all major hazards
disasters	6.3.1.a.8: Expenditure on disaster prevention, preparedness, clean-up and rehabilitation
Topic 6.3.2:	6.3.2.a: National technological disaster preparedness and management systems [related to water]
Preparedness	6.3.2.a.1: Existence and description (e.g., number of staff) of public disaster management
for	plans/programmes (and private when available)
technological	6.3.2.a.2: Expenditure on disaster prevention, preparedness, clean-up and rehabilitation
disasters	

5.16 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.

# 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*

Water Resources		
Sub-component	Sub-component 1.1: Physical Conditions	
Topic 1.1.2:	1.1.2.a: Lakes	
Hydrographical	1.1.2.a.1: Surface area	
characteristics	1.1.2.a.2: Maximum depth	
	1.1.2.b: Rivers and streams	
	1.1.2.b.1: Length	
	1.1.2.c: Artificial reservoirs	
	1.1.2.c.1: Surface area	
	1.1.2.c.2: Maximum depth	
	1.1.2.d: Watersheds	
	1.1.2.d.1: Description of main watersheds	
	1.1.2.f: Aquifers	
	1.1.2.g: Glaciers	
Sub-component	2.6: Water Resources	
Topic 2.6.1:	2.6.1.a: Inflow of water to inland water resources	
Water	<b>2.6.1.a.1: Precipitation</b> (also in 1.1.1.b)	
resources	2.6.1.a.2: Inflow from neighbouring territories	
	2.6.1.a.3: Inflow subject to treaties	
	2.6.1.b: Outflow of water from inland water resources	
	2.6.1.b.1: Evapotranspiration	
	2.6.1.b.2: Outflow to neighbouring territories	
	2.6.1.b.3: Outflow subject to treaties	
	2.6.1.b.4: Outflow to the sea	
	2.6.1.c: Inland water stocks	
	2.6.1.c.1: Surface water stocks in artificial reservoirs	
	2.6.1.c.2: Surface water stocks in lakes	
	2.6.1.c.3: Surface water stocks in rivers and streams	
	2.6.1.c.4: Surface water stocks in wetlands	
	2.6.1.c.5: Surface water stocks in snow, ice and glaciers	
	2.6.1.c.6: Groundwater stocks	

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

# Water Use and Management

Sub-component 2.6: Water Resources	
Topic 2.6.2:	2.6.2.a: Total water abstraction
Abstraction,	2.6.2.b: Water abstraction from surface water
use and returns	2.6.2.c: Water abstraction from groundwater
of water	2.6.2.c.1: From renewable groundwater resources
	2.6.2.c.2: From non-renewable groundwater resources
	2.6.2.d: Water abstracted for own use
	2.6.2.e: Water abstracted for distribution
	2.6.2.f: Desalinated water
	2.6.2.g: Reused water
	2.6.2.h: Water use
	2.6.2.i: Rainwater collection
	2.6.2.j: Water abstraction from the sea
	2.6.2.k: Losses during transport
	2.6.2.1: Exports of water
	2.6.2.m: Imports of water
	2.6.2.n: Returns of water
Sub-component 3.2: Generation and Management of Wastewater	
Topic 3.2.1:	3.2.1.a: Volume of wastewater generated
Generation and	
pollutant	
content of	
wastewater	
Topic 3.2.2:	3.2.2.a: Volume of wastewater collected

Collection and	3.2.2.b: Volume of wastewater treated	
treatment of	3.2.2.c: Total urban wastewater treatment capacity	
wastewater	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	
Sub-component 5.1: Human Settlements		
Topic 5.1.2:	5.1.2.a: Population using an improved drinking water source	
Access to	5.1.2.b: Population using an improved sanitation facility	
selected basic	5.1.2.e: Population connected to wastewater treatment	
services	5.1.2.f: Population supplied by water supply industry	

# **Environmental Effects**

Sub-component 1.3: Environmental Quality		
Topic 1.3.2:	1.3.2.a: Nutrients and chlorophyll	
Freshwater	1.3.2.a.1: Concentration level of nitrogen	
quality	1.3.2.a.2: Concentration level of phosphorous	
	1.3.2.a.3: Concentration level of chlorophyll A	
	1.3.2.b: Organic matter	
	1.3.2.b.1: Biochemical oxygen demand (BOD)	
	1.3.2.b.2: Chemical oxygen demand (COD)	
	1.3.2.c: Pathogens	
	1.3.2.c.1: Concentration levels of faecal coliforms	
	1.3.2.d: Metals (e.g., mercury, lead, nickel, arsenic, cadmium)	
	1.3.2.d.1: Concentration levels in sediment and freshwater	
	1.3.2.d.2: Concentration levels in freshwater organisms	
	1.3.2.e: Organic contaminants (e.g., PCBs, DDT, pesticides, furans, dioxins, phenols and radioactive waste)	
	1.3.2.e.1: Concentration levels in sediment and freshwater	
	1.3.2.e.2: Concentration levels in freshwater organisms	
	1.3.2.f: Physical and chemical characteristics	
	1.3.2.f.1: pH/Acidity/Alkalinity	
	1.3.2.f.2: Temperature	
	1.3.2.f.3: Total suspended solids (TSS)	
	1.3.2.f.4: Salinity	
	1.3.2.f.5: Dissolved oxygen (DO)	
	1.3.2.g: Plastic waste and other freshwater debris	
	1.3.2.g.1: Amount of plastic waste and other debris	
Sub-component	2.6: Water Resources	
Topic 2.6.1:	2.6.1.c: Inland water stocks	
Water	2.6.1.c.1: Surface water stocks in artificial reservoirs	
resources	2.6.1.c.2: Surface water stocks in lakes	
	2.6.1.c.3: Surface water stocks in rivers and streams	
	2.6.1.c.4: Surface water stocks in wetlands	
	2.6.1.c.5: Surface water stocks in snow, ice and glaciers	
	2.6.1.c.6: Groundwater stocks	
Sub-component	3.2: Generation and Management of Wastewater	
Topic 3.2.1:	3.2.1.b: Pollutant content of wastewater	
Generation and		
pollutant		
content of		
wastewater		
Topic 3.2.3:	3.2.3.a: Wastewater discharge	
Discharge of	3.2.3.a.1: Total volume of wastewater discharged to the environment after treatment	
wastewater to	3.2.3.a.2: Total volume of wastewater discharged to the environment without treatment	
the	3.2.3.b: Pollutant content of discharged wastewater	
environment		

Protection and Mitigation Activities	
Sub-component 6.1: Environment Protection and Resource Management Expenditure	
Topic 6.1.1:	6.1.1.a: Government environment protection and resource management expenditure [on water]
Government	6.1.1.a.1: Annual government environment protection expenditure
environment	6.1.1.a.2: Annual government resource management expenditure
protection and	
resource	
management	
expenditure	
Topic 6.1.2:	6.1.2.a: Private sector environment protection and resource management expenditure [on water]
Corporate,	6.1.2.a.1: Annual corporate environment protection expenditure
non-profit	6.1.2.a.2: Annual corporate resource management expenditure
institution and	6.1.2.a.3: Annual non-profit institution environment protection expenditure
household	6.1.2.a.4: Annual non-profit institution resource management expenditure
environment	6.1.2.a.5: Annual household environment protection expenditure
protection and	6.1.2.a.6: Annual household resource management expenditure
resource	
management	
expenditure	
Sub-component	6.2: Environmental Governance and Regulation
Topic 6.2.2:	6.2.2.a: Direct regulation
Environmental	6.2.2.a.1: List of regulated pollutants and description (e.g., by year of adoption and maximum
regulation and	allowable levels) [related to water]
instruments	6.2.2.a.2: Description (e.g., name, year established) of licensing system to ensure compliance with
	environmental standards for businesses or other new facilities [related to water]
	6.2.2.a.3: Number of applications for licenses [compliance with water standards] received and
	approved per year
	6.2.2.a.4: List of quotas for biological [aquatic] resource extraction
	6.2.2.a.5: Budget and number of staff dedicated to enforcement of environmental regulations
	[related to water]
	6.2.2.b: Economic instruments
	6.2.2.b.1: List and description (e.g., year of establishment) of green/environmental [related to water]
	taxes
	6.2.2.b.2: List and description (e.g., year of establishment) of environmentally relevant subsidies
	[related to water]
	6.2.2.b.3: List of [water] eco-labelling and environmental certification programmes
Topic 6.2.3:	6.2.3.a: Participation in MEAs and other global environmental conventions
Participation in	6.2.3.a.1: List and description (e.g., year of participation <sup>(a)</sup> of country) of MEAs and other
MEAs and	global environmental conventions [regulating, managing and affecting water]
environmental	
conventions	
	(a) 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
	commination, ratification, and succession. Countries of areas who have signed but not become party to the agreements under a given convention or treaty are not considered to be participating
Participation in MEAs and environmental conventions	<ul> <li>6.2.3.a.1: List and description (e.g., year of participation<sup>(a)</sup> of country) of MEAs and other global environmental conventions [regulating, managing and affecting water]</li> <li>(a) 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.</li> </ul>

### 5.2 Energy and the Environment

5.17 Energy is indispensable to all ecosystems and is a necessary input for 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 For statistical purposes, energy is measured in its "usable form" embedded in energy products. Although physically speaking there would be no such thing as "energy production" or "energy consumption", in statistics these terms refer to the extraction/manufacturing and use of energy products, respectively.
- 5.19 Energy production and consumption affects the environment in different ways. The first issue relates to depletion of non-renewable energy resources, for as energy resources are extracted, depletion occurs. In addition, extraction of 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.
- 5.20 The consumption of mineral energy resources also affects the environment. 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 fossil energy resources, but the capture 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 consumption in order to meet the demands of development in a sustainable and clean manner.
- 5.21 Sustainable Energy for All is a global initiative driving actions and mobilizing commitments to positively transform the world's energy systems since sustainable development is not possible without sustainable energy.<sup>93</sup> Access to modern energy services is fundamental to human development and an investment in our collective future. The United Nations Secretary-General's High-Level Group on Sustainable Energy for All was launched in 2011,<sup>94</sup> creating a Global Action Agenda to

<sup>94</sup> United Nations (2014). The Secretary-General's High-level Group on Sustainable Energy for All. Available from

<sup>&</sup>lt;sup>93</sup> Sustainable Energy for All (2013). Available from http://www.se4all.org/ (accessed 22 September 2014).

http://www.un.org/wcm/content/site/sustainableenergyforall/home/Initiative (accessed 22 September 2014).

guide efforts undertaken in support of achieving the initiative's three objectives: (i) ensure universal access to modern energy services; (ii) double the rate of improvement in energy efficiency; and (iii) double the share of renewable energy in the global energy mix. The objectives are to be achieved by 2030, and it contains 11 action areas and provides a framework through which the countries and stakeholders can create their own pathways towards Sustainable Energy for All. The initiative aims to bring together leadership from all sectors of society: business, governments, investors, community groups and academia. Sustainable Energy for All has generated significant momentum since its launch. More than 75 countries have chosen to pursue Sustainable Energy for All's objectives, from small island states to large, emerging economies.

- 5.22 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.<sup>95</sup> Among other things, it called for action to ensure "access to sustainable modern energy services for 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 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.
- 5.23 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 IRES.<sup>96</sup> Statistics on energy production and consumption are usually compiled 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.

<sup>&</sup>lt;sup>95</sup> United Nations (2012). Rio+20 outcome document, "The Future We Want". Available from <u>http://www.uncsd2012.org/thefuturewewant.html</u> (accessed 22 October 2013).

<sup>&</sup>lt;sup>96</sup> United Nations Statistics Division (2011). "International Recommendations for Energy Statistics (draft version)". Available from <a href="http://unstats.un.org/unsd/statcom/doc11/BG-IRES.pdf">http://unstats.un.org/unsd/statcom/doc11/BG-IRES.pdf</a> (accessed 10 November 2013).

## Application of the FDES to energy statistics

- 5.24 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.
- 5.25 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 consumption.

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



## Figure 5.6: Energy production and consumption 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	
Topic 2.2.1:	2.2.1.a: Energy resources	
Stocks and	2.2.1.a.1: Stocks of commercially recoverable resources	
changes of	2.2.1.a.2: New discoveries	
energy	2.2.1.a.3: Upward reappraisals	
resources	2.2.1.a.4: Upward reclassifications	
	2.2.1.a.5: Extraction	
	2.2.1.a.6: Catastrophic losses	
	2.2.1.a.7: Downward reappraisals	
	2.2.1.a.8: Downward reclassifications	
	2.2.1.a.9: Stocks of potentially commercially recoverable resources	
	2.2.1.a.10: Stocks of non-commercial and other known resources	

Extraction of Energy Minerals, Energy Production and Consumption	
Sub-component	2.2: Energy Resources
Topic 2.2.1:	2.2.1.a: Energy resources
Stocks and	2.2.1.a.5: Extraction
changes of	
energy	
resources	
Topic 2.2.2:	2.2.2.a: Production of energy
Production,	2.2.2.a.1: Total production
trade and	2.2.2.a.2: Production from non-renewable sources
consumption of	2.2.2.a.3: Production from renewable sources
energy	2.2.4.a.4: Primary energy production
	2.2.4.a.7: Secondary energy production
	2.2.2.b: Total energy supply
	2.2.2.c: Final consumption of energy

# **Environmental Effects**

Sub-component 1.3: Environmental Quality	
Topic 1.3.1:	1.3.1.a: Local air quality
Air quality	<b>1.3.1.a.1:</b> Concentration level of particulate matter ( $PM_{10}$ )
	<b>1.3.1.a.2:</b> Concentration level of particulate matter (PM <sub>2.5</sub> )
	<b>1.3.1.a.3:</b> Concentration level of tropospheric ozone (O <sub>3</sub> )
	1.3.1.a.4: Concentration level of carbon monoxide (CO)
	<b>1.3.1.a.5:</b> Concentration level of sulphur dioxide (SO <sub>2</sub> )
	<b>1.3.1.a.6:</b> Concentration levels of nitrogen oxides $(NO_X)$
	1.3.1.a.7: Concentration levels of heavy metals
	1.3.1.a.8: Concentration levels of non-methane volatile organic compounds (NMVOCs)
	1.3.1.a.9: Concentration levels of dioxins
	1.3.1.a.10: Concentration levels of furans
	1.3.1.a.11: Concentration levels of other pollutants [related to energy production and consumption]
	1.3.1.a.12: Number of days where maximum allowable levels were surpassed per year
	1.3.1.b: Global atmospheric concentrations of greenhouse gases
	1.3.1.b.1: Global atmospheric concentration level of carbon dioxide (CO <sub>2</sub> )
	1.3.1.b.2: Global atmospheric concentration level of methane ( $CH_4$ )
Sub-component 2.2: Energy Resources	
Topic 2.2.1:	2.2.1.a: Energy resources
Stocks and	2.2.1.a.1: Stocks of commercially recoverable resources
changes of	
energy	
resources	

Sub-component	Sub-component 2.3: Land		
Topic 2.3.1:	<b>2.3.1.a:</b> Area under land use categories [related to energy production and consumption]		
Land use			
Sub-component	3.1: Emissions to Air		
Topic 3.1.1:	3.1.1.a: Total emissions of direct greenhouse gases (GHGs), by gas [related to energy production and		
Emissions of	consumption]:		
greenhouse	311 a 1: Carbon dioxide (CO.)		
gases	3.11 a 2 Methane (CH.)		
gases	3.11 a 2: Nitrone oxides (N O)		
	3.11.a.s. Hurbus values (1900) 3.11.a.s. Durbus values (0ECc)		
	3.11.4.4.1 emitted using (IFCs)		
	2.11.a.5. Hydrolladoleadolis (HCS)		
	5.1.1.a.o. Surplus nexational (SF6)		
	sensuration).		
	consumption]:		
	3.1.1.0.1: Suppur dioxide (SO <sub>2</sub> )		
	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		
Topic 3.1.3:	3.1.3.a: Emissions of other substances [related to energy production and consumption]		
Emissions of	3.1.3.a.1: Particulate matter (PM)		
other	3.1.3.a.2: Heavy metals		
substances	3.1.3.a.3: Other		
Sub-component	3.2: Generation and Management of Wastewater		
Topic 3.2.1:	<b>3.2.1.a: Volume of wastewater generated</b> [related to energy production and consumption]		
Generation and	3.2.1 b: Pollutant content of wastewater [related to energy production and consumption]		
pollutant	control commencement of water and [former to charge production and concemption]		
content of			
wastewater			
Sub-component	3 3: Congration and Management of Waste		
Topic 3.3.1:	<b>3.3.1 a:</b> Amount of waste generated by source [related to energy production and consumption]		
Generation of	3.3.1 b: Amount of waste generated by waste category frelated to energy production and consumption]		
Waste	<b>3.3.1.6:</b> Amount of base reduction was to cancer of related to energy production and consumption]		
Sub component	3.5.1.C. Albolini of Hazardous waste generated [related to energy production and consumption]		
Topia 4.2.1:	4.2.1 is Occurrence of technological disasters [veloted to energy production and consumption]		
Topic 4.2.1.	4.2.1.a. Occurrence of technological disasters [related to energy production and consumption]		
Occurrence of	4.2.1.a.1: Type of technological disaster		
technological	4.2.1.a.2: Location		
disasters	4.2.1.a.s: Date of occurrence		
	4.2.1.a.4: Duration		
Topic 4.2.2:	4.2.2.a: People affected by technological disasters [related to energy production and consumption]		
Impact of	4.2.2.a.1: Number of people killed		
technological	4.2.2.a.2: Number of people injured		
disasters	4.2.2.a.3: Number of people homeless		
	4.2.2.a.4: Number of people affected		
	4.2.2.b: Economic losses due to technological disasters [related to energy production and consumption]		
	4.2.2.c: Physical losses/damages due to technological disasters [related to energy production and		
	consumption]		
	4.2.2.d: Effects of technological disasters on integrity of ecosystems [related to energy production and		
	consumption]		
	4.2.2.d.1: Area affected by technological disasters		
	4.2.2.d.2: Loss of vegetation cover		
	4.2.2.d.3: Area of watershed affected		
	4.2.2.d.4: Other (e.g., for oil spills: volume of oil released into the environment, impact on		
	ecosystem)		
	4.2.2.e: External assistance received [related to energy production and consumption]		
Sub-component	5.1: Human Settlements		
Topic 5.1.4:	5.1.4.a: Population exposed to air pollution in main cities		
Exposure to			
ambient			
pollution			
r r r r r r r r r r r r r r r r r r r			

Sub-component	5.2: Environmental Health
Topic 5.2.1:	5.2.1.a: Airborne diseases and conditions [related to energy production and consumption]
Airborne	5.2.1.a.1: Incidence
diseases and	5.2.1.a.2: Prevalence
conditions	5.2.1.a.3: Mortality
	5.2.1.a.4: Loss of work days
	5.2.1.a.5: Estimates of economic cost in monetary terms
Topic 5.2.5:	5.2.5.a: Toxic substance- and nuclear radiation-related diseases and conditions [related to energy production
Toxic	and consumption]
substance- and	5.2.5.a.1: Incidence
nuclear	5.2.5.a.2: Prevalence
radiation-	5.2.5.a.3: Loss of work days
related diseases	5.2.5.a.4: Estimates of economic cost in monetary terms
and conditions	

Protection and Mitigation Activities	
Sub-component 6.1: Environment Protection and Resource Management Expenditure	
Topic 6.1.1:	6.1.1.a: Government environment protection and resource management expenditure [related to energy
Government	production and consumption]
environment	6.1.1.a.1: Annual government environment protection expenditure
protection and	6.1.1.a.2: Annual government resource management expenditure
resource	
management	
expenditure	
Topic 6.1.2:	6.1.2.a: Private sector environment protection and resource management expenditure [related to energy
Corporate,	production and consumption]
non-profit	6.1.2.a.1: Annual corporate environment protection expenditure
institution and	6.1.2.a.2: Annual corporate resource management expenditure
household	6.1.2.a.3: Annual non-profit institution environment protection expenditure
environment	6.1.2.a.4: Annual non-profit institution resource management expenditure
protection and	6.1.2.a.5: Annual household environment protection expenditure
resource	6.1.2.a.6: Annual household resource management expenditure
management	
expenditure	
Sub-component	6.2: Environmental Governance and Regulation
Topic 6.2.2:	6.2.2.a: Direct regulation [related to energy production and consumption]
Environmental	<b>6.2.2.a.1: List of regulated pollutants and description</b> (e.g., by year of adoption and maximum
regulation and	allowable levels)
instruments	6.2.2.a.2: Description (e.g., name, year established) of licensing system to ensure compliance with
	environmental standards for businesses or other new facilities
	6.2.2.a.3: Number of applications for licenses received and approved per year
	6.2.2.a.5: Budget and number of staff dedicated to enforcement of environmental regulations
	6.2.2.b: Economic instruments [related to energy production and consumption]
	6.2.2.b.1: List and description (e.g., year of establishment) of green/environmental taxes
	6.2.2.b.2: List and description (e.g., year of establishment) of environmentally relevant subsidies
	6.2.2.b.3: List of eco-labelling and environmental certification programmes
	6.2.2.b.4: Emission permits traded
Topic 6.2.3:	6.2.3.a: Participation in MEAs and other global environmental conventions
Participation in	<b>6.2.3.a.1:</b> List and description (e.g., year of participation <sup>(a)</sup> of country) of MEAs and other
MEAs and	<b>global environmental conventions</b> [related to energy production and consumption]
environmental	
conventions	
	(a) 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, format
	a given convention or treaty are not considered to be participating
Sub-component	6.3: Extreme Event Preparedness and Disaster Management
Topic 6.3.2:	6.3.2.a: National technological disaster preparedness and management systems [related to energy production
Preparedness	and consumption]
for	6.3.2.a.1: Existence and description (e.g., number of staff) of public disaster management
technological	plans/programmes (and private when available)
disasters	6.3.2.a.2: Expenditure on disaster prevention, preparedness, clean-up and rehabilitation

#### 5.3 Climate Change

- 5.26 The Conference of the Parties of the UNFCCC has affirmed that climate change is one of the greatest challenges of our time.<sup>97</sup> Climate change is a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.<sup>98</sup> 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 affect the global energy balance (the balance between incoming energy from the Sun and outgoing heat from the earth) and ultimately lead to climate change.
- 5.27 The Kyoto Protocol is an international agreement linked to the UNFCCC. Its main 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 per cent against 1990 levels over the five-year period 2008-2012.<sup>99</sup> In 2012, the Doha Amendment (to the Kyoto Protocol) was adopted. This amendment further reduced the GHG emissions by at least 18 percent below 1990 levels in the eight-year period from 2013 to 2020. It also expands the list of GHGs regulated by the Kyoto Protocol.<sup>100</sup> These conventions and protocols involve reporting obligations, which in turn create additional data requirements and demand for environment statistics.
- 5.28 The Rio+20 United Nations Conference on Sustainable Development reaffirmed the preeminence of climate change, expressing alarm about the rise of GHGs 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 GHGs. 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

http://unfccc.int/kyoto\_protocol/items/2830.php (accessed 11 September 2014).

<sup>100</sup> United Nations Framework Convention on Climate Change (2014). Doha Amendment. Available from:

<sup>&</sup>lt;sup>97</sup> United Nations Framework Convention on Climate Change (2011). Available from <u>http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf</u> (accessed 15 September 2013).

<sup>&</sup>lt;sup>98</sup> United Nations Framework Convention on Climate Change (2013). Available from

https://unfccc.int/files/essential\_background/background\_publications\_htmlpdf/application/pdf/conveng.pdf (accessed 18 June 2015). <sup>99</sup> United Nations Framework Convention on Climate Change (2014). Kyoto Protocol. Available from:

http://unfccc.int/kyoto\_protocol/doha\_amendment/items/7362.php (accessed 11 September 2014).

regard, the Conference indicated adaptation to climate change to be an "urgent global priority".101

5.29 The Intergovernmental Panel on Climate Change (IPCC) has elaborated a sequence of events that describe the complexity of climate change by constructing a schematic framework (see Figure 5.7). This framework has been the basis upon which this crosscutting application of the FDES is constructed.

Figure 5.7: Schematic framework representing anthropogenic drivers, impacts of and responses to climate change, and their linkages<sup>102</sup>



5.30 As seen, climate change occurs through a chain of events and can be observable at all levels, from local to global. Climate process drivers are emissions of GHGs that are associated with current production and consumption patterns which are heavily

<sup>&</sup>lt;sup>101</sup> United Nations (2012). Rio+20 outcome document, "The Future We Want". Available from <u>http://www.uncsd2012.org/thefuturewewant.html</u> (accessed 22 October 2013). <sup>102</sup> Intergovernmental Panel on Climate Change, "Climate Change 2007: Synthesis Report". Available from

http://www.ipcc.ch/publications\_and\_data/ar4/syr/en/mainssyr-introduction.html (accessed 9 December 2013).

dependent on fossil fuels for energy and transportation. These persistently high emissions lead to high atmospheric CO<sub>2</sub> concentrations, which in turn prevent heat from escaping the Earth, increasing temperature and humidity, and changing climate patterns. The evidence of global warming and climate change is unequivocal,<sup>103</sup> including increased global temperatures, changing weather patterns, more intense extreme events, rising sea levels, shrinking ice sheets and glacial retreats.<sup>104</sup> Climate change evidence refers to the different processes that substantiate the occurrence of changing climate patterns and at the global, regional and local levels. 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. Mitigation aims to decrease the sources of GHGs, while climate change adaptation is 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.<sup>105</sup>

5.31 Climate change mitigation refers to efforts to reduce or prevent emission of greenhouse gases, and may involve using new technologies, incorporating and increasing renewable energies, making older equipment more energy efficient, and changing management practices or consumer behaviour. Efforts underway around the world range from hightech subway systems to bicycling paths and walkways. Protecting natural carbon sinks like forests and oceans, or creating new sinks through silviculture or green agriculture are also elements of mitigation.<sup>106</sup> The development and deployment of renewable energy technologies and more efficient use of renewable energy sources will play a significant role in mitigation of emissions of GHGs, thereby presenting important options for the mitigation of climate change as well as contributing to sustainable development. Harnessing of solar and wind energy, the production of biofuels through new processes, enhanced geothermal systems and emerging ocean technologies are some areas of potential advancement in this regard. Current strategies to foster renewable energies including direct regulation and the establishment of economic instruments must also be monitored.

<sup>&</sup>lt;sup>103</sup> Intergovernmental Panel on Climate Change, "Climate Change 2007: Synthesis Report". Available from <u>http://www.ipcc.ch/publications\_and\_data/ar4/syr/en/spms1.html</u> (accessed 24 April 2013).

<sup>&</sup>lt;sup>104</sup> The evidence also is accounted for warming oceans, declining arctic sea ice (extent and thickness) and ocean acidification. National Aeronautics and Space Administration, "Global Climate Change. Vital Signs of the Planet". Available from <u>http://climate.nasa.gov/evidence/</u> (accessed 23 April 2013).

<sup>&</sup>lt;sup>105</sup> United Nations Framework Convention on Climate Change (2013). "Glossary of Climate Change Acronyms". Available from <u>http://unfccc.int/essential\_background/glossary/items/3666.php#A</u> (accessed 15 May 2013).

<sup>&</sup>lt;sup>106</sup> United Nations Environment Programme. Environment for Development - Climate Change Mitigation. Available from <u>http://www.unep.org/climatechange/mitigation/</u> (accessed 19 April 2013).

- 5.32 Climate change impact 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. Weather patterns have become more extreme, with more intense and longer events such as droughts, floods and increased precipitation over many land areas, as well as more hot days and heat waves. Associated risks include more frequent and dangerous floods and storms, greater stress on water supplies, a decline in agricultural productivity and food security, and a further spread of water-related diseases, particularly in tropical areas.
- 5.33 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.<sup>107</sup> 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 necessary response to climate change and the development of statistics and methodologies for assessing adaptation are needed.

### **Statistics on Climate Change**

5.34 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.

<sup>&</sup>lt;sup>107</sup> Intergovernmental Panel on Climate Change, Fourth Assessment Report (2007). "Climate Change 2007: Impacts, Adaptation and Vulnerability", Cambridge University Press. Available from <u>http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4\_wg2\_full\_report.pdf</u> (accessed 10 October 2013).

- 5.35 The UNECE is actively working to develop climate change related statistics with its member countries and other international organisations.<sup>108</sup> The work primarily addresses data that are already collected by statistical offices and that can support analysis or research related to climate change. Scientific data (e.g. meteorological data) that measure changes in weather and climate are not a focus of the work. The CES set up a Task Force on climate change related statistics in November 2011. The work resulted in CES "Recommendations on Climate Change-Related Statistics" that were endorsed by the CES plenary session in April 2014.<sup>109</sup>
- 5.36 According to the UNECE, climate change related statistics refer to environmental, social and economic data that measure the human causes of climate change, the impacts of climate change on human and natural systems, the efforts of humans to avoid the consequences as well as their efforts to adapt to these consequences.<sup>110</sup>
- 5.37 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 important when informing any country on climate change. These statistics should be complemented with both social and economic statistics to provide a comprehensive set of information.
- 5.38 With regard to determining and apportioning the appropriate environment statistics for measurement of climate change, consideration of a sequence of changes is important. Statistics pertaining to the different steps of the sequence depicted in Figure 5.7 are necessary to monitor climate change and to observe how it is affecting different countries and regions.
- 5.39 At present, the availability of relevant statistics in most countries 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.

<sup>&</sup>lt;sup>108</sup> United Nations Economic Commission for Europe (2014). Climate change related statistics. Available from <u>http://www.unece.org/stats/climate.html</u> (accessed 24 September 2014).

 <sup>&</sup>lt;sup>109</sup> United Nations Economic Commission for Europe (2014). "Recommendations on Climate Change-Related Statistics". Available from <a href="http://www.unece.org/fileadmin/DAM/stats/publications/2014/CES\_CC\_Recommendations.pdf">http://www.unece.org/fileadmin/DAM/stats/publications/2014/CES\_CC\_Recommendations.pdf</a> (accessed 3 December 2014).
 <sup>110</sup> United Nations Economic Commission for Europe (2014). Climate change related statistics. Available from

http://www.unece.org/stats/climate.html (accessed 24 September 2014).

- 5.40 When compiling statistics on climate change at the national level, it is important to assess relevance as well as policy and legal aspects in the particular country. The relevance of climate change varies by country, given different political dynamics, the characteristics 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 programme to mitigate carbon emissions. It is an important step when preparing climate change statistics to first understand the national relevance, conceptual aspects and existing policies. Similarly, on the international level, an understanding of a country's participation<sup>111</sup> in specific conventions and related MEAs is a necessary step in preparing climate change statistics.
- 5.41 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

5.42 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, 5.8 and 5.9 organize the pertinent sub-components, topics and statistics of the Core Set according to the sequence of events relating to climate change as per the IPCC (Figure 5.7), with one modification – under "Socio-Economic Development" the focus has been put on only those elements that belong to the realm of environment statistics.

<sup>&</sup>lt;sup>111</sup> 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.

- 5.43 The climate change sequence depicted in Figures 5.8 and 5.9 thus contains four boxes organizing the stages of Climate Process Drivers, Climate Change Evidence, Climate Change Impacts and Vulnerability, and Mitigation and Adaptation.
- 5.44 Figure 5.8 presents the relevant 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.



## *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-componer	nt 1.3: Environmental Quality
Topic 1.3.1:	1.3.1.b: Global atmospheric concentrations of greenhouse gases
Air quality	1.3.1.b.1 Global atmospheric concentration level of carbon dioxide (CO <sub>2</sub> )
	1.3.1.b.2 Global atmospheric concentration level of methane (CH <sub>4</sub> )
Sub-componer	at 3.1: Emissions to Air
Topic 3.1.1:	3.1.1.a: Total emissions of direct greenhouse gases (GHGs), by gas:
Emissions of	3.1.1.a.1: Carbon dioxide (CO <sub>2</sub> )
greenhouse	3.1.1.a.2: Methane (CH <sub>4</sub> )
gases	3.1.1.a.3: Nitrous oxide (N <sub>2</sub> O)
	3.1.1.a.4: Perfluorocarbons (PFCs)
	3.1.1.a.5: Hydrofluorocarbons (HFCs)
	3.1.1.a.6: Sulphur hexafluoride (SF <sub>6</sub> )
	3.1.1.b: Total emissions of indirect greenhouse gases (GHGs), by gas:
	<b>3.1.1.b.1:</b> Sulphur dioxide (SO <sub>2</sub> )
	<b>3.1.1.b.2:</b> Nitrogen oxides (NO <sub>x</sub> )
	3.1.1.b.3: Non-methane volatile organic compounds (NM-VOCs)
	3.1.1.b.4: Other
Topic 3.1.2:	3.1.2.a: Consumption of ozone depleting substances (ODS), by substance:
Consumption	3.1.2.a.1: Chlorofluorocarbons (CFCs)
of ozone	3.1.2.a.2: Hydrochlorofluorocarbons (HCFCs)
depleting	3.1.2.a.3: Halons
substances	3.1.2.a.4: Methyl chloroform
	3.1.2.a.5: Carbon tetrachloride
	3.1.2.a.6: Methyl bromide
	3.1.2.a.7: Other

Climate Change Evidence	
Sub-componer	at 1.1: Physical Conditions
Topic 1.1.1:	1.1.1.a: Temperature
Atmosphere,	1.1.1.a.1: Monthly average
climate and	1.1.1.a.2: Minimum monthly average
weather	1.1.1.a.3: Maximum monthly average
	1.1.1.b: Precipitation
	1.1.1.b.1: Annual average
	1.1.1.b.2: Long-term annual average
	1.1.1.b.3: Monthly average
	1.1.1.b.4: Minimum monthly value
	1.1.1.b.5: Maximum monthly value
Topic 1.1.2:	1.1.2.e: Seas
Hydrographical	1.1.2.e.4: Sea level
characteristics	
Sub-componer	t 4.1: Natural Extreme Events and Disasters
Topic 4.1.1:	4.1.1.a: Occurrence of natural extreme events and disasters
Occurrence of	4.1.1.a.1: Type of natural extreme event and disaster (geophysical, meteorological, hydrological,
natural extreme	climatological, biological)
events and	4.1.1.a.2: Location
disasters	4.1.1.a.3: Magnitude (where applicable)
	4.1.1.a.4: Date of occurrence
	4.1.1.a.5: Duration

Climate Change Impacts and Vulnerability	
Sub-component 1.1: Physical Conditions	
Topic 1.1.2:	1.1.2.a: Lakes
Hydrographical	1.1.2.a.1: Surface area
characteristics	1.1.2.a.2: Maximum depth
	1.1.2.b: Rivers and streams
	1.1.2.b.1: Length
	1.1.2.c: Artificial reservoirs
	1.1.2.c.1: Surface area
	1.1.2.c.2: Maximum depin
	1.1.2.e. Seds $1.1.2.a.5$ : Area of sequence
	1.1.2.e.J. Area of sea ice
Topic 1 1 4:	1.1.2.g. Glaciers
Soil	1.1.4.b.2: Area affected by desertification
characteristics	
Sub-componer	nt 1.2: Land Cover, Ecosystems and Biodiversity
Topic 1.2.1:	1.2.1.a: Area under land cover categories
Land cover	
Topic 1 2 2.	1.2.2 a: General ecosystem characteristics, extent and nattern
Ecosystems	1.2.2.a. 1: Area of ecosystems
and	1.2.2.b: Ecosystems' chemical and physical characteristics
biodiversity	1.2.2.b.2: Carbon
2	1.2.2.c: Biodiversity
	1.2.2.c.1: Known flora and fauna species
	1.2.2.c.2: Endemic flora and fauna species
	1.2.2.c.3: Invasive alien flora and fauna species
	1.2.2.c.4: Species population
	1.2.2.c.5: Habitat fragmentation
Topic 1.2.3:	1.2.3.a: Forest area
Forests	1.2.3.a.1: Total
	1.2.3.a.2: Natural
	1.2.3.a.5: Planted
	1.2.3.a.4. Florest area affected by fire
	1 2 3 b: Forest biomass
	1.2.4.b.1: Total
	1.2.4.b.2: Carbon storage in living forest biomass
Sub component	t 1 3. Environmental Quality
Topia 1.2.2:	1 2 2 by Organia matter
Topic 1.5.5: Marina water	1.3.3.0. Organic matter 1.3.3.b.1: Biochemical ovygan domand (BOD)
	1.3.3.b.1. Dischemical oxygen demand (COD)
quanty	1 3 3 f: Physical and chemical characteristics [of marine water hodies]
	1.3.3.f.1: nH/Acidity/Alkalinity
	1.3.3.f.2: Temperature
	1.3.3.f.3: Total suspended solids (TSS)
	1.3.3.f.4: Salinity
	1.3.3.f.5: Dissolved oxygen (DO)
	1.3.3.f.6: Density
	1.3.3.g: Coral bleaching
	1.3.3.g.1: Area affected by coral bleaching
Sub-component 2.3: Land	
Topic 2.3.1:	2.3.1.a: Area under land use categories
Land use	
Topic 2.3.2:	2.3.2.a: Use of forest land
Use of forest	2.3.2.a.1: Area deforested
land	2.3.2.a.2: Area reforested
	2.3.2.a.5: Area allorested
	2.5.2.a.4: Natural growth
Sub-component 4.1: Natural Extreme Events and Disasters	
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Topic 4.1.2:	4.1.2.a: People affected by natural extreme events and disasters
Impact of	4.1.2.a.1: Number of people killed
natural extreme	4.1.2.a.2: Number of people injured
events and	4.1.2.a.3: Number of people homeless
disasters	4.1.2.a.4: Number of people affected
	4.1.2.b: Economic losses due to natural extreme events and disasters
	4.1.2.c: Physical losses/damages due to natural extreme events and disasters
	4.1.2.d: Effects of natural extreme events and disasters on integrity of ecosystems
	<i>4.1.2.d.1: Area affected by natural disasters</i>
	4.1.2.d.2: Loss of vegetation cover
	4.1.2.d.3: Area of watershed affected
	4.1.2.d.4: Other
Sub-componer	t 5.1: Human Settlements
Topic 5.1.3:	5.1.3.c: Population living in hazard prone areas
Housing	5.1.3.d: Hazard prone areas
conditions	
Sub-componer	t 5.2: Environmental Health
Topic 5.2.3:	5.2.3.a: Vector borne diseases
Vector borne	5.2.3.a.1: Incidence
diseases	5.2.3.a.2: Prevalence
	5.2.3.a.3: Mortality
	5.2.3.a.4: Loss of work days
	5.2.3.a.5: Estimates of economic cost in monetary terms
Topic 5.2.4:	5.2.4.a: Problems associated with excessive UV radiation exposure
Health	5.2.4.a.1: Incidence
problems	5.2.4.a.2: Prevalence
associated with	5.2.4.a.3: Loss of work days
excessive UV	5.2.4.a.4: Estimates of economic cost in monetary terms
radiation	
exposure	

	Mitigation and Adaptation
Sub-component 2.2: Energy Resources	
Topic 2.2.2:	2.2.2.a: Production of energy
Production,	2.2.2.a.3: Production from renewable sources
trade and	
consumption of	
energy	
Sub-componer	t 6.1: Environment Protection and Resource Management Expenditure
Topic 6.1.1:	6.1.1.a: Government environment protection and resource management expenditure [on climate change
Government	mitigation activities]
environment	6.1.1.a.1: Annual government environment protection expenditure
protection and	6.1.1.a.2: Annual government resource management expenditure
resource	
management	
expenditure	
Topic 6.1.2:	6.1.2.a: Private sector environment protection and resource management expenditure [on climate change
Corporate,	mitigation activities]
non-profit	6.1.2.a.1: Annual corporate environment protection expenditure
institution and	6.1.2.a.2: Annual corporate resource management expenditure
household	6.1.2.a.3: Annual non-profit institution environment protection expenditure
environment	6.1.2.a.4: Annual non-profit institution resource management expenditure
protection and	6.1.2.a.5: Annual household environment protection expenditure
resource	6.1.2.a.6: Annual household resource management expenditure
management	
expenditure	
Sub-component 6.2: Environmental Governance and Regulation	
Topic 6.2.2:	6.2.2.a: Direct regulation
Environmental	6.2.2.a.1: List of regulated pollutants and description (e.g., by year of adoption and maximum

regulation and	allowable levels) [related to climate change]
instruments	6.2.2.a.2: Description (e.g., name, year established) of licensing system to ensure compliance with
	environmental standards for businesses or other new facilities [related to climate change]
	6.2.2.a.3: Number of applications for licences received and approved per year [related to climate
	change]
	6.2.2.a.4: List of quotas for biological resource extraction
	6.2.2.a.5: Budget and number of staff dedicated to enforcement of environmental regulations
	[related to climate change]
	6.2.2.b: Economic instruments [related to climate change]
	6.2.2.b.1: List and description (e.g., year of establishment) of green/environmental taxes
	6.2.2.b.2: List and description (e.g., year of establishment) of environmentally relevant subsidies
	6.2.2.b.3: List of eco-labelling and environmental certification programmes
	6.2.2.b.4: Emission permits traded
Topic 6.2.3:	6.2.3.a: Participation in MEAs and other global environmental conventions
Participation in	<b>6.2.3.a.1:</b> List and description (e.g., year of participation <sup>(a)</sup> of country) of MEAs and other
MEAs and	global environment conventions [related to climate change]
other global	
environmental	
conventions	
	(a) 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 convertient or treating considered to be participating
Sub componer	a given convention of dealy are not considered to be participating.
Sub-component 0.5: Extreme Event Preparedness and Disaster Management	
Topic 0.5.1:	6.3.1.a: National natural extreme event and disaster preparedness and management systems
Preparedness	6.3.1.a.1: Existence of national disaster plans programmes
for natural	0.5.1.a.2: Description (e.g. number of starf) of national disaster plans/programmes
extreme events	
and disasters	

#### 5.4 Agriculture and the Environment

- 5.45 Agriculture is essential to sustaining livelihoods, securing food production and providing income. Agriculture is an environment-dependent activity that involves the use of ecosystem goods and services and environmental resources such as land, soil, water, and energy. Agriculture is the largest water consumer in the world.<sup>112</sup>
- 5.46 Sustainable agricultural production contributes to long-term food security. The promotion and support of sustainable agriculture that conserves land, water, biodiversity and ecosystems, while enhancing resilience to climate change and natural disasters, has been agreed upon internationally, as has the need to maintain natural ecological processes.<sup>113</sup>
- 5.47 Large scale or intensive agriculture requires the increasing use of chemicals, infrastructure and machinery. In its effort to improve crop production, agriculture has become an industry which uses more and more anthropogenic inputs in the form of chemical fertilizers, pesticides, and modified genetic material. Changes to soil chemistry through fertilizer and pesticide applications, as well as alteration of ecosystems and biota through introduction of genetic material all influence the health and wellbeing of humans and other living beings. Agricultural infrastructure (e.g., access roads and networks for delivery of products), immovable irrigation infrastructure, dam construction for access to water resources, as well as wind and solar energy infrastructure for exploiting groundwater resources, all contribute to changes in the ecosystems.
- 5.48 Many advances in conventional agricultural production in recent decades have been realised with little or no regard for biodiversity. Modern agricultural practices, which intensify a given crop's production yields, have led to gross simplification of agricultural systems and biodiversity leading to an increasing need for conservation efforts of existing biodiversity. This has generated substantial efforts to develop holistic approaches to agricultural management, for example, organic farming or integrated pest management. These are now very recognized practices in many parts of the world and can reduce the environmental impact of farming significantly.

<sup>&</sup>lt;sup>112</sup> United Nations Educational, Scientific, and Cultural Organization (2014). World Water Assessment Programme. Available from: <u>http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/facts-and-figures/all-facts-wwdr3/fact2-agricultural-use/</u> (accessed 11 September 2014).

<sup>&</sup>lt;sup>113</sup>United Nations (2012). Rio+20 outcome document, "The Future We Want". Available from <u>http://www.uncsd2012.org/thefuturewewant.html</u> (accessed 9 November 2013).

- 5.49 The increased use of GMOs in modern agriculture has had some negative impact on biodiversity, however higher yielding pesticide-resistant genetically modified crops may also reduce GHG emissions. More and better monitoring data are needed to assess these effects.
- 5.50 Agriculture both contributes to and is seriously influenced by climate change. It leads to GHG emissions by decreasing carbon sinks (via deforestation and wetland conversion), contributing to methane emissions (via rice cultivation and ruminant livestock), releasing nitrous oxide through nitrogen fertilizers, and emitting carbon dioxide via machinery and transport. In turn, as a result of climate change, agriculture is subjected to changes in water availability, increased exposure to heat stress, changed distribution of pests and diseases, increased leaching of nutrients from soil, greater soil erosion from stronger winds and rainfall, and an increased frequency of wildfires.
- 5.51 On the other hand, agriculture also provides opportunities for tackling climate change. This can take three forms: a) decreasing GHG emissions via better agricultural management of livestock and rice cultivation; b) improving the carbon sink function of agricultural soils and of vegetation on agricultural land; and c) contributing to the development of renewable energy sources via agricultural biomass, e.g. from manure or crop residues.
- 5.52 Flows and balances of nutrients and their contribution to soil fertility are critical to agricultural production. Globally, human society has more than doubled worldwide terrestrial cycling of nitrogen and phosphorous, and caused an imbalance in these nutrients, which is leading to environmental problems such as soil degradation and loss of soil fertility. Improving nutrient efficiency in crop and animal production is integral to mitigating this problem.
- 5.53 Regarding livestock production, growth and productivity gains are frequently achieved through the use of, antibiotics, hormones, genetic material, and intensive feeding practices on pasture, rangeland and feedlots. Bacteria in poultry litter, veterinary antibiotics, anti-parasitic medicines and hormones are just a fraction of the contaminants that are introduced to the environment through livestock production. The cumulative effect of releases from livestock production and agriculture make monitoring of the environmental consequences a pressing need. However, there are still many rangeland systems that make positive contributions to biodiversity and landscapes.

#### Application of the FDES to agriculture and the environment

- 5.54 In this cross-cutting issue, the scope of agriculture is set out according to groups 011 through 016 in ISIC Rev. 4, which comprise crop and animal production.<sup>114</sup> Although the scope is restricted to these contents, using the pattern applied below, similar exercises can be carried out for forestry, aquaculture and agro-industrial activities and their relationship to the environment.
- 5.55 Figure 5.10 is a schematic presentation of the relationship between agriculture and the environment. The scheme also helps to illustrate how the FDES can be applied to study these relationships.

Figure 5.10: The relationship between agriculture and the environment



<sup>114</sup> United Nations Statistics Division (2008). "International Standard Industrial Classification of All Economic Activities, Rev. 4". Available from <a href="http://unstats.un.org/unsd/cr/registry/isic-4.asp">http://unstats.un.org/unsd/cr/registry/isic-4.asp</a> (accessed 14 June 2013).

- 5.56 Environmental conditions and quality (FDES Component 1) largely determine the agricultural potential of a country. These environmental conditions (such as climate and weather, hydrological conditions, terrain, soil types and fertility levels etc.) actually provide the basic ecological foundation for agriculture.
- 5.57 Agricultural production uses environmental resources (FDES Component 2) such as land, soil, water and energy. The resources are modified both qualitatively and quantitatively, for example water can become polluted and overused, or nutrients from soil can be depleted and would require replenishment by artificial means. Other natural inputs and processes are also necessary to produce crops and livestock, namely the permanent flux of solar luminescence, photosynthesis and a wide range of other ecosystem services. Additionally, manufactured inputs such as fertilizers, pesticides and other agrochemicals (for crops), antibiotics, hormones, etc. (for livestock) are also used in agricultural production and released to the environment.
- 5.58 The production of different types of crops and livestock (FDES Component 2) might be carried out by different farming methods such as traditional, extensive, monoculture, or organic. Therefore the intake of resources and agrochemicals as well as the residuals could be more, or less sustainable, depending on the state, conditions and the resilience of surrounding environments. Monitoring the yields and their changes through time and space provides additional information to assess the sustainability and health of ecosystems.
- 5.59 Agricultural processes generate different kinds of residuals (FDES Component 3). Emissions to water occur from the use of agrochemicals. Also important, particularly in terms of contributing to climate change, are the agricultural emissions to air and atmosphere resulting from both land use change associated with agriculture (i.e., deforestation), from the use of fossil fuels for energy and transportation in agriculture, and from livestock digestive functions (methane). Agriculture can also emit ODS into the environment, particularly methyl bromide, which is known to be used as a soil and structural fumigant to control pests in many countries. The application of and the residuals from substances in agriculture such as fertilizers and pesticides are an environmental health concern. Residuals in soil from the use of agrochemicals play an important role in determining its quality, productive capacity and pollution levels.

- 5.60 Agricultural waste is to a great extent composed of organic materials such as harvest remains from grain, oilseed, vegetable, and orchard crops. It also includes manure and animal output, in solid or liquid form, from livestock operations. Organic waste is a resource whenever it is reused or recycled, for example to produce organic fertilizer from biomass and manure. Other examples of solid waste include empty pesticide and fertilizer containers, old silage wrap, expired pesticides, medicines, used oil, gasoline and diesel containers, and used tyres.
- 5.61 Extreme events and natural disasters (FDES Component 4) can also affect environmental resource stocks and therefore their use, as well as the production and yields of agriculture and livestock. More intensive droughts, floods, landslides, hurricanes, storms, etc. impact the state of the environment and the ecological functions that support agriculture. They can severely affect soil, land and biological resources to be used or already in use as well as the productivity of these environmental resources. Extreme events and disasters can directly affect the soil and land under crops or pastures, and can also affect the water cycle and critical watersheds. They can impact relevant infrastructure and even damage the crops and livestock themselves, depending on the intensity, the duration and nature of the extreme event and disaster, the ecosystem's resilience, and the preparedness and response by society.
- 5.62 Overall, agricultural activities change the environment. They can transform ecosystems and physical conditions (FDES Component 1) via irrigation, drainage, deforestation, and the use of fertilizers and pesticides. They modify the quality and quantity of environmental resources (FDES Component 2) being used or to be used in the future, depending on the type and extent of the agricultural activities and the resilience of the environment. These changes can be qualitative and quantitative in nature. Qualitative transformation becomes an environmental issue when it concerns pollution, i.e., the biological and chemical pollution of water and the eutrophication of rivers, lakes and seas, the pollution of soil or its degradation particularly in specific sites and zones, and the air and atmospheric pollution already described under residuals. Quantitative changes include considerable land use changes (e.g., loss of natural ecosystems such as forest to pastures and crops), increased or new water stress, overuse and depletion of water, and contribution to soil erosion and degradation. Finally, agriculture may lead to both changes in physical conditions (temperature, humidity and precipitation from climate change) and to disruptions of ecological functions including biodiversity loss (terrestrial and aquatic) around agricultural areas, the introduction of invasive species, etc.

- 5.63 These changes in the environment will also affect human environmental health (FDES Component 5). Of particular importance are human health problems related to toxic substance exposure. The use of toxic substances in agriculture such as those found in pesticides (fungicides, herbicides, insecticides, rodenticides, etc.) and their potential appearance in food, in air or water are important environmental and health concerns.
- 5.64 Information on the responses of society aimed at protecting, managing, and restoring environmental resources (water, energy, soil and land) and at reducing the negative environmental impacts of agricultural activities is important (FDES Component 6). The relevant information about environmental protection expenditure, economic measures, actions and programmes aimed at protecting and restoring soil and water functions to sustainable levels, as well as promoting organic and sustainable agriculture, cleaner energy production and efficiency in agriculture, is significant. These social efforts can diminish the negative impacts and effects of agriculture on the environment and human health, and depending on the magnitude of impacts over time and across space, they could even restore the environmental quality and conditions and ensure the sustainable use of environmental resources.
- 5.65 The statistical description of the relationship between agriculture and the environment brings together statistical topics and statistics from all components of the FDES. In addition, supporting statistics are needed that are commonly available from agricultural, economic and social statistics. Geospatial statistics and GIS are playing an increasing role in complementing traditional data in this area.
- 5.66 In the figures below, the FDES has been applied for the specific purpose of organizing the relevant environment statistics needed to inform about issues related to agriculture and the environment. Figures 5.11 and 5.12 illustrate how the contents of the FDES and its Core Set and Basic Set of Environment Statistics can be used to select and relate its relevant parts to properly describe the relationship of agriculture with the environment.
- 5.67 Figures 5.11 and 5.12 are based on the sequence scheme relating agriculture and the environment as depicted in Figure 5.10, and they present the FDES components, subcomponents, topics and environment statistics that are considered necessary to inform about this cross-cutting issue. Figure 5.11 presents the key information to describe the relationship of agriculture and the environment down to the topic level. Figure 5.12 presents the individual statistics of the Core Set and the Basic Set of Environment Statistics, organized under the different topics and components of the FDES, in a way

that disaggregates the topics of Figure 5.10 to the most detailed level possible. At the end of this analysis between agriculture and the environment, several commonly used agrienvironmental indicators are presented as an illustration of those that can be constructed with the selected environment statistics.



Figure 5.11: Topics in the FDES that relate to agriculture and the environment Environmental Conditions and Quality

## Figure 5.12: Agriculture and the environment, statistics in the Basic Set and Core Set of Environment Statistics

	Environmental Conditions and Quality
Sub-componer	nt 1.1: Physical Conditions
Topic 1.1.1:	1.1.1.a: Temperature
Atmosphere,	1.1.1.a.1: Monthly average
climate and	1.1.1.a.2: Minimum monthly average
weather	1.1.1.a.3: Maximum monthly average
	1.1.1.b: Precipitation (also in 2.6.1.a)
	1.1.1.b.1: Annual average
	1.1.1.b.2: Long-term annual average
	1.1.1.b.3: Monthly average
	1.1.1.b.4: Minimum monthly value
	1.1.1.b.5: Maximum monthly value
	1.1.1.c: Relative humidity
	1.1.1.c.1: Minimum monthly value
	1.1.1.c.2: Maximum monthly value
	1.1.1.f: Solar radiation
	1.1.1.f.1: Average daily value
	1.1.1.f.2: Average monthly value
	1.1.1.f.3: Number of hours with sunshine
Topic 1.1.2:	1.1.2.a: Lakes
Hydrographical	1.1.2.a.1: Surface area
characteristics	1.1.2.a.2: Maximum depth
	1.1.2.b: Rivers and streams
	1.1.2.b.1: Length
	1.1.2.c: Artificial reservoirs
	1.1.2.c.1: Surface area
	1.1.2.c.2: Maximum depth
	1.1.2.d: Watersheds
	1.1.2.d.1: Description of main watersheds
	1.1.2.f: Aquifers
Topic 1.1.4:	1.1.4.a: Soil characterization
Soil	1.1.4.a.1: Area of soil types
characteristics	1.1.4.b: Soil degradation
	1.1.4.b.1: Area affected by soil erosion
	1.1.4.b.2: Area affected by desertification
	1.1.4.b.3: Area affected by salinization
	1.1.4.b.4: Area affected by waterlogging
	1.1.4.b.5: Area affected by acidification
	1.1.4.b.6: Area affected by compaction
	1.1.4.c: Nutrient content of soil, measured in levels of:
	1.1.4.c.1: Nitrogen (N)
	1.1.4.c.2: Phosphorous (P)
	1.1.4.c.3: Calcium (Ca)
	1.1.4.c.4: Magnesium (Mg)
	1.1.4.c.5: Potassium (K)
	1.1.4.c.6: Zinc (Zn)
Sub-componer	it 1.2: Land Cover, Ecosystems and Biodiversity
Topic 1.2.1:	1.2.1.a.: Area under land cover categories
Land cover	
Topic 1.2.2:	1.2.2.a: General ecosystem characteristics, extent and pattern
Ecosystems	1.2.2.a.1: Area of ecosystems
and	1.2.2.a.2: Proximity of ecosystem to urban areas and cropland
biodiversity	

	Environmental Resource Use
Sub-componer	nt 2.2: Energy Resources
Topic 2.2.2:	2.2.2.c: Final consumption of energy [for agriculture]
Production,	
trade and	
consumption of	
energy	
Sub-componer	nt 2.3: Land
Topic 2.3.1:	2.3.1.a: Area under land use categories
Land use	2.3.1.b: Other aspects of land use
	2.3.1.b.1: Area of land under organic farming
	2.3.1.b.2: Area of land under irrigation
	2.3.1.b.4: Area of land under agroforestry
C 1	2.3.1.c: Land ownership
Sub-componer	at 2.5: Biological Resources
Topic 2.5.3:	2.5.3.a: Main annual and perennial crops
Crops	2.5.3.a.1: Area narvested
	2.5.3.a.2: Area planted
	2.5.3.a.5: Amount produced
	2.5.3.a.4. Amount of organic production
	2.5.3.b: Amount used of:
	<b>2.5.3.b.1: Natural fertilizers</b> (e.g., manure, compost, lime) (also in 3.4.1.a)
	<b>2.5.3.b.2: Chemical fertilizers</b> (also in 3.4.1.a)
	<b>2.5.3.b.3: Pesticides</b> (also in 3.4.1.a)
	2.5.3.b.4: Genetically modified seeds
	2.5.3.c: Monoculture/resource-intensive farming systems
	2.5.3.c.1: Area being used for production
	2.5.3.c.2: Amount produced
	2.5.3.c.3: Amount of genetically modified crops produced
	2.5.3.d: Imports of crops
T	2.5.3.e: Exports of crops
Topic 2.5.4:	2.5.4.a: Livestock
Livestock	2.5.4.a.1: Number of live animals
	2.5.4.a.2. Number of animals staughtered
	2.5.4.0. Amount used of: $2.5.4 h l \cdot Antihiotics (also in 3.4.1 f)$
	2.5.4.0.1. Hambling (also in 3.4.1.d)
	2.5.4 c: Imports of livestock
	2.5.4.d: Exports of livestock
Sub-componer	nt 2.6: Water Resources
Topic 2.6.1:	2.6.1.a: Inflow of water to inland water resources
Water	<b>2.6.1.a.1: Precipitation</b> (also in 1.1.1.b)
resources	2.6.1.b: Outflow of water from inland water resources
	2.6.1.b.1: Evapotranspiration
	2.6.1.c: Inland water stocks
	2.6.1.c.1: Surface water stocks in artificial reservoirs
	2.6.1.c.2: Surface water stocks in lakes
	2.6.1.c.3: Surface water stocks in rivers and streams
	2.6.1.c.4: Surface water stocks in wetlands
	2.6.1.c.3: Surface water stocks in snow, ice and glaciers
Topic 2 ( ):	2.0.1.c.0: Groundwater Stocks
Abstraction	2.0.2.a: 1 otal water abstraction [107 agriculture]
use and returns	2.6.2.c. Water abstraction from groundwater [for agriculture]
of water	2.6.2.c. water abstraction from groundwater [10] agroundure]
or water	2.6.2.c.2: From non-renewable groundwater resources
	2.6.2.d: Water abstracted for own use [for agriculture]
	2.6.2.e: Water abstracted for distribution [for agriculture]

- 2.6.2.f: Desalinated water [for agriculture]
- 2.6.2.g: Reused water [for agriculture]
- 2.6.2.h: Water use [for agriculture]
- 2.6.2.1. Water use [10] agriculture] 2.6.2.1: Rainwater collection [for agriculture] 2.6.2.1: Water abstraction from the sea [for agriculture] 2.6.2.k: Losses during transport [for agriculture] 2.6.2.1: Exports of water [for agriculture] 2.6.2.m: Imports of water [for agriculture]

- 2.6.2.n: Returns of water [for agriculture]

#### **Inputs to Agriculture from Economy**

Sub-component 2.5: Biological Resources	
Topic 2.5.3:	2.5.3.b: Amount used of:
Crops	<b>2.5.3.b.1: Natural fertilizers</b> (e.g. manure, compost, lime) (also in 3.4.1.a)
	<b>2.5.3.b.2: Chemical fertilizers</b> (also in 3.4.1.a)
	<b>2.5.3.b.3: Pesticides</b> (also in 3.4.1.b)
	2.5.3.b.4: Genetically modified seeds
Topic 2.5.4:	2.5.4.b: Amount used of:
Livestock	2.5.4.b.1: Antibiotics (also in 3.4.1.f)
	2.5.4.b.2: Hormones (also in 3.4.1.d)

## **Agricultural Production**

Sub-componer	nt 2.5: Biological Resources
Topic 2.5.3:	2.5.3.a: Main annual and perennial crops
Crops	2.5.3.a.1: Area harvested
	2.5.3.a.2: Area planted
	2.5.3.a.3: Amount produced
	2.5.3.a.4: Amount of organic production
	2.5.3.a.5: Amount of genetically modified crops produced
	2.5.3.c: Monoculture/resource-intensive farming systems:
	2.5.3.c.1: Area being used for production
	2.5.3.c.2: Amount produced
	2.5.3.c.3: Amount of genetically modified crops produced
Topic 2.5.4:	2.5.4.a: Livestock
Livestock	2.5.4.a.1: Number of live animals
	2.5.4.a.2: Number of animals slaughtered

#### Residuals

Sub-component 3.1: Emissions to Air	
Topic 3.1.1:	3.1.1.a: Total emissions of direct greenhouse gases, by gas [from agriculture]:
Emissions of	3.1.1.a.1: Carbon dioxide (CO <sub>2</sub> )
greenhouse	3.1.1.a.2: Methane (CH <sub>4</sub> )
gases	
Topic 3.1.2:	3.1.2.a: Consumption of ozone depleting substances (ODS), by substance [by agriculture]:
Consumption	3.1.2.a.6: Methyl bromide
of ozone	
depleting	
substances	
Topic 3.1.3:	3.1.3.a: Emissions of other substances [from agriculture]:
Emissions of	3.1.1.a.1: Particulate matter (PM)
other	3.1.1.a.2: Heavy metals
substances	3.1.1.a.3: Other
Sub-component 3.2: Generation and Management of Wastewater	
Topic 3.2.1:	3.2.1.a: Volume of wastewater generated [from agriculture]
Generation and	3.2.1.b: Pollutant content of wastewater [from agriculture]
pollutant	
content of	
wastewater	

Topic 3.2.3:	3.2.3.a: Wastewater discharge [from agriculture]
Discharge of	3.2.3.a.1: Total volume of wastewater discharged to the environment after treatment
wastewater to	3.2.3.a.2: Total volume of wastewater discharged to the environment without treatment
the	3.2.3.b: Pollutant content of discharged wastewater [from agriculture]
environment	
Sub-componen	t 3.3: Generation and Management of Waste
Topic 3.3.1:	3.3.1.a: Amount of waste generated by source [by agriculture]
Generation of	3.3.1.b: Amount of waste generated by waste category [by agriculture]
waste	3.3.1.c: Amount of hazardous waste generated [by agriculture]
Sub-componen	t 3.4: Release of Chemical Substances
Topic 3.4.1:	3.4.1.a: Total amount of fertilizers used (also in 2.5.1.b and 2.5.3.b) [by agriculture]
Release of	3.4.1.b: Total amount of pesticides used (also in 2.5.1.b and 2.5.3.b) [by agriculture]
chemical	3.4.1.c: Total amount of pellets used (also in 2.5.2.e) [by agriculture]
substances	3.4.1.d: Total amount of hormones used (also in 2.5.2.e and 2.5.4.b) [by agriculture]
	3.4.1.e: Total amount of colourants used (also in 2.5.2.e) [by agriculture]
	3.4.1.f: Total amount of antibiotics used (also in 2.5.2.e and 2.5.4.b) [by agriculture]

	Environmental Changes
	Changes in Quality
Sub-componen	at 1.3: Environmental Quality
Topic 1.3.2:	1.3.2.a: Nutrients and chlorophyll
Freshwater	1.3.2.a.1: Concentration level of nitrogen
quality	1.3.2.a.2: Concentration level of phosphorous
	1.3.2.a.3: Concentration level of chlorophyll A
	1.3.2.b: Organic matter
	1.3.2.b.1: Biochemical oxygen demand (BOD)
	1.3.2.b.2: Chemical oxygen demand (COD)
	1.3.2.c: Pathogens
	1.3.2.c.1: Concentration levels of faecal coliforms
	1.3.2.d: Metals (e.g., mercury, lead, nickel, arsenic, cadmium)
	1.3.2.d.1: Concentration levels in sediment and freshwater
	1.3.2.d.2: Concentration levels in freshwater organisms
	1.3.2.e: Organic contaminants (e.g., PCBs, DDT, pesticides, furans, dioxins, phenols, and radioactive waste)
	1.3.2.e.1: Concentration levels in sediment and freshwater
	1.3.2.e.2: Concentration levels in freshwater organisms
	1.3.2.f: Physical and chemical characteristics
	1.3.2.f.1: pH/Acidity/Alkalinity
	1.3.2.f.2: Temperature
	1.3.2.f.3: Total suspended solids (TSS)
	1.3.2.f.4: Salinity
	1.3.2.f.5: Dissolved oxygen (DO)
Topic 1.3.3:	1.3.3.a: Nutrients and chlorophyll
Marine water	1.3.3.a.1: Concentration level of nitrogen
quality	1.3.3.a.2: Concentration level of phosphorous
	1.3.3.a.3: Concentration level of chlorophyll A
	1.3.3.b: Organic matter
	1.3.3.b.1: Biochemical oxygen demand (BOD)
	1.3.3.b.2: Chemical oxygen demand (COD)
	1.3.3.c: Pathogens
	1.3.3.c.1: Concentration levels of faecal coliforms in marine water bodies
	1.3.3.d: Metals (e.g., mercury, lead, nickel, arsenic, cadmium)
	1.3.3.d.1: Concentration levels in sediment and marine water
	1.3.3.d.2: Concentration levels in marine organisms
	1.5.5.e: Organic contaminants (e.g., PCBs, DD1, pesticides, turans, dioxins, pnenois, and radioactive waste)
	1.3.5.e.1: Concentrations in sediment and marine water
	1.3.5.e.2: Concentrations in marine organisms
	1.5.5.f: Physical and chemical characteristics
	1.3.5.1.1 pH/Acidity/Alkalinity
	1.3.5.1.2: Temperature
Topic 1.3.3: Marine water quality	<ul> <li>1.3.2.b.1: Biochemical oxygen demand (BOD)         <ul> <li>1.3.2.b.2: Chemical oxygen demand (COD)</li> </ul> </li> <li>1.3.2.c. Pathogens         <ul> <li>1.3.2.c.1: Concentration levels of faecal coliforms</li> </ul> </li> <li>1.3.2.d.1: Concentration levels in faechal coliforms</li> <li>1.3.2.d.1: Concentration levels in freshwater organisms</li> <li>1.3.2.d.2: Concentration levels in freshwater organisms</li> </ul> <li>1.3.2.e.1: Concentration levels in sediment and freshwater         <ul> <li>1.3.2.e.2: Concentration levels in sediment and freshwater</li> <li>1.3.2.e.1: Concentration levels in sediment and freshwater</li> <li>1.3.2.e.2: Concentration levels in sediment and freshwater</li> <li>1.3.2.e.1: Concentration levels in freshwater organisms</li> </ul> </li> <li>1.3.2.e.1: Concentration levels in freshwater organisms</li> <li>1.3.2.e.2: Concentration levels in freshwater organisms</li> <li>1.3.2.f.1: pH/Acidity/Alkalinity         <ul> <li>1.3.2.f.2: Temperature</li> <li>1.3.2.f.3: Total suspended solids (TSS)</li> <li>1.3.2.f.5: Dissolved oxygen (DO)</li> </ul> </li> <li>1.3.3.a: Nutrients and chlorophyll</li> <li>1.3.3.a.1: Concentration level of nitrogen</li> <li>1.3.3.a.3: Concentration level of chlorophyll A</li> <li>1.3.3.a.3: Concentration level of chlorophyll A</li> <li>1.3.3.b.1: Biochemical oxygen demand (COD)</li> <li>1.3.3.c.1: Concentration levels of faecal coliforms in marine water bodies</li> <li>1.3.3.d.1: Concentration levels of secal coliforms in marine water</li> <li>1.3.3.d.2: Concentration levels in sediment and marine water</li> <li>1.3.3.d.1: Concentration levels in sediment and marine water</li> <li>1.3.3.d.2: Concentration levels in sediment and marine water</li> <li>1.3.3.d.2: Concentr</li>

	133fA. Salinity
	1.3.5 f.5: Dissolved oxygen (DO)
	1.3.3.1.5. Dissolution (DO)
	1.2.2 g: Coral blocking
	1.3.5.g. Cota bleaching
	1.3.5.g.i: Area anected by coral bleaching
	1.3.5.1. Red tude
	134.5.1.1. Occurrence
	1.3.5.1.2. Impleted area
Topia 1.2.4.	1.2.4 or Sites offstad by pollution
Topic 1.5.4:	1.3.4.a: Sites anected by pointion
Soll pollution	1.3.4.a.1: Contaminated sites
	1.3.4.a.2: Potentially containinated sites
	1.3.4.a.3: Remediated sites
	1.3.4.4.4: Other sites
	Changes in Quantity
Sub-componen	nt 1.1: Physical Conditions
Topic 1.1.4:	1.1.4.b: Soil degradation
Soil	1.1.4.b.1: Area affected by soil erosion
characteristics	1.1.4.b.2: Area affected by desertification
	1.1.4.b.3: Area affected by salinization
	1.1.4.b.4: Area affected by waterlogging
	1.1.4.b.5: Area affected by acidification
	1.1.4.b.6: Area affected by compaction
	1.1.4.c: Nutrient content of soil, measured in levels of:
	1.1.4.c.1: Nitrogen (N)
	1.1.4.c.2: Phosphorous (P)
	1.1.4.c.5: Potassium (K)
Sub-componer	nt 2.3: Land
Topic 2.3.1:	2.3.1.a: Area under land use categories
Land use	
C	hanges in Physical Conditions and Disruption of Ecological Functions
Sub-componer	nt 1.2: Land Cover, Ecosystems and Biodiversity
Topic 1.2.2:	1.2.2.c: Biodiversity
Ecosystems	1.2.3.c.1: Known flora and fauna species
and	1.2.3.c.2: Endemic flora and fauna species
biodiversity	1.2.3.c.3: Invasive alien flora and fauna species
	1.2.3.c.4: Species population
	1.2.3.c.5: Habitat fragmentation

	Human Settlements and Environmental Health	
Sub-componen	Sub-component 5.1: Human Settlements	
Topic 5.1.1:	5.1.1.b: Population living in rural areas	
Urban and	5.1.1.d: Total rural area	
rural		
population		
Sub-component 5.2: Environmental Health		
Topic 5.2.5:	5.2.5.a: Toxic substance- and nuclear radiation-related diseases and conditions [agrochemical-related only]	
Toxic	5.2.5.a.1: Incidence	
substance- and	5.2.5.a.2: Prevalence	
nuclear		
radiation-		
related diseases		
and conditions		

Extreme Events and Disasters			
Sub-component 4.1: Natural Extreme Events and Disasters			
Topic 4.1.2:	4.1.2.b: Economic losses due to natural extreme events and disasters (e.g., damage to buildings,		
Impact of	transportation networks, loss of revenue for businesses, utility disruption, etc.) [adjacent to agriculture]		

natural extreme	4.1.2.c: Physical losses/damages due to natural extreme events and disasters (e.g., area and amount of crops,
events and	livestock, aquaculture, biomass, etc.) [adjacent to agriculture]
disasters	4.1.2.d: Effects of natural extreme events and disasters on integrity of ecosystems
	4.1.2.d.1: Area affected by natural disasters [adjacent to agriculture]
	4.1.2.d.2: Loss of vegetation cover [adjacent to agriculture]
	4.1.2.d.3: Area of watershed affected
	4.1.2.d.4: Other
Sub-componen	t 4.2: Technological Disasters
Topic 4.2.2:	4.2.2.b: Economic losses due to technological disasters (e.g., damage to buildings, transportation networks,
Impact of	loss of revenue for businesses, utility disruption, etc.) [adjacent to agriculture]
technological	4.2.2.c: Physical losses/damages due to technological disasters (e.g., area and amount of crops, livestock,
disasters	aquaculture, biomass, etc.) [adjacent to agriculture]
	4.2.2.d: Effects of technological disasters on integrity of ecosystems
	4.2.2.d.1: Area affected by technological disasters [adjacent to agriculture]
	4.2.2.d.2: Loss of vegetation cover [adjacent to agriculture]
	4.2.2.d.3: Area of watershed affected
	4.2.2.d.4: Other (e.g., for oil spills: volume of oil released into the environment, impact on
	ecosystem)

Responses			
Sub-componen	t 6.1: Environment Protection and Resource Management Expenditure		
Topic 6.1.1:	6.1.1.a: Government environment protection and resource management expenditure [only in agriculture]		
Government	6.1.1.a.1: Annual government environment protection expenditure		
environment	6.1.1.a.2: Annual government resource management expenditure		
protection and			
resource			
management			
expenditure			
Topic 6.1.2:	6.1.2.a: Private sector environment protection and resource management expenditure [only in agriculture]		
Corporate, non-	6.1.2.a.1: Annual corporate environment protection expenditure		
profit	6.1.2.a.2: Annual corporate resource management expenditure		
institution and	6.1.2.a.3: Annual non-profit institution environment protection expenditure		
household	6.1.2.a.4: Annual non-profit institution resource management expenditure		
environment	6.1.2.a.5: Annual household environment protection expenditure		
protection and	6.1.2.a.6: Annual household resource management expenditure		
resource			
management			
expenditure			
Sub-componen	t 6.2: Environmental Governance and Regulation		
Topic 6.2.2:	6.2.2.a: Direct regulation [related to agriculture]		
Environmental	<b>6.2.2.a.1: List of regulated pollutants and description</b> (e.g., by year of adoption and maximum		
regulation and	allowable levels)		
instruments	6.2.2.a.2: Description (e.g., name, year established) of licensing system to ensure compliance with		
	environmental standards for businesses or other new facilities		
	6.2.2.a.3: Number of applications for licences received and approved per year		
	6.2.2.a.4: List of quotas for biological resource extraction		
	6.2.2.a.5: Budget and number of staff dedicated to enforcement of environmental regulations		
	6.2.2.b: Economic instruments [related to agriculture]		
	6.2.2.b.1: List and description (e.g., year of establishment) of green/environmental taxes		
	6.2.2.b.2: List and description (e.g., year of establishment) of environmentally relevant subsidies		
	6.2.2.6.3: List of eco-labelling and environmental certification programmes		
<b>T</b> : (22	6.2.2.b.4: Emission permits traded		
Topic 6.2.3:	6.2.3.a: Participation in MEAs and other global environmental conventions		
Participation in	6.2.3.a.1: List and description (e.g., year of participation <sup>(a)</sup> of country) of MEAs and other		
MEAs and	global environmental conventions [related to agriculture only; desertification, POPs, etc.]		
environmental			
conventions	na dha annutina na ana haa haanna anda ta dha annannata nu dar dha tarata na annundian achish is achism. I dham dha sa iste a f		
(a) Participation mea	ins the country or area has become party to the agreements under the treaty or convention, which is achieved through a variety of 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-componen	t 6.4: Environmental Information and Awareness
Topic 6.4.2:	6.4.2.a: Environmental education [related to food/health from agriculture, and/or organic and sustainable
Environmental	agriculture]
education	6.4.2.a.1: Allocation of resources by central and local authorities for environmental education
	6.4.2.a.2: Number and description of environmental education programmes in schools
	6.4.2.a.3: Number of students pursuing environment-related higher education (e.g., science,
	management, education, engineering)
Topic 6.4.3:	6.4.3.a: Public environmental perception and awareness [related to food/health from agriculture, and/or
Environmental	organic and sustainable agriculture]
perception and	6.4.3.a.1: Knowledge and attitudes about environmental issues or concerns
awareness	6.4.3.a.2: Knowledge and attitudes about environmental policies
Topic 6.4.4:	6.4.4.a: Environmental engagement [related to food/health from agriculture, and/or organic and sustainable
Environmental	agriculture]
engagement	6.4.4.a.1: Existence of pro-environmental NGOs [number of NGOs and their respective human and
	financial resources]
	6.4.4.a.2: Number of pro-environmental activities
	6.4.4.a.3: Number of pro-environmental programmes

#### Additional indicators commonly used in Agriculture and the Environment

- 5.68 Agri-environmental indicators (AEI) are indicators able to describe and assess state and trends in the environmental performance of agriculture to furnish useful indications to scientists and policymakers about the state of the environment, about the effects of different policies, as well as about the efficiency in the use of budgets in terms of environmental outcomes.<sup>115</sup>
- 5.69 AEIs have ideally to be robust, timely, simple, and relevant to the different stakeholders involved in agriculture. The most used indicator framework subdivides AEIs according to five categories within the Driving force-Pressure-State-Impact-Response (DPSIR) model developed by the European Environment Agency (EEA 1999) and built upon the PSR model (OECD 1993). The Agri-Environmental Indicators dataset available within FAOSTAT has been produced in line with the Agri-Environmental Indicators frameworks developed by OECD and EUROSTAT in the last 20 years. Each indicator is described by different data series.

<sup>&</sup>lt;sup>115</sup> Food and Agriculture Organization of the United Nations (2013). "Agri-Environmental Indicators". Available from <u>http://faostat.fao.org/site/674/default.aspx</u> (accessed 25 September 2014).

Domain	Sub-domain	Indicator	
Air & Climate Change	Ammonia emissions	Ammonia (NH <sub>3</sub> ) emissions from agriculture as a % of total NH <sub>3</sub> emissions	
Energy	Energy use in Agriculture and Forestry	Agriculture and forestry energy use as a % of total energy use	
	Bioenergy production	Bioenergy production as a % of total renewable energy production	
	Nitrogen Consumption	Nitrogen nutrient use on arable and permanent crop area (N tonnes/1000 ha)	
Fertilizers Consumption	Phosphate Consumption	Phosphate nutrient use on arable and permanent crop area ( $P_2O_5$ tonnes/1000 ha)	
	Nitrogen and Phosphate	Nitrogen and Phosphate nutrient use on arable and permanent crop area $(N+P_2O_5 \text{ tonnes}/1000 \text{ ha})$	
	Agricultural area	Agricultural area as a % of land area	
	Agricultural area use change	Changes in agricultural area (% per year)	
	Area equipped for irrigation	Area equipped for irrigation as a % of agricultural area	
	Conservation agriculture	Conservation agriculture area (>30% group cover) as a % of agricultural area	
Land		Permanent crops area as a % of agricultural area	
	Cropping patterns	Permanent meadows and pastures area as a % of agricultural area	
		Arable land area as a % of agricultural area	
	Organic agricultural area	Organic area as a % of agricultural area	
	Protected land area	Protected terrestrial area as a % of land area	

# Table 5.1: Agri-Environmental Indicators available within FAOSTAT<sup>116</sup>

<sup>&</sup>lt;sup>116</sup> Food and Agriculture Organization of the United Nations (2014). "Agri-Environmental Indicators available within FAOSTAT". Available from: <u>http://faostat3.fao.org/faostat-gateway/go/to/download/E/\*/E</u> (accessed 25 September 2014).

	Livestock Density	Livestock total per hectare of agricultural area (livestock total number/ha)
	Cattle and Buffalo	Cattle and Buffalo as a % of total livestock
Livestock	Pigs	Pigs as a % of total livestock
	Sheep and goats	Sheep and goats as a % of total livestock
	Poultry birds	Poultry birds as a % of total livestock
Pesticides	Pesticides Use	Pesticide use on arable and permanent crop area (tonnes/1000 ha)
	Soil Erosion - GLASOD	Average soil erosion expressed in GLASOD erosion degree
Soil	Land degradation - GLASOD	Average land degradation expressed in GLASOD erosion degree
	Carbon in topsoil	Average carbon content in the topsoil as a % in weight
Water	Water use in agriculture	Water withdrawal for agricultural use as a % of total water withdrawal

Annexes

### Annex A: The Basic Set of Environment Statistics

A.1 The tables containing the complete Basic Set include additional columns which provide further guidance. The fourth 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 fifth 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.

#### **BASIC SET 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; regular text is Tier 2 statistics; and *italicized text is Tier 3 statistics*.

Component 1: Environmental Conditions and Quality							
Sub-component	Sub-component 1.1: Physical Conditions						
Торіс	(	Statistics and Related InformationCategory of(Bold Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)Measurement		Potential Aggregations and Scales	Methodological Guidance		
Topic 1.1.1: Atmosphere, climate and weather	a. b. c.	Temperature         1. Monthly average         2. Minimum monthly average         3. Maximum monthly average         Precipitation (also in 2.6.1.a)         1. Annual average         2. Long-term annual average         3. Monthly average         4. Minimum monthly value         5. Maximum monthly value         Relative humidity         1. Minimum monthly value	Degrees Degrees Degrees Height Height Height Height Height	<ul> <li>National</li> <li>Sub-national</li> </ul>	<ul> <li>World Meteorological Organization (WMO)</li> <li>Intergovernmental Panel on Climate Change (IPCC)</li> <li>National Oceanic and Atmospheric Administration (NOAA)/ National Aeronautics and Space Administration (NASA)</li> </ul>		
	d. e.	2. Maximum monthly value Pressure 1. Minimum monthly value 2. Maximum monthly value Wind speed 1. Minimum monthly value 2. Maximum monthly value 2. Maximum monthly value	Pressure unit Pressure unit Speed Speed	<ul> <li>National</li> <li>Sub-national</li> <li>By station</li> <li>National</li> <li>Sub-national</li> </ul>			
	f.	2. Maximum moning value         Solar radiation         1. Average daily value         2. Average monthly value         3. Number of hours with sunshine	Area, Energy unit Area, Energy unit Number	<ul> <li>National</li> <li>Sub-national</li> <li>National</li> <li>Sub-national</li> </ul>	<ul><li>WMO</li><li>IPCC</li><li>NOAA / NASA</li></ul>		
	g.	UV radiation 1. Maximum daily value 2. Average daily value 3. Maximum monthly value 4. Average monthly value	Area, Energy unit Area, Energy unit Area, Energy unit Area, Energy unit	<ul> <li>By month and per year</li> <li>National</li> <li>Sub-national</li> </ul>	<ul> <li>World Health Organization (WHO)-UV Radiation Index</li> <li>WMO-UV Radiation</li> </ul>		
	h.	Occurrence of El Niño, La Niña events, when relevant 1. Occurrence 2. Time period	Number Time period	By location     National     Sub-national			

## Table A.1: The Basic Set of Environment Statistics

<b>Topic 1.1.2:</b>	a.	Lakes		By location	<ul> <li>United Nations</li> </ul>
Hvdrographical		1. Surface area	Area	<ul> <li>By watershed/river basin</li> </ul>	Statistics Division
characteristics		2. Maximum depth	Depth	National	(UNSD): International
	b.	Rivers and streams		<ul> <li>Sub-national</li> </ul>	Recommendations for
		1. Length	Length		Water Statistics
	с.	Artificial reservoirs			(IRWS) • UN-Water
		1. Surface area	Area		
		2. Maximum depth	Depth		
	d.	Watersheds			
		1. Description of main watersheds	Area,		ive
		-	Description		
	e.	Seas		<ul> <li>By location</li> <li>National, within coastal waters or Exclusive Economic Zone (EEZ)</li> </ul>	
		1. Coastal waters	Area		
		2. Territorial sea	Area		
		3. Exclusive Economic Zone (EEZ)	Area		
		4. Sea level	Depth		
		5. Area of sea ice	Area		
	f.	Aquifers	Depth,	<ul> <li>By location</li> </ul>	
			Description	<ul> <li>By salinity levels</li> </ul>	
				<ul> <li>By watershed</li> </ul>	
				National	
				Sub-national	
				• Renewable	
	~	Clasier	<b>A</b>	Non-renewable     Devlacetien	
	g.	g. Glaciers	Area	- By location	
				• Inational	
				- Sub-nauonai	

Topic 1.1.3:	a.	Geological, geographical and geomorphological		National	• UNSD:
Coological and		conditions of terrestrial areas and islands			Demographic
goographical		1. Length of border	Length		Yearbook
information	-	2. Area of country or region	Area, Location		<ul> <li>Food and</li> </ul>
mormation		3. Number of islands	Number	By location	Agriculture
		4. Area of islands	Area	National	United Nations (EAO)
		5. Main geomorphological characteristics of islands	Description		<ul> <li>Center for</li> </ul>
		6. Spatial distribution of land relief	Description,		International Earth
			Location		Science Information
		7. Characteristics of landforms (e.g., plains, hills,	Description,		Network (CIESIN)
		plateaus, dunes, volcanoes, mountains, sea mounts,	Area, Height		
	-	etc.)	<b>A</b>		
		8. Area by rock types	Area	-	
		9. Length of fault lines	Length	-	
	b.	<b>Coastal waters</b> (includes area of coral reefs,	Area,		
		mangroves, etc.)	Description		
	C.	Length of marine coastline	Length	-	
<b>T</b>	d.	Coastal area	Area		
Торіс 1.1.4:	a.	Soli characterization		<ul> <li>By location</li> <li>By soil type</li> </ul>	<ul> <li>FAO and the International Institute for Applied Systems Analysis (IIASA) Harmonized World Soil Database</li> <li>International Soil Reference and Information Centre (ISRIC) World Data Centre for Soils</li> </ul>
Soil		1. Area by soil types	Area	<ul> <li>By son type</li> <li>National</li> </ul>	
characteristics	b.	Soil degradation		• Sub-national	
		1. Area affected by soil erosion	Area		
		2. Area affected by desertification	Area		
		3. Area affected by salinization	Area		
		4. Area affected by waterlogging	Area		
		5. Area affected by acidification	Area		
		6. Area affected by compaction	Area		
	с.	Nutrient content of soil, measured in levels of:		By soil type	<ul> <li>United Nations</li> </ul>
		1. Nitrogen (N)	Concentration	By nutrient	Convention to Combat
		2. Phosphorous (P)	Concentration	National     Submational	Desertification (UNCCD) • FAQ Global
-		3. Calcium (Ca)	Concentration	- Sub-national	
		4. Magnesium (Mg)	Concentration	1	Assessment of
		5. Potassium (K)	Concentration	1	Human-induced Soil Degradation (GLASOD)
		6. <i>Zinc</i> ( <i>Zn</i> )	Concentration	]	
		7. Other	Concentration	]	

#### **Component 2: Environmental Resources and their Use** Sub-component 2.1: Mineral Resources **Statistics and Related Information** Methodological **Category of** Topic **Potential Aggregations and Scales** (Bold Text - Core Set/Tier 1; Regular Text - Tier 2; Measurement Guidance Italicized Text - Tier 3) FAO Land Cover **Topic 1.2.1:** Area under land cover categories By location a. Area • By type of land cover (e.g., artificial surfaces Classification System Land cover including urban and associated areas; herbaceous crops; • System of woody crops; multiple or layered crops; grassland; tree-Environmentalcovered areas; mangroves; shrub-covered areas; shrubs Economic Accounting and/or herbaceous vegetation, aquatic or regularly (SEEA) Central flooded; sparsely natural vegetated areas; terrestrial Framework (2012) land barren land; permanent snow and glaciers; inland water cover categories bodies; and coastal water bodies and inter-tidal areas)<sup>(a)</sup> European National Environment Agency Sub-national (EEA)

<b>Topic 1.2.2:</b>	a.	General ecosystem characteristics, extent and pattern		By location	<ul> <li>Millennium Ecosystem</li> </ul>	
Fcosystems		1. Area of ecosystems	Area	By ecosystem (e.g., Forest, Cultivated, Dryland,     Assessment		
Leosystems		2. Proximity of ecosystem to urban areas and cropland	Distance	Coastal, Marine, Urban, Polar, Inland Water, Island,	Convention on	
and	1			Mountain) <sup>(b)</sup>	(CPD)	
biodiversity	D.	Ecosystems chemical and physical characteristics	<u> </u>	4	(CBD)	
		1. Nutrients	Concentration		Commission for Europe	
		2. Carbon	Concentration		(UNECE) Standard	
		3. Pollutants	Concentration		Statistical Classification of	
					Flora, Fauna and Biotopes	
					(1996)	
					Convention on	
					Wetlands of International	
					Waterfowl Habitat (The	
					Ramsar Convention)	
	с.	Biodiversity		By ecosystem (e.g., Forest, Cultivated, Dryland)	<ul> <li>Millennium Ecosystem</li> </ul>	
		1 Known flore and found species	Number	Coastal, Marine, Urban, Polar, Inland Water, Island,	Assessment	
		1. Known not a and fauna species	Number	Mountain) <sup>(b)</sup>	• CBD	
		2. Endemic flora and fauna species	Number	<ul> <li>By status category (e.g., extinct, extinct in the wild, threatened, near threatened, least concern)</li> <li>By class (e.g., mammals, fishes, birds, reptiles, etc.)</li> </ul>	The International Union	
		5. Invasive allen nora and faulta species	Number		for Conservation of Nature	
		4. Species population	Number		(IUCN) Red List of Threatened Species	
				National	UNECE Standard	
		5. Habitat fragmentation	Area,	Sub-national	Statistical Classification of	
			Description, Location, Number		Flora, Fauna and Biotopes	
					(1996)	
					FAO FISHSTAT	
					(Species population and	
					species)	
	d.	Protected areas and species		<ul> <li>By location</li> <li>By management category<sup>(c)</sup></li> </ul>	IUCN Protected Area	
		rotected areas and species			Management Categories	
		1. Protected terrestrial and marine area (also in 1.2.3.a)	Number, Area	<ul> <li>By ecosystem (e.g., Forest, Cultivated, Dryland,</li> </ul>	<ul> <li>UNSD: Millennium</li> </ul>	
				Coastal, Marine, Urban, Polar, Inland Water, Island,	Development Goal (MDG)	
				Mountain) <sup>(b)</sup>	Indicator 7.6 Metadata	
				National		
				Sub-national		
		2. Protected flora and fauna species	Number	• By species	• IUCN Red List of	
				• By ecosystem (e.g., Forest, Cultivated, Dryland,	Threatened Species	
				Coastal, Marine, Urban, Polar, Inland Water, Island,	<ul> <li>UNSD: MDG indicator</li> <li>7 7 Metadata</li> </ul>	
				Mountain) <sup>(0)</sup>	,., moudulu	
				<ul> <li>Dy status category</li> <li>National</li> </ul>		
				Sub-national		
(a) SEEA land cover categor	ries, bas	ed on FAO Land Cover Classification System (http://unstats.un.org/unsd/e	envaccounting/seeaRev/S	EEA_CF_Final_en.pdf)		
(b) Reporting categories used in the Millennium Ecosystem Assessment (http://www.millenniumassessment.org/documents/						

(c) IUCN reporting categories: Strict nature reserves; Wilderness areas; National parks, Natural monuments or features; Habitat/species management areas; Protected landscapes/seascapes; and Protected areas with sustainable use of

natural resources (http://www.iucn.org/about/work/programmes/gpap\_home/gpap\_quality/gpap\_pacategories/)

<b>Topic 1.2.3:</b>	a.	Forest area		By forest type	<ul> <li>FAO Global Forest</li> </ul>
Forests		1. Total	Area	<ul> <li>National</li> </ul>	Resources Assessment
		2 Natural	Area	Sub-national	(FRA)
		2. Diantad	Area	<ul> <li>By dominant tree species</li> </ul>	<ul> <li>UN Forum on</li> </ul>
		5. Planed	Area	<ul> <li>By ownership category</li> </ul>	Forests (UNFF)
		4. Protected forest area (also in 1.2.2.d)	Area		Monitoring,
		5. Forest area affected by fire	Area		Assessment and
	b.	Forest biomass			Reporting (MAR)
		1. Total	Volume		• UNSD: MDG
		2. Carbon storage in living forest biomass	Mass		Indicator 7.1 Metadata
			1111055		<ul> <li>Montreal Process</li> </ul>
					(Working Group on
					Criteria and Indicators
					for the Conservation
					and Sustainable
					Management of
					Temperate and Boreal
					Forests)
					<ul> <li>State of Europe's</li> </ul>
					Forests (Forest
					Europe/UNECE-FAO
					Forestry and Timber
					Section)

Table A.1: The	Basic Set of	f Environment	Statistics (	<i>(continued)</i>
10010111111110	Duble Sel of	Birrererer	Sichibiles	<i>continuea</i> )

Component 1: Environmental Conditions and Quality							
Sub-component 1.3: Environmental Quality							
Tonio		Statistics and Related Information	Category of		Methodological		
Topic	(Bold Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)		Measurement	Fotential Aggregations and Scales	Guidance		
<b>Topic 1.3.1:</b>	a.	Local air quality		<ul> <li>By point measurement</li> </ul>	WHO Air Quality		
Air quality		1. Concentration level of particulate matter	Concentration	Sub-national	Guidelines - Global		
I V		(PM <sub>10</sub> )		Daily maximum	Update 2005,		
		2. Concentration level of particulate matter (PM <sub>2.5</sub> )	Concentration	<ul><li>Monthly maximum and average</li><li>Yearly maximum and average</li></ul>	Particulate matter, ozone, nitrogen		
		3. Concentration level of tropospheric ozone (O <sub>3</sub> )	Concentration		dioxide and sulfur		
		4. Concentration level of carbon monoxide (CO)	Concentration		• WHO Air quality		
		5. Concentration level of sulphur dioxide (SO <sub>2</sub> )	Concentration		guidelines for		
		6. Concentration levels of nitrogen oxides (NO <sub>X</sub> )	Concentration		particulate matter,		
		7. Concentration levels of heavy metals	Concentration		ozone, nitrogen		
		8. Concentration levels of non-methane volatile organic compounds (NMVOCs)	Concentration		dioxide and sulfur dioxide, Global update		
		9. Concentration levels of dioxins	Concentration		2005, Summary of risk		
		10. Concentration levels of furans	Concentration		INFCE Standard		
		11. Concentration levels of other pollutants	Concentration		Statistical		
		12. Number of days where maximum allowable	Number	By pollutant	Classification of		
		levels were surpassed per year			Ambient Air Quality (1990)		
	b.	Global atmospheric concentrations of greenhouse gases		Global	• WMO		
		1. Global atmospheric concentration level of carbon dioxide (CO <sub>2</sub> )	Concentration				
		2. Global atmospheric concentration level of methane (CH <sub>4</sub> )	Concentration				

<b>Topic 1.3.2:</b>	a.	Nutrients and chlorophyll		By water body	<ul> <li>UNECE Standard</li> </ul>
Freshwater		1. Concentration level of nitrogen	Concentration	By watershed/river basin	Statistical
quality		2. Concentration level of phosphorous	Concentration	<ul> <li>By surface of groundwater</li> <li>By point measurement</li> </ul>	Freshwater Quality for
		3. Concentration level of chlorophyll A	Concentration	<ul><li>By type of water resource</li></ul>	the Maintenance of
	b.	Organic matter		5 51	Aquatic Life (1992)
					UN Environment
		1. Biochemical oxygen demand (BOD)	Concentration		Programme (UNEP)
		2. Chemical oxygen demand (COD)	Concentration		Monitoring System -
	c.	Pathogens			Water (GEMS-Water)
		1. Concentration levels of faecal coliforms	Concentration		• WHO
	d.	Metals (e.g., mercury, lead, nickel, arsenic, cadmium)			
		1. Concentration levels in sediment and freshwater	Concentration		
		2. Concentration levels in freshwater organisms	Concentration		
	e.	Organic contaminants (e.g., PCBs, DDT, pesticides,			<ul> <li>UNECE Standard</li> </ul>
		furans, dioxins, phenols, and radioactive waste)			Statistical
		1. Concentration levels in sediment and freshwater	Concentration		Classification of Freshwater Quality for
		2. Concentration levels in freshwater organisms	Concentration		the Maintenance of
					Aquatic Life (1992)
					<ul> <li>UNEP GEMS-</li> </ul>
					Water
					<ul> <li>Stockholm</li> <li>Convention</li> </ul>
	r	Dhaving land sharring labors staristics			- UNECE Standard
	1.	Physical and chemical characteristics			• UNECE Standard Statistical
		1. pH/Acidity/Alkalinity	Level		Classification of
		2. Temperature	Degrees		Freshwater Quality for
		3. Total suspended solids (TSS)	Concentration		the Maintenance of
		4. Salinity	Concentration		• UNEP GEMS-
		5. Dissolved oxygen (DO)	Concentration		Water
	g.	Plastic waste and other freshwater debris			
		1. Amount of plastic waste and other debris	Area, Mass		

Topic 1.3.3:	a.	Nutrients and chlorophyll		• By coastal zone, delta, estuary or other local marine	<ul> <li>UNECE Standard</li> </ul>
Marina watar		1. Concentration level of nitrogen	Concentration	environment	Statistical Classification
		2. Concentration level of phosphorous	Concentration	Sub-national	of Marine Water Quality
quality		3. Concentration level of chlorophyll A	Concentration	National	(1992)
	b.	Organic matter		Supranational	<ul> <li>NOAA/NASA</li> </ul>
		1. Biochemical oxygen demand (BOD)	Concentration	By point measurement	UNEP Regional Seas
		2. Chemical oxygen demand (COD)	Concentration	• By water resource	Programme
	c.	Pathogens		1	
		1. Concentration levels of faecal coliforms in recreational	Concentration		
		marine waters			
	d.	Metals (e.g., mercury, lead, nickel, arsenic, cadmium)			
		1. Concentration levels in sediment and marine water	Concentration		
		2. Concentration levels in marine organisms	Concentration		
	e.	Organic contaminants (e.g., PCBs, DDT, pesticides, furans dioxins phenols and radioactive waste)			UNECE Standard     Statistical Classification
		1 Concentration levels in sediment and marine water	Concentration		of Marine Water Quality
		2 Concentration levels in marine organisms	Concentration		(1992)
			Contentiation		<ul> <li>NOAA/NASA</li> </ul>
					<ul> <li>UNEP Regional Seas</li> </ul>
					Programme
					• Stockholm
					Convention
	f.	Physical and chemical characteristics			UNECE Standard
		1. pH/Acidity/Alkalinity	Concentration,		Statistical Classification
	-	A 77	Level	4	of Marine water Quality
	-	2. Temperature	Degrees	4	(1992)
		3. Total suspended solids (TSS)	Concentration	4	INFP Regional Seas
	-	4. Salinity	Concentration	4	Programme
	-	5. Dissolved oxygen (DO)	Concentration	4	Tiogramme
	<u> </u>	0. Density	Density	4	
	g.	Coral bleaching	•		
	Ŀ	1. Area anected by coral bleaching       Diastic waste and other marine data	Area	- Du accatal zono delte estuare en ether la sel music	- UNIECE Standard
	n.	Plastic waste and other marine debris	Arra Mara	• By coastal zone, delta, estuary or other local marine	UNECE Standard     Statistical Classification
		1. Amouni of plastic waste and other debris in marine	Alea, Mass	By location	of Marine Water Quality
	i	Waters Pad tida		<ul> <li>Sub-national</li> </ul>	(1992)
	1.		Number	<ul> <li>National</li> </ul>	NOAA/NASA
		2. Impacted area	Area	Supranational	<ul> <li>UNEP Regional Seas</li> </ul>
		2. Impucieu dreu 3. Duration	Duration	By point measurement	Programme
					-
		Oil collution			
	j.	Oil pollution			
	j.	Oil pollution       1. Area of oil slicks       2. Amount of tan helle	Area		

<b>Topic 1.3.4:</b>	a.	Sites affected by pollution		By location	
Soil pollution		1. Contaminated sites	Area, Number	Sub-national	
•		2. Potentially contaminated sites	Area, Number	By type of pollutant	
		3. Remediated sites	Area, Number	• By source	
		4. Other sites	Area, Number		
<b>Topic 1.3.5:</b>	a.	Levels of noise from specific sources	Level	By source     By location	• WHO
Noise	b.	Levels of noise in specific locations	Level	Sub-national	

Component 2: Environmental Resources and their Use						
Sub-componen	t 2.1	: Mineral Resources				
<b>—</b> •	Statistics and Related Information         (Bold Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)		Category of Measurement	Potential Aggregations and Scales	Methodological Guidance	
Торіс						
<b>Topic 2.1.1:</b>	a.	Mineral resources		• By mineral (e.g., metal ores including precious	<ul> <li>United Nations</li> </ul>	
Stocks and		1. Stocks of commercially recoverable resources	Mass, Volume	metals and rare earths, coal, oil, gas, stone, sand	Framework	
changes of		2. New discoveries	Mass, Volume	and clay, chemical and fertilizer minerals, salt,	Classification for	
mineral		3. Upward reappraisals	Mass, Volume	gemstones, abrasive minerals, graphite, asphalt,	Energy and Mineral	
manumana		4. Upward reclassifications	Mass, Volume	natural solid bitumen, quartz, mica)	Resources (UNFC	
resources		5. Extraction	Mass, Volume	<ul> <li>National</li> <li>Sub national</li> </ul>	2009) • SEEA Control	
		6. Catastrophic losses	Mass, Volume	- Suo-manoman	- SEEA Cellual Framework (2012)	
		7. Downward reappraisals	Mass, Volume		asset and physical	
		8. Downward reclassifications	Mass, Volume		flow accounts	
		9. Stocks of potentially commercially recoverable	Mass, Volume		<ul> <li>International</li> </ul>	
		resources			Standard Industrial	
		10. Stocks of non-commercial and other known	Mass, Volume		Classification of All	
		resources			Economic Activities	
<b>Topic 2.1.2:</b>	a.	Production of minerals	Mass, Volume		(ISIC) Rev. 4, Section	
Production and	b.	Imports of minerals	Currency,		B, Divisions 05-09	
trade of		*	Mass, Volume		• Harmonized	
minerals	C	Exports of minerals	Currency		Commodity	
mineruis	С.	Exports of minerals	Mass Volume		Coding Systems (HS)	
			Triass, volume		2012 Section V	
					Chapters 25 and 26	
					and Section VI	
					Chapter 28	

Component 2: Environmental Resources and their Use								
Sub-component	Sub-component 2.2: Energy Resources							
Торіс	Statistics and Related Information           (Bold Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)		Category of Measurement	Potential Aggregations and Scales	Methodological Guidance			
						<b>Topic 2.2.1:</b>	a.	Energy resources
Stocks and		1. Stocks of commercially recoverable resources	Mass, Volume	natural gas liquids, oil shale, and extra heavy oil	International Decommondations for			
changes of		2. New discoveries	Mass, Volume	lignite peat non-metallic minerals except for	Energy Statistics			
energy		3. Upward reappraisals	Mass, Volume	coal or peat, uranium and thorium ores)	(IRES)			
resources		4. Upward reclassifications	Mass, Volume	National	<ul> <li>International</li> </ul>			
		5. Extraction	Mass, Volume	Sub-national	Energy Agency (IEA)			
		6. Catastrophic losses	Mass, Volume		Energy Statistics			
		7. Downward reappraisals	Mass, Volume		<ul> <li>SEEA Central</li> </ul>			
		8. Downward reclassifications	Mass, Volume		Framework (2012)			
		9. Stocks of potentially commercially recoverable resources	Mass, Volume		asset and physical flow accounts			
		10. Stocks of non-commercial and other known resources	Mass, Volume		<ul><li>UNFC 2009</li><li>ISIC Rev. 4,</li></ul>			
					Section B, Divisions			
					HS 2012, Section V, Chapter 27			

<b>Topic 2.2.2:</b>	a.	Production of energy		• By non-renewable resource (e.g., petroleum,	UNSD: IRES	
Production, trade and		1. Total production	Energy unit, Mass, Volume	natural gas, coal, nuclear fuels, non-sustainable firewood, waste, other non-renewables)	IEA Energy Statistics Manual	
consumption of energy		2. Production from non-renewable sources	Energy unit, Mass, Volume	hydroelectric, geothermal, tidal action, wave action, marine, wind and biomass)	• Joint wood Energy Enquiry (UNECE- FAO Forestry and	
		3. Production from renewable sources	Energy unit, Mass, Volume	<ul><li>National</li><li>Sub-national</li></ul>	Timber Section)	
		4. Primary energy production	Energy unit, Mass, Volume	• By primary energy resource (e.g., petroleum, natural gas, coal, hydroenergy, geothermal, nuclear fuels, come meduate, other primary)		
		5. Imports of energy	Energy unit, Mass, Volume	<ul> <li>By secondary energy resource (e.g., electricity, liquefied petroleum gas, gasoline/alcohol,</li> </ul>		
		6. Exports of energy	Energy unit, Mass, Volume	kerosene, diesel oil, fuel oil, coke, charcoal, gases, other secondary)		
		7. Secondary energy production	Energy unit, Mass, Volume	Sub-national		
	b.	Total energy supply	Energy unit, Mass, Volume	By energy product		
	c.	Final consumption of energy	Energy unit, Mass, Volume	<ul> <li>By households</li> <li>By ISIC economic activity</li> <li>By tourists</li> <li>National</li> <li>Sub-national</li> </ul>		
Component 2: Environmental Resources and their Use						
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Sub-componen	t 2.3	3: Land				
Торіс	(	Statistics and Related Information Bold Text - Core Set/Tier 1; Regular Text - Tier 2;	Category of Measurement	Potential Aggregations and Scales	Methodological Guidance	
		Italicized Text - Tier 3)	ivicusui cincitt		Guidance	
Topic 2.3.1: Land use	a.	Area under land use categories	Area	<ul> <li>By type of land use (e.g., agriculture; forestry; land used for aquaculture; use of built-up and related areas; land used for maintenance and restoration of environmental functions; other uses of land not elsewhere classified; land not in use; inland waters used for aquaculture or holding facilities; inland waters used for maintenance and restoration of environmental functions; other uses of inland waters not elsewhere classified; inland water uses of inland waters not elsewhere classified; inland water not in use; coastal waters (includes area of coral reefs, mangroves, etc.); Exclusive Economic Zone (EEZ))</li> <li>National</li> <li>Sub-national</li> </ul>	<ul> <li>FAO</li> <li>UNECE Standard Classification of Land Use (1989)</li> <li>SEEA Central Framework (2012) Annex 1</li> </ul>	
	b.	Other aspects of land use		National		
		1. Area of land under organic farming	Area	Sub-national	FAO Inter- departmental Working Group on Organic Agriculture	
		2. Area of land under irrigation	Area			
		3. Area of land under sustainable forest management	Area		Forest Stewardship	
		4. Area of land under agroforestry	Area	]	Council	
	c.	Land ownership	Area	<ul><li>By ownership category</li><li>National</li><li>Sub-national</li></ul>	• FAO	

<b>Topic 2.3.2:</b>	a.	Use of forest land		By forest type	FAO FRA
Use of forest				National     Submational	<ul> <li>UNFF MAR</li> <li>UNSD: MDC</li> </ul>
land				<ul> <li>Sub-national</li> <li>By dominant tree species</li> </ul>	<ul> <li>UNSD: MDG</li> <li>Indicator 7.1 Motodata</li> </ul>
				- By dominant tree species	<ul> <li>Montreal Process</li> </ul>
		1. Area deforested	Area		(Working Group on
		2. Area reforested	Area	-	Criteria and Indicators
		3 Area afforested	Area		for the Conservation
		4 Natural growth	Area	-	and Sustainable
			i nou		Management of
					Temperate and Boreal
					Forests)
					<ul> <li>State of Europe's</li> </ul>
					Forests (Forest
					Europe/UNECE-FAO
					Forestry and Timber
					Section)
	b.	Forest area by primary designated function	Area	Production	<ul> <li>FAO FRA</li> </ul>
				<ul> <li>Protection of soil and water</li> </ul>	
				Conservation of biodiversity	
				Social services	
				Multiple use	
				• Other	

Component 2: Environmental Resources and their Use					
Sub-component 2.4: Soil Resources					
	Statistics and Related Information	Category of		Methodological	
Торіс	( <b>Bold Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Potential Aggregations and Scales	Guidance	
<b>Topic 2.4.1:</b>	The development of the necessary statistics in this	topic is subject	to further research.		
Soil resources					

Component 2: Environmental Resources and their Use							
Sub-component 2.5: Biological Resources							
Торіс	B	Statistics and Related Information	Category of Measurement	Potential Aggregations and Scales	Methodological Guidance		
Topic 2.5.1: Timber resources	a.	Timber resources         1. Stocks of timber resources         2. Natural growth         3. Fellings         4. Removals         5. Felling residues         6. Natural losses         7. Catastrophic losses         8. Reclassifications         Amount used of:         1. Fertilizers (also in 3.4.1.a)         2. Pesticides (also in 3.4.1.b)	Volume Volume Volume Volume Volume Volume Volume Volume Area, Mass, Volume Area, Mass,	<ul> <li>By type (e.g., natural or planted)</li> <li>National</li> <li>Sub-national</li> <li>National</li> <li>Sub-national</li> </ul>	<ul> <li>SEEA Central Framework (2012)</li> <li>FAO FRA</li> <li>State of Europe's Forests (Forest Europe/UNECE-FAO Forestry and Timber Section)</li> <li>UNECE/FAO Joint Working Party on Forest Statistics, Economics and Management</li> <li>ISIC Rev. 4, Section A, Division 02</li> <li>FAOSTAT database</li> </ul>		
	с.	Forest production	Volume Volume	<ul> <li>By type of product (e.g., timber, industrial roundwood, fuelwood, pulp, chips)</li> <li>National</li> <li>Sub-national</li> </ul>	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 Timber Committee UNECE/FAO Joint Working Party on Forest Statistics, Economics and Management ISIC Rev. 4, Section A, Division 02 FAOSTAT database		
	d. e. f.	Fuelwood production         Imports of forest products         Exports of forest products	Volume Currency, Mass, Volume Currency, Mass, Volume	National     By type of product	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) HS 2012, Sections IX and X     FAOSTAT database		

<b>Topic 2.5.2:</b>	a.	Fish capture production	Mass	By relevant freshwater and marine species     FAO International
Aquatic	b.	Aquaculture production	Mass	National Standard Statistical
resources				Sub-national     Classification for
resources	c.	Imports of fish and fishery products	Currency, Mass,	By relevant freshwater and marine species     Aquatic Animals and
			Volume	By type of product     Plants (ISSCAAP)
	d.	Exports of fish and fishery products	Currency, Mass,	• By species • ISIC Rev. 4,
			Volume	Section A, Division 03
	e.	Amount used of:		• By type of water (i.e., marine or freshwater)
		1. Pellets (also in 3.4.1.c)	Mass, Volume	National     Law of the Sea
		2. Hormones (also in 3.4.1.d)	Mass, Volume	• Sub-national (UNCLOS)
		3. Colourants (also in 3.4.1.e)	Mass, Volume	• UNSD MDG
		4. Antibiotics (also in 3.4.1.f)	Mass, Volume	Indicator 7.4 Metadata
		5. Fungicides	Mass, Volume	• HS 2012. Section I.
	f.	Aquatic resources		• By relevant freshwater and marine species Chapter 03
		1. Stocks of aquatic resources	Mass	• By type (e.g., natural or cultivated)
		2. Additions to aquatic resources	Mass	• National Framework (2012)
		3. Reductions in aquatic resources	Mass	• Sub-national
<b>Topic 2.5.3:</b>	a.	Main annual and perennial crops		By crop     FAO Indicative
Crops		1. Area harvested	Area	By size     Crop Classification
-		2. Area planted	Area	• National (for 2010 round of
		3. Amount produced	Mass	• Sub-national agricultural censuses)
		4. Amount of organic production	Mass	FAU/WHU      Specifications for
		5. Amount of genetically modified crops produced	Mass	Pesticides (2010)
	b.	Amount used of:		By type of fertilizer     FAO Specifications
		1. Natural fertilizers (e.g., manure, compost, lime)	Area, Mass,	• By type of pesticide for Commonly Used
		(also in 3.4.1.a)	Volume	By crop Fertilizers (2009)
		2. Chemical fertilizers (also in 3.4.1.a)	Area, Mass,	National     Submational     ISIC Rev. 4.
			Volume	Sub-national Section A, Division 1
		3. <b>Pesticides</b> (also in 3.4.1.b)	Area, Mass, Volume	• FAOSTAT
		4. Genetically modified seeds	Mass	By crop
				• National
				Sub-national
	с.	Monoculture/resource-intensive farming systems		By crop
		1. Area being used for production	Area	• By size
		2. Amount produced	Mass	National
		3. Amount of genetically modified crops produced	Mass	Sub-national
	d.	Imports of crops	Currency, Mass	
	e.	Exports of crops	Currency, Mass	

<b>Topic 2.5.4:</b>	a.	Livestock		By type of animal	FAOSTAT
Livestock		1. Number of live animals	Number	National     Sub national	database
		2. Number of animals slaughtered	Number	- Sub-national	Section A Division 01
	b.	Amount used of:			<ul> <li>HS 2012, Section I,</li> </ul>
		1. Antibiotics (also in 3.4.1.f)	Mass		Chapter 01
		2. Hormones (also in 3.4.1.d)	Mass		
	c.	Imports of livestock	Currency, Number		
	d.	Exports of livestock	Currency, Number		
Topic 2.5.5: Other non-	a.	Permits for regulated hunting and trapping of wild animals		<ul><li>By type of animal</li><li>By species</li></ul>	• ISIC Rev. 4, Section A, Class 0170
cultivated		1. Number of permits issued per year	Number		
biological		2. Number of animal kills allowed by permits	Number		
resources	b.	Imports of endangered species	Currency, Number		Convention on International Trade in
	c.	Exports of endangered species	Currency, Number		Endangered Species of Wild Fauna and Flora (CITES)
	d.	Reported wild animals killed or trapped for food or sale	Number		• ISIC Rev. 4, Section A, Class 0170
	e.	Trade in wildlife and captive-bred species	Description, Mass, Number	<ul><li>By status category</li><li>National</li><li>Sub-national</li></ul>	CITES
	f.	Non-wood forest products and other plants	Mass, Volume	<ul><li>By type of product</li><li>National</li><li>Sub-national</li></ul>	• ISIC Rev. 4, Section A, Class 0230

Component 2: Environmental Resources and their Use						
Sub-componen	t 2.6	6: Water Resources				
		Statistics and Related Information	Category of		Methodological	
Торіс		(Bold Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Measurement	Potential Aggregations and Scales	Guidance	
<b>Topic 2.6.1:</b>	a.	Inflow of water to inland water resources		National	UNSD: IRWS	
Water		1. <b>Precipitation</b> (also in 1.1.1.b)	Volume	Sub-national     Determitement of anisin and destination	UNECE Standard	
resources		2. Inflow from neighbouring territories	Volume	• By territory of origin and destination	Classification of Water	
		3. Inflow subject to treaties	Volume		Use (1989)	
	b.	Outflow of water from inland water resources			• UNSD: MDG	
		1. Evapotranspiration	Volume		Indicator 7.5 Metadata	
		2. Outflow to neighbouring territories	Volume		FAO AQUASTAT     SEEA Control	
		3. Outflow subject to treaties	Volume		Framework (2012)	
		4. Outflow to the sea	Volume		asset accounts	
	c.	Inland water stocks		National	SEEA Water	
		1. Surface water stocks in artificial reservoirs	Volume	Sub-national	UNSD:     Englished and Statistics	
		2. Surface water stocks in lakes	Volume		Section - Water	
		3. Surface water stocks in rivers and streams	Volume		Questionnaire	
		4. Surface water stocks in wetlands	Volume			
		5. Surface water stocks in snow, ice and glaciers	Volume			
		6. Groundwater stocks	Volume			

<b>Topic 2.6.2:</b>	a.	Total water abstraction	Volume	By type of source	<ul> <li>UNSD: IRWS</li> </ul>
Abstraction.	b.	Water abstraction from surface water	Volume	National	<ul> <li>UNECE Standard</li> </ul>
use and returns	c.	Water abstraction from groundwater		Sub-national	Statistical
of water		1. From renewable groundwater resources	Volume		Classification of Water
		2. From non-renewable groundwater resources	Volume		• FAO AOUASTAT
	d.	Water abstracted for own use	Volume	By ISIC economic activity	<ul> <li>SEEA Central</li> </ul>
	e.	Water abstracted for distribution	Volume	National	Framework (2012)
				Sub-national	<ul> <li>SEEA Water</li> </ul>
	f.	Desalinated water	Volume	National	• UNSD:
	g.	Reused water	Volume	• Sub-national	Environment Statistics
	1	Water	X7 - 1	D ISIC	Questionnaire
	n.	water use	volume	By ISIC economic activity	Questionnane
				<ul> <li>By tourists</li> <li>National</li> </ul>	
				<ul> <li>Sub-national</li> </ul>	
	i.	Rainwater collection	Volume	National	
	j.	Water abstraction from the sea	Volume	Sub-national	
	k.	Losses during transport	Volume	By ISIC economic activity	
				<ul> <li>National</li> </ul>	
				Sub-national	
	1.	Exports of water	Volume	National	
	m.	Imports of water	Volume	Sub-national	
	n.	Returns of water	Volume	By ISIC economic activity	
				• By destination (e.g., inland water, land, sea,	
				ocean)	
				National	
				Sub-national	

Component 3: Residuals					
Sub-component	it 3.1	1: Emissions to Air			
		Statistics and Related Information	Category of		Methodological
Торіс	( <b>B</b>	old Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Measurement	Potential Aggregations and Scales	Guidance
Topic 3.1.1: Emissions of greenhouse gases	a.	Total emissions of direct greenhouse gases (GHGs), by gas:         1. Carbon dioxide (CO2)         2. Methane (CH4)         3. Nitrous oxide (N2O)         4. Perfluorocarbons (PFCs)         5. Hydrofluorocarbons (HFCs)         6. Sulphur hexafluoride (SF6)         Total emissions of indirect greenhouse gases (GHGs), by gas:         1. Sulphur dioxide (SO2)         2. Nitrogen oxides (NOx)         3. Non-methane volatile organic compounds (NM-VOCs)         4. Other	Mass Mass Mass Mass Mass Mass Mass Mass	<ul> <li>By ISIC economic activity</li> <li>By tourists</li> <li>National</li> <li>Sub-national</li> <li>By IPCC source categories</li> </ul>	<ul> <li>IPCC Emission Factor Database</li> <li>UN Framework Convention on Climate Change (UNFCCC) Reporting Guidelines</li> <li>UNECE Standard Statistical Classification of Ambient Air Quality (1990)</li> <li>UNSD: MDG Indicator 7.2 Metadata</li> <li>WHO</li> </ul>
Topic 3.1.2: Consumption of ozone depleting substances Topic 3.1.3. Emissions of other substances	a.	Consumption of ozone depleting substances (ODS), by substance:         1. Chlorofluorocarbons (CFCs)         2. Hydrochlorofluorocarbons (HCFCs)         3. Halons         4. Methyl chloroform         5. Carbon tetrachloride         6. Methyl bromide         7. Other         Emissions of other substances:         1. Particulate matter (PM)         2. Heavy metals         3. Other	Mass Mass Mass Mass Mass Mass Mass Mass		<ul> <li>UNEP Ozone Secretariat</li> <li>IPCC Emission Factor Database</li> <li>UNECE Standard Statistical Classification of Ambient Air Quality (1990)</li> <li>UNSD: MDG Indicator 7.3 Metadata</li> <li>WHO</li> <li>UNECE Standard Statistical Classification of Ambient Air Quality (1990)</li> <li>European Monitoring and Evaluation Programme (EMEP) under the Convention on Long-</li> </ul>

			Pollution
			1

Component 3:	Res	siduals			
Sub-component	t 3.2	: Generation and Management of Waste	ewater		
		Statistics and Related Information	Category of		Methodological
Торіс	(	<b>Bold Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Potential Aggregations and Scales	Guidance
Topic 3.2.1: Generation and pollutant	a.	Volume of wastewater generated	Volume	<ul> <li>By ISIC economic activity</li> <li>By tourists</li> <li>National</li> <li>Sub-national</li> </ul>	<ul> <li>UNSD: IRWS</li> <li>ISIC Rev. 4, Section</li> <li>E, Divisions 35-37</li> <li>SEEA Water</li> </ul>
content of wastewater	b.	Pollutant content of wastewater	Mass	<ul> <li>By pollutant or pollution parameter (e.g., biochemical oxygen demand (BOD), chemical oxygen demand (COD), nitrogen, phosphorous, total suspended solids (TSS))</li> <li>By ISIC economic activity</li> <li>National</li> <li>Sub-national</li> </ul>	UNSD: Environment Statistics Section - Water Questionnaire
Topic 3.2.2:	a.	Volume of wastewater collected	Volume	<ul><li>National</li><li>Sub-national</li></ul>	<ul><li>UNSD: IRWS</li><li>ISIC Rev. 4, Section</li></ul>
treatment of wastewater	b. c. d.	Volume of wastewater treated         Total urban wastewater treatment capacity         1. Number of plants         2. Capacity of plants         Total industrial wastewater treatment capacity         1. Number of plants         2. Capacity of plants         We the set of plants	Volume Number Volume Number Volume Volume	<ul> <li>By treatment type (e.g., primary, secondary, tertiary)</li> <li>National</li> <li>Sub-national</li> </ul>	E, Division 35 and 36 • UNSD: Environment Statistics Section - Water Questionnaire
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	Volume	<ul> <li>By treatment type (e.g., primary, secondary, tertiary)</li> <li>By recipient (e.g., surface water, groundwater, wetland, sea, land)</li> <li>By ISIC economic activity</li> <li>National</li> <li>Sub-national</li> <li>By source (point/non-point source)</li> </ul>	
	b.	Pollutant content of discharged wastewater	Mass	<ul> <li>By pollutant or pollution parameter (e.g., BOD, COD, nitrogen, phosphorous)</li> <li>National</li> <li>Sub-national</li> <li>Net emission by ISIC economic activity</li> <li>By source (point/non-point source)</li> </ul>	

Component 3:	Res	siduals			
Sub-componen	t 3.3	: Generation and Management of Waste	:		
Торіс	(	Statistics and Related Information Bold Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Category of Measurement	Potential Aggregations and Scales	Methodological Guidance
Topic 3.3.1: Generation of waste	a.	Amount of waste generated by source	Mass	<ul> <li>By ISIC economic activity</li> <li>By households</li> <li>By tourists</li> <li>National</li> <li>Sub-national</li> </ul>	European Commission: European List of Waste, pursuant to European Waste
	b.	Amount of waste generated by waste category	Mass	<ul> <li>By waste category (e.g., chemical waste, municipal waste, food waste, combustion waste, etc.)</li> <li>National</li> <li>Sub-national</li> </ul>	<ul> <li>Framework Directive</li> <li>Eurostat: Environmental Data Centre on Waste</li> <li>Eurostat: European Waste Classification for Statistics (EWC- Stat), version 4 (Waste entopering)</li> </ul>
	с.	Amount of hazardous waste generated	Mass	<ul> <li>By ISIC economic activity</li> <li>National</li> <li>Sub-national</li> </ul>	<ul> <li>Categories)</li> <li>Basel Convention: Waste categories and hazardous characteristics</li> <li>Eurostat: Manual on Waste Statistics</li> <li>Eurostat: Guidance on classification of waste according to EWC-Stat categories</li> <li>SEEA Central Framework (2012)</li> <li>UNSD: Environment Statistics Section - Waste Questionnaire</li> </ul>

<b>Topic 3.3.2:</b>	a.	Municipal waste		• By type of treatment and disposal (e.g., reuse,	Eurostat:
Management of		1. Total municipal waste collected	Mass	recycling, composting, incineration, landfilling,	Environmental Data
waste		2. Amount of municipal waste treated by type of	Mass	other)	Centre on Waste
		treatment and disposal		• By type of waste, when possible	• Eurostat metadata:
		3. Number of municipal waste treatment and	Number	• National	Organisation for
		disposal facilities		• Sub-national	economic Co-
		4. Capacity of municipal waste treatment and	Volume		Development
		disposal facilities			(OECD)/Eurostat
	b.	Hazardous waste			definition of municipal
		1. Total hazardous waste collected	Mass		waste
		2. Amount of hazardous waste treated by type of	Mass		• UNSD:
		treatment and disposal			<b>Environment Statistics</b>
		3. Number of hazardous waste treatment and	Number		Section - Waste
		disposal facilities			Questionnaire
		4. Capacity of hazardous waste treatment and	Volume		<ul> <li>Basel Convention:</li> </ul>
		disposal facilities			waste categories and
	c.	Other/industrial waste			characteristics
		1. Total other/industrial waste collected	Mass		<ul> <li>Eurostat: EWC-</li> </ul>
		2. Amount of other/industrial waste treated by type	Mass	1	Stat. version 4 (Waste
		of treatment and disposal			categories)
		3. Number of treatment and disposal facilities	Number		<ul> <li>European</li> </ul>
		4. Capacity of industrial waste treatment and	Volume		Commission:
		disposal facilities			European Waste
	d.	d. Amount of recycled waste	Mass	By specific waste streams (e.g., e-waste,	Framework Directive
				packaging waste, end of life vehicles)	(waste treatment
				By waste category	<ul> <li>Eurostat: Manual on</li> </ul>
				National	Waste Statistics
				• Sub-national	<ul> <li>Eurostat: Guidance</li> </ul>
	e.	Imports of waste	Mass	<ul> <li>By waste category (e.g., chemical waste,</li> </ul>	on classification of
	f.	Exports of waste	Mass	municipal waste, combustion waste, etc.)	waste according to
	g.	Imports of hazardous waste	Mass		• Rotterdam
	1-	Execute of homendays must	Мала	4	Convention
	n.	Exports of nazardous waste	Mass		
	I				

Component 3:	Res	siduals			
Sub-componen	t 3.4	: Release of Chemical Substances			
		Statistics and Related Information	Catagory of		Methodological
Торіс	(	<b>Bold Text - Core Set/Tier 1</b> ; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i> )	Measurement	Potential Aggregations and Scales	Guidance
Topic 3.4.1:	a.	Total amount of fertilizers used		National	FAOSTAT
Release of chemical		1. Natural fertilizers (also in 2.5.1.b and 2.5.3.b)	Area, Mass, Volume	<ul> <li>Sub-national</li> <li>By ISIC economic activity (forestry, agriculture)</li> </ul>	<ul> <li>Stockholm</li> <li>Convention</li> </ul>
substances		2. Chemical fertilizers (also in 2.5.1.b and 2.5.3.b)	Area, Mass, Volume	<ul><li>By type of fertilizer</li><li>By type of pesticide</li></ul>	
	b.	Total amount of pesticides used (also in 2.5.1.b and 2.5.3.b)	Area, Mass, Volume		
	с.	Total amount of pellets used (also in 2.5.2.e)	Mass, Volume	<ul> <li>National</li> <li>Sub-national</li> <li>By ISIC economic activity (aquaculture)</li> </ul>	Stockholm Convention
	d.	Total amount of hormones used (also in 2.5.2.e and 2.5.4.b)	Mass, Volume	<ul> <li>National</li> <li>Sub-national</li> <li>By ISIC economic activity (aquaculture, livestock production)</li> </ul>	
	e.	Total amount of colourants used (also in 2.5.2.e)	Mass, Volume	<ul> <li>National</li> <li>Sub-national</li> <li>By ISIC economic activity (aquaculture)</li> </ul>	
	f.	<i>Total amount of antibiotics used (also in 2.5.2.e and 2.5.4.b)</i>	Mass, Volume	<ul> <li>National</li> <li>Sub-national</li> <li>By ISIC economic activity (aquaculture, livestock production)</li> </ul>	

Component 4: Extreme Events and Disasters						
Sub-component	t 4.1	: Natural Extreme Events and Disasters				
		Statistics and Related Information	Category of		Methodological	
Торіс	(	Bold Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Measurement	Potential Aggregations and Scales	Guidance	
Topic 4.1.1: Occurrence of natural extreme events and disasters	a.	Occurrence of natural extreme events and disasters          1. Type of natural extreme event and disaster       (geophysical, meteorological, hydrological, climatological, biological)         2. Location       3. Magnitude (where applicable)         4. Date of occurrence	Description Location Intensity Date	<ul><li>By event</li><li>National</li><li>Sub-national</li></ul>	<ul> <li>Centre for Research on the Epidemiology of Disasters</li> <li>Emergency Events</li> <li>Database (CRED</li> <li>EMDAT)</li> <li>UN Economic</li> </ul>	
Topic 4.1.2:	a.	5. Duration People affected by natural extreme events and disasters	Time period		Commission for Latin America and the Caribbean (ECLAC)	
Impact of natural extreme events and disasters		<ol> <li>Number of people killed</li> <li>Number of people injured</li> <li>Number of people homeless</li> <li>Number of people affected</li> </ol>	Number Number Number Number		Handbook for Estimating the Socio- economic and Environmental Effects of Disasters	
	b.	<b>Economic losses due to natural extreme events</b> <b>and disasters</b> (e.g., damage to buildings, transportation networks, loss of revenue for businesses, utility disruption, etc.)	Currency	<ul> <li>By event</li> <li>By ISIC economic activity</li> <li>National</li> <li>Sub-national</li> </ul>	The United Nations     Office for Disaster     Risk Reduction     (UNISDR)	
	c.	Physical losses/damages due to natural extreme events and disasters (e.g., area and amount of crops, livestock, aquaculture, biomass etc.)	Area, Description, Number	By direct and indirect damage		
	d.	Effects of natural extreme events and disasters on integrity of ecosystems 1. Area affected by natural disasters	Area	<ul><li>By event</li><li>By ecosystem</li><li>National</li></ul>		
		<ul><li>2. Loss of vegetation cover</li><li>3. Area of watershed affected</li><li>4. Other</li></ul>	Area Area Description	Sub-national		
	e.	External assistance received	Currency	<ul><li>By event</li><li>National</li></ul>		

Component 4: Extreme Events and Disasters							
Sub-component	t 4.2	: Technological Disasters					
		Statistics and Related Information	Category of		Methodological		
Торіс	(	Bold Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Measurement	Potential Aggregations and Scales	Guidance		
<b>Topic 4.2.1:</b>	a.	Occurrence of technological disasters		By event     Dy ISIC according optimity	CRED EMDAT     ECLAC: Handback		
Occurrence of technological		1. Type of technological disaster (industrial, transportation, miscellaneous)	Description	<ul> <li>By ISIC economic activity</li> <li>National</li> <li>Sub-national</li> </ul>	for Estimating the Socio-economic and		
disasters		2. Location	Location		Environmental Effects		
		3. Date of occurrence	Date		of Disasters		
		4. Duration	Time period				
<b>Topic 4.2.2:</b>	a.	People affected by technological disasters		• By event			
Impact of		1. Number of people killed	Number	<ul> <li>National</li> <li>Sub national</li> </ul>			
technological		2. Number of people injured	Number				
disasters		3. Number of people homeless	Number				
		4. Number of people affected	Number				
	b.	Economic losses due to technological disasters (e.g., damage to buildings, transportation networks, loss of revenue for businesses, utility disruption, etc.)	Currency	<ul> <li>By event</li> <li>By ISIC economic activity</li> <li>National</li> </ul>			
	c.	Physical losses/damages due to technological disasters (e.g., area and amount of crops, livestock, aquaculture, biomass etc.)	Area, Description, Number	<ul> <li>Sub-national</li> <li>By direct and indirect damage</li> <li>By event</li> <li>National</li> </ul>			
	d.	Effects of technological disasters on integrity of ecosystems					
		1. Area affected by technological disasters	Area	Sub-national			
		2. Loss of vegetation cover	Area				
		3. Area of watershed affected	Area				
		4. Other (e.g., for oil spills: volume of oil released into the environment, impact on ecosystem)	Description				
	e.	External assistance received	Currency	<ul><li>By event</li><li>National</li></ul>			

Component 5: Human Settlements and Environmental Health									
Sub-component	Sub-component 5.1: Human Settlements								
Topia		Statistics and Related Information	Category of	Potential Aggregations and Scales	Methodological				
Торіс	(	Bold Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Measurement	r otential Aggregations and Scales	Guidance				
<b>Topic 5.1.1:</b>	a.	Population living in urban areas	Number	• Urban	<ul> <li>UN Population</li> </ul>				
Urban and	b.	Population living in rural areas	Number	Rural	Division				
rural	c.	Total urban area	Area		UN Population				
nonulation	d.	Total rural area	Area		Fund (UNFPA)				
population	e.	Population living in coastal areas	Number						
<b>Topic 5.1.2:</b>	a.	Population using an improved drinking water	Number	• Urban	<ul> <li>UNSD: MDG</li> </ul>				
Access to		source		Rural	Indicator 7.8 and 7.9				
selected basic	b.	Population using an improved sanitation facility	Number	National	Metadata				
services	c.	Population served by municipal waste collection	Number	Sub-national	• UN-Water				
Set vices					• UNSD:				
					Environment Statistics				
					Section - water and				
					• WHO/(United				
					Nations Children's				
					Fund (UNICEE) Joint				
					Monitoring				
					Programme for Water				
					Supply and Sanitation				
	d.	Population connected to wastewater collecting	Number	• By treatment type (e.g., primary, secondary.	UNSD: IRWS				
		system		tertiary)	<ul> <li>ISIC Rev. 4,</li> </ul>				
	e.	Population connected to wastewater treatment	Number	National	Section E, Division				
		-		<ul> <li>Sub-national</li> </ul>	35-37				
	f.	Population supplied by water supply industry	Number	National	• UNSD:				
				<ul> <li>Sub-national</li> </ul>	<b>Environment Statistics</b>				
					Section - Water				
					Questionnaire				
	g.	Price of water	Currency	<ul> <li>By source (e.g., piped, vendor)</li> </ul>					
	h.	Population with access to electricity	Number						
	i.	Price of electricity	Currency						

<b>Topic 5.1.3:</b>	a.	Urban population living in slums	Number		UN Habitat
Housing	b.	Area of slums	Area		<ul> <li>UNSD: MDG</li> <li>Indicator 7 10</li> </ul>
conditions	c.	Population living in hazard prone areas	Number	• Urban	Metadata
	d.	Hazard prone areas	Area	• Rural	
	e.	Population living in informal settlements	Number	<ul> <li>National</li> <li>Sub-national</li> </ul>	
	f. Homeless population Number				
	g.	Number of dwellings with adequacy of building materials defined by national or local standards	Number		
<b>Topic 5.1.4:</b>	a.	Population exposed to air pollution in main cities	Number	• By pollutant (e.g., SO <sub>2</sub> , NOx, O <sub>3</sub> )	• WHO
Exposure to	_				-
ambient	b.	Population exposed to noise pollution in main cities	Number		
pollution					
<b>Topic 5.1.5:</b>	a.	Extent of urban sprawl	Area		UN Habitat
Environmental	b.	Available green areas	Area		<ul><li>WHO</li><li>UNEP Urban</li></ul>
concerns	c.	Number of private and public vehicles	Number	By type of engine or type of fuel	Environment Unit
specific to	d.	Population using public modes of transportation	Number		
settlements	e.	Population using hybrid and electric modes of transportation	Number		
	f.	Extent of the roadways	Length		
	g.	<i>Existence of urban planning and zoning regulations and instruments in main cities</i>	Description		
	h.	Effectiveness of urban planning and zoning regulations and instruments in main cities	Description		

	Table A.1:	The Basic	Set of	<sup>e</sup> Environment	<b>Statistics</b>	(continued)
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Component 5: Human Settlements and Environmental Health						
Sub-component	t 5.2	: Environmental Health				
		Statistics and Related Information	Category of		Methodological	
Торіс	(	Bold Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Measurement	Potential Aggregations and Scales	Guidance	
Topic 5.2.1: Airborne diseases and conditions	a.	Airborne diseases and conditions 1. Incidence 2. Prevalence 3. Mortality 4. Loss of work days 5. Estimates of economic cost in monetary terms	Number Number Number Number Currency	<ul> <li>By disease or condition</li> <li>National</li> <li>Sub-national</li> <li>Urban</li> <li>Rural</li> <li>By gender</li> </ul>	• WHO	
Topic 5.2.2: Water-related diseases and conditions	a.	Water-related diseases and conditions         1. Incidence         2. Prevalence         3. Mortality         4. Loss of work days         5. Estimates of economic cost in monetary terms	Number Number Number Number Currency	<ul><li>By age group</li><li>By time period</li></ul>		
Topic 5.2.3: Vector borne diseases	a.	Vector borne diseases          1. Incidence         2. Prevalence         3. Mortality         4. Loss of work days         5. Estimates of economic cost in monetary terms	Number Number Number Number Currency			
Topic 5.2.4: Health problems associated with excessive UV radiation exposure	a.	Problems associated with excessive UV radiation exposure         1. Incidence         2. Prevalence         3. Loss of work days         4. Estimates of economic cost in monetary terms	Number Number Number Currency			
Topic 5.2.5: Toxic substance- and nuclear radiation- related diseases and conditions	a.	Toxic substance-and nuclear radiation-related diseases and conditions         1. Incidence         2. Prevalence         3. Loss of work days         4. Estimates of economic cost in monetary terms	Number Number Number Currency	<ul> <li>By category of toxic substance</li> <li>By disease or condition</li> <li>National</li> <li>Sub-national</li> <li>Urban</li> <li>Rural</li> <li>By gender</li> <li>By age group</li> </ul>	• WHO	

Component 6: Environment Protection, Management and Engagement						
Sub-componen	t 6.1	: Environment Protection and Resource	Management I	Expenditure		
Торіс		Statistics and Related Information (Bold Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Category of Measurement	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         1. Annual government environment protection expenditure         2. Annual government resource management expenditure	Currency Currency	<ul> <li>By environmental activity</li> <li>By type of expenditure: current, investment</li> <li>By ministry</li> <li>National</li> <li>Sub-national</li> <li>By funding</li> </ul>	<ul> <li>Classification of Environmental Activities (CEA)</li> <li>SEEA Central Framework (2012) Annex 1</li> <li>Eurostat - SERIEE Environmental Protection Expenditure Accounts Compilation Guide</li> </ul>	
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         1. Annual corporate environment protection expenditure         2. Annual corporate resource management expenditure         3. Annual non-profit institution environment protection expenditure         4. Annual non-profit institution resource management expenditure         5. Annual household environment protection expenditure         6. Annual household resource management expenditure	Currency Currency Currency Currency Currency Currency Currency	<ul> <li>By environmental activity</li> <li>By type of expenditure: current, investment</li> <li>By ISIC economic activity</li> <li>National</li> <li>Sub-national</li> </ul>		

Component 6:	En	vironment Protection, Management an	d Engageme	nt	
Sub-component 6.2: Environmental Governance and Regulation					
Торіс	(Bc	Statistics and Related Information	Category of Measurement	Potential Aggregations and Scales	Methodological Guidance
Topic 6.2.1: Institutional strength	a.	Government environmental institutions and their resources         1. Name of main environmental authority and year of establishment         2. Annual budget of the main environmental authority         3. Number of staff in the main environmental authority         4. List of environmental departments in other authorities and year of establishment         5. Annual budget of environmental departments in other authorities	Description       Currency       Number       Description       Currency	<ul><li>National</li><li>Sub-national</li></ul>	
	b.	<ul> <li>6. Number of staff of environmental departments in other authorities</li> <li>Other environmental institutions and their resources</li> <li>1. Name of institution and year of establishment</li> <li>2. Annual budget of the institution</li> <li>3. Number of staff in the institution</li> </ul>	Number Description Currency Number	<ul><li>National</li><li>Sub-national</li></ul>	
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)         2. Description (e.g., name, year established) of licensing system to ensure compliance with environmental standards for businesses or other new facilities	Description, Number Description	<ul> <li>Per media (e.g., water, air, land, soil, oceans)</li> <li>By ISIC economic activity</li> <li>National</li> <li>Sub-national</li> </ul>	
		<ul> <li>3. Number of applications for licences received and approved per year</li> <li>4. List of quotas for biological resource extraction</li> <li>5. Budget and number of staff dedicated to enforcement of environmental regulations</li> </ul>	Number Number Currency, Number		
	b.	Economic instruments Economic instruments 1. List and description (e.g., year of establishment) of green/environmental taxes 2. List and description (e.g., year of establishment) of environmentally relevant subsidies 3. List of eco-labelling and environmental certification programmes 4. Emission permits traded	Description, Currency Description, Currency Description Number, Currency		
Topic 6.2.3: Participation in MEAs and environmental conventions (d) Participation means the	a.	Participation in MEAs and other global environmental conventions           1. List and description (e.g., year of participation <sup>(d)</sup> of country)           of MEAs and other global environmental conventions	Description, Number	through a variety of means depending on country circumstance	Secretariats of MEAs
acceptance, approval, form	al cont	firmation, ratification, and succession. Countries or areas who have sign	ed but not become party	to the agreements under a given convention or treaty are not co	onsidered 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:		Category of Measurement	Potential Aggregations and Scales	Methodological Guidance				
1 opro	Italicized Text - Tier 3)								
Topic 6.3.1: Preparedness	a.	National natural extreme event and disaster preparedness and management systems		<ul><li>National</li><li>Sub-national</li></ul>	International     Emergency     Menagement				
for natural		1. Existence of national disaster plans/programmes	Description		Organization (IEMO)				
extreme events and disasters		2. Description (e.g., number of staff) of national disaster plans/programmes	Description		<ul><li>UNISDR</li><li>Hyogo Framework</li></ul>				
		3. Number and type of shelters in place or able to be deployed	Description, Number		for Action				
		4. Number and type of internationally certified emergency and recovery management specialists	Description, Number						
		5. Number of volunteers	Number						
		6. <i>Quantity of first aid, emergency supplies and equipment stockpiles</i>	Number						
		7. Existence of early warning systems for all major hazards	Description						
		8. Expenditure on disaster prevention, preparedness, clean-up and rehabilitation	Currency						
Topic 6.3.2: Preparedness	a.	National technological disaster preparedness and management systems							
for technological		1. Existence and description (e.g., number of staff) of public disaster management plans/programmes (and private when available)	Description						
uisasters		2. Expenditure on disaster prevention, preparedness, clean-up and rehabilitation	Currency						

Component 6: Environment Protection, Management and Engagement										
Sub-component 6.4: Environmental Information and Awareness										
Торіс		Statistics and Related Information (Bold Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	Category of Measurement	Potential Aggregations and Scales	Methodological Guidance					
Topic 6.4.1: Environmental information	a. b.	<ul> <li>Environmental information systems</li> <li>1. Existence of publicly accessible environmental information system</li> <li>2. Annual number of visits/users of specific environmental information programmes or environmental information systems</li> <li>Environment statistics</li> <li>1. Description of national environment statistics programmes (e.g., existence, year of establishment, lead agency, human and financial resources)</li> <li>2. Number and type of environment statistics products and periodicity of updates</li> <li>3. Existence and number of participant institutions in interagency environment statistics platforms or committees</li> </ul>	Description Number Description Description, Number Number	<ul> <li>National</li> <li>Sub-national</li> </ul>						
Topic 6.4.2: Environmental education	a.	<ul> <li>Environmental education</li> <li>1. Allocation of resources by central and local authorities for environmental education</li> <li>2. Number and description of environmental education programmes in schools</li> <li>3. Number of students pursuing environment-related higher education (e.g., science, management, education, engineering)</li> </ul>	Currency Description, Number Number							
Topic 6.4.3: Environmental perception and awareness Topic 6.4.4: Environmental engagement	a. a.	Public environmental perception and awareness         1. Knowledge and attitudes about environmental issues or concerns         2. Knowledge and attitudes about environmental policies         Environmental engagement         1. Existence of pro-environmental NGOs (number of NGOs and their respective human and financial resources)         2. Number of pro-environmental activities	Description Description Currency, number							
		3. Number of pro-environmental programmes	Number							

### Annex B: Developments since 1984

B.1 A number of relevant policy and conceptual developments have occurred since the original FDES was published in 1984. The goals for policy making in the field of the environment and sustainable development have usually been accompanied by implicit or explicit frameworks and in some cases indicator sets to monitor progress. They have also generally either used or proposed a specific conceptualization of environmental or environmental sustainability related phenomena. Annex B reviews main conceptual and policy developments relevant to environment statistics since 1984 together with the most important developments in frameworks for environmental statistics and indicators.

### Conceptual and policy developments and related frameworks

### Sustainable development

- B.2 The concept of sustainable development came to the forefront in 1986, when the United Nations World Commission on Environment and Development, led by Gro Harlem Brundtland enunciated it as an alternative approach to economic growth that could "meet the needs of the present without compromising the ability of future generations to meet their own needs". This was a synergistic approach that would replace the previously held view of economic growth and the health of the environment as competing interests. The outcome document, *Our Common Future*,<sup>117</sup> was a strategy paper intended to inform the formulation of global policy in a wide array of areas relating the environment to the economy within the development context.
- B.3 Subsequent to the work of that Commission, the United Nations Conference on Environment and Development (UNCED), or Earth Summit, held in Rio de Janeiro, Brazil, in June 1992 gave rise to a fresh round of interest and this time outlined policy directives for the environment. Agenda 21, which was the agreed programme of action of the Summit for the implementation of sustainable development, called for comprehensive global action in all areas of sustainable development, in particular "improved living standards for all better protected and managed ecosystems and a safer, more prosperous future". The declarations coming from that Summit were:
  - i. The Rio Declaration on Environment and Development affirming that scientific uncertainty should not delay measures to prevent environmental degradation where

<sup>&</sup>lt;sup>117</sup> United Nations, World Commission on Environment and Development (1987). "Our Common Future", Oxford University Press.

there are threats of serious or irreversible damage; and that States had a right to exploit their own resources but not to cause damage to the environment of other States;<sup>118</sup>

- ii. The Statement of Forest Principles exhorting all countries to make an effort to "green the world" (through reforestation and forest conservation).
- B.4 Three international environmental treaties<sup>119</sup> also came into being as a direct result of the Rio Summit. These "Rio Conventions" are:
  - i. The UNFCCC, with the objective of stabilizing GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system;
  - ii. The Convention on Biological Diversity (CBD) which represented a dramatic step forward in the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising from the use of genetic resources; and
  - iii. The United Nations Convention to Combat Desertification (UNCCD), which is the only international legally binding instrument to effectively tackle desertification and the effects of drought.
- **B.5** In 2002, ten years after the Rio Summit in 1992, the follow-up World Summit on Sustainable Development (WSSD) was held in Johannesburg, South Africa in August-September 2002. The Johannesburg Summit reinforced the scope of sustainable development emphasizing the need to protect ecosystems and to achieve integrated management of land, water and living resources, while strengthening regional, national and local capacities. The outcome document of that Summit, the Johannesburg Declaration on Sustainable Development and the Plan of Implementation of the World Summit on Sustainable Development<sup>120</sup>, recognized that protecting and managing the natural resource base for economic and social development is one of the overarching objectives of and essential requirements for sustainable development. It also noted that healthy ecosystems and healthy environments are invaluable to ensure the ability of present and future generations to meet their own needs. As enshrined in that Declaration, sustainable development encompassed three basic pillars: economic development, social development and environmental protection, at the local, national, regional and global levels.

<sup>&</sup>lt;sup>118</sup> United Nations (1992). "Report of the United Nations Conference on Environment and Development", Rio de Janeiro, 3-14 June 1992, Annex I. Available from <a href="http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm">http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm</a> (accessed 30 October 2013).

<sup>&</sup>lt;sup>119</sup> A more detailed description of the conventions and multilateral environmental agreements can be seen in Annex C.

<sup>&</sup>lt;sup>120</sup> United Nations (2002). "Report of the World Summit on Sustainable Development", Johannesburg, South Africa, 26 August - 4 September 2002. Available from <a href="http://www.un.org/jsummit/html/documents/summit\_docs/131302\_wssd\_report\_reissued.pdf">http://www.un.org/jsummit/html/documents/summit\_docs/131302\_wssd\_report\_reissued.pdf</a> (accessed 16 October 2013).

- The next follow-up conference, the United Nations Conference on Sustainable **B.6** Development (UNCSD), Rio+20, was held in Rio de Janeiro, Brazil, in June 2012. The outcome document of the Conference, titled "The Future We Want" (A/CONF.216/L.1)<sup>121</sup> addresses six areas: Our common vision; Renewing political commitment; Green economy in the context of sustainable development and poverty eradication; Institutional framework for sustainable development; Framework for action and follow-up; and Means of implementation. The agreement adopted in Rio calls for the United Nations General Assembly (UNGA) to undertake a number of tasks: take decisions on designating a body to operationalize the 10-year framework of programmes on sustainable consumption and production; determine the modalities for the Third International Conference on Small Island Developing States (SIDS), which was held in Apia, Samoa from 1 to 4 September 2014; identify the format and organizational aspects of the high-level forum, which is to replace the Commission on Sustainable Development (CSD); strengthen UNEP; constitute a working group to develop global SDGs to be agreed by the UNGA; establish an intergovernmental process under the UNGA to prepare a report proposing options on an effective sustainable development financing strategy; and consider a set of recommendations from the Secretary-General for a facilitation mechanism that promotes the development, transfer and dissemination of clean and environmentally sound technologies.
- B.7 The need to strengthen the monitoring of sustainable development, through improved data collection and the establishment of indicators was emphasized in the outcome document of the Rio+20 Conference. The availability and quality of environment statistics were given utmost importance for the purpose of monitoring the environmental sustainability and achievements of green economy. It was addressed that there is a growing need to develop and combine statistics and indicators beyond GDP that are more inclusive of environmental and social aspects in order to cover the full realm of sustainable development. In order to strengthen the measurement of the environmental pillar that would contribute to measuring beyond GDP, the importance of comparable and regularly collected environment statistics were emphasized. The FDES 2013 and the Core Set of Environment Statistics being produced by UNSD will provide appropriate tools for assisting countries in this regard. UNSD's work in strengthening of environmental information, data and indicators in collaboration with UNEP was deemed to be important. The embedment of geospatial information in environment statistics was also stressed. In

<sup>&</sup>lt;sup>121</sup> United Nations (2012). Rio+20 outcome document, "The Future We Want". Available from <u>http://www.uncsd2012.org/thefuturewewant.html</u> (accessed 9 November 2013).

short, the results of the outcome document were extremely positive with regard to acknowledging the need to strengthen the production of environment statistics.

- B.8 Advancing the conceptual aspects of sustainable development has provided additional motivation for assessing the progress and implementation gaps in meeting previously agreed commitments and addressing new and emerging challenges. In this regard, the renewed call to secure political commitment to this concept at Rio+20 was a well-argued force for developing the policy relevant to sustainable development.
- B.9 The draft Outcome Document of the Third International Conference on SIDS<sup>122</sup> contains a section on Data and Statistics, where the work of the international statistical community is clearly mentioned. In this regard, the importance of strengthening national statistical systems to face the challenge of increased demands for data is evident. It was recognized that improved data collection and statistical analysis are required to enable SIDS to effectively plan, follow up on, evaluate the implementation of and track successes in attaining the internationally agreed development goals.
- B.10 These clear policy positions on sustainable development, taken after the publication of the FDES in 1984, have had direct relevance to the area of environment statistics. It is vitally important to take them into consideration in this revision as the concept of sustainable development has played a defining role in helping to coalesce thinking, around goals that are well-defined and representative, regarding the state of the environment. This concept of sustainable development has underscored the point that it is important to conserve the environment while ensuring the economic and social well-being of the world's human population. Adequate response to these initiatives has contributed significantly to defining the statistical needs in this area. Any conceptual approaches that ensue for describing the environment must respond to them, making possible a better understanding of the sustainability of the environment as well as serving the function of assessment and decision support.
- B.11 Twenty-two years after Rio, and around 30 years after the original FDES, the environment statistics community faces a new opportunity to methodologically strengthen the environment statistics domain, while policy driven processes advocate for countries to support and strengthen their official programmes at the national, regional and global levels.

<sup>&</sup>lt;sup>122</sup> United Nations Conference on Small Island Developing States, Draft outcome document. Available from <a href="http://www.sids2014.org/content/documents/358A-CONF-223-5%20ENGLISH.pdf">http://www.sids2014.org/content/documents/358A-CONF-223-5%20ENGLISH.pdf</a> (accessed 11 September 2014).

### Climate Change

- B.12 According to prevailing science, the current state regarding the science of climate change is that human activity particularly the burning of fossil fuels has made the blanket of GHGs around the earth "thicker." <sup>123</sup> The UNFCCC has affirmed that climate change is one of the greatest challenges of our time.<sup>124</sup> The world's climate is changing and will continue to change at rates unprecedented in recent human history. The impacts and risks associated with these changes are already happening in many systems and sectors essential for human livelihood, including water resources, food security, coastal zones and health. Adaptation to the adverse effects of climate change is vital in order to reduce those effects as well as future impacts. In this context, there is an urgent need for an integrated policy response to the climate change and development challenge.
- B.13 Arising out of the UNFCCC was the Kyoto Protocol. This Protocol is an international agreement whose major feature is that it sets binding targets for reducing GHG emissions (as of mid-2011) for 37 industrialized countries and the European community. Unlike the UNFCCC, it provides for binding targets rather than encouragement for signatories to attain these goals. The Kyoto mechanisms have been designed to:
  - i. Stimulate sustainable development through technology transfer and investment;
  - ii. Help countries with Kyoto commitments to meet their targets by reducing emissions or removing carbon from the atmosphere in other countries in a cost-effective way; and
  - iii. Encourage the private sector and developing countries to contribute to emission reduction efforts.
- B.14 The complexity of the climate system means predictions vary widely, but even the minimum changes in forecast could mean frequently flooded coastlines, disruptions to food and water supplies, and the extinction of many species. Accordingly, Parties are required to undertake efforts to:
  - i. Mitigate climate change, stabilizing GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system;
  - ii. Reduce emissions of GHGs;
  - iii. Enhance action on adaptation to the adverse effects of climate change. This is vital in order to reduce the impacts of climate change that are happening now and increase resilience to future impacts; and

<sup>&</sup>lt;sup>123</sup> United Nations Framework Convention on Climate Change, "Climate Change Information Sheet 1". Available from <a href="http://unfccc.int/cop3/fccc/climate/fact01.htm">http://unfccc.int/cop3/fccc/climate/fact01.htm</a> (accessed 12 November 2013).

<sup>&</sup>lt;sup>124</sup> United Nations Framework Convention on Climate Change (2011). Available from <u>http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf</u> (accessed 14 November 2013).

- iv. Promote and cooperate in research and systematic observations of the climate system, including through support to existing international programmes and networks.
- B.15 As a cross-cutting issue, climate change statistics are spread over a large proportion of the domain of environment statistics. The very real challenge that this poses to environment statistics should not be underestimated. It is essential that the scientific approach to climate change be addressed, with the provision of well-structured, relevant, reliable and timely information. The policy aspect and the supporting information also remain pressing requirements that need to be confronted with a view to integration and coherence.
- B.16 With regard to determining and apportioning the appropriate statistics and indicators for measurement of climate change, a sequence of changes is necessary to be able to convert anthropogenic emissions to GHG concentration changes, GHG concentration changes to radiative forcing, and radiative forcing to climate change. This will go a long way in consolidating measurement, analysis and assessment in this area of the environment (see Chapter 5, section 5.3 Climate Change).
- B.17 At the same time, there is renewed and strengthened demand for environment statistics that can be used to monitor, at different scales, the different stages and sequences of climate change such as contributing emissions, mitigation, impact and adaptation. Generally, NSOs around the world are experiencing difficulties in providing this type of information and unequivocal inter-institutional cooperation and new resources are needed to produce climate change statistics that are nationally and globally relevant in a timely fashion.

#### Monitoring the Millennium Development Goals (MDGs)

B.18 At the Millennium Summit of the United Nations, held in New York in 2000, world leaders adopted the "United Nations Millennium Declaration", which includes a statement of values, principles and objectives for the international agenda for the twenty-first century and sets deadlines for many collective actions. The framework for monitoring MDGs is intended as a tool to follow up on the Millennium Declaration. As a framework to monitor progress in internationally agreed targets and goals to be achieved by 2015, it reflects the global consensus over a wide range of development challenges including the environment. It is comprised of eight Goals that are in turn composed of targets and a given number of indicators to monitor progress towards each of the agreed

targets. Goal 7: Ensure environmental sustainability, can be monitored through its four targets and 10 indicators, of which only two indicators have a quantifiable target to be achieved by 2015. National, regional and global reporting about the progress made in these 10 indicators has increased, but data gaps and discrepancies among national and international sources have persisted, particularly in this goal. The MDG indicator framework is policy driven and its purpose is to monitor progress in achieving targets.

### Emergence of the SDGs, targets and indicators to guide the post-2015 development agenda

- B.19 At Rio+20, governments agreed to launch a process to develop a set of SDGs. They requested the establishment of an Open Working Group (OWG) of 30 elected UN Member States to elaborate a proposal for SDGs through an inclusive and transparent intergovernmental process open to all stakeholders. The Member States decided to use an innovative, constituency-based system of representation that was new to bodies with limited membership. This means that most of the seats in the OWG were shared by several countries working together through 13 sessions. On 19 July 2014 the OWG completed its mandate at the final formal session by adopting (by acclamation) the final outcome proposal of the OWG containing the Chapeau and the proposed 17 goals and 169 targets (including 62 targets on means of implementation). The OWG adopted its outcome, the "Proposal of the Open Working Group for Sustainable Development Goals" by acclamation, and the proposal will be submitted to the United Nations General Assembly (GA) for consideration and appropriate action at its 68th session. At the point of submission to the GA, no indicators have been proposed. However, once they have been identified, systematic data production and collection for these indicators will have to be established or strengthened within national statistical systems.
- B.20 Of the 17 goals proposed by the OWG, the ones that are directly related to environmental aspects are as follows:
  - Goal 6: Ensure availability and sustainable management of water and sanitation for all;
  - Goal 7: Ensure access to affordable, reliable, sustainable, and modern energy for all;
  - Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable;
  - Goal 12: Ensure sustainable consumption and production patterns;
  - Goal 13: Take urgent action to combat climate change and its impacts;
  - Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development; and

• Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

### Beyond GDP, Green Economy and Green Growth

- B.21 Continuing with developments relating to environment statistics, at the beginning of 2008, the Stiglitz-Sen-Fitoussi Commission was set up to address issues related to the measurement of economic performance and social progress. A central underlying assumption and motive was the recognition that the best known measure of economic activity, GDP, was not in itself a sufficient and appropriate guide for modern policy making to cover social and environmental objectives. Among its recommendations, the Stiglitz Report<sup>125</sup> suggested that the environmental aspects of sustainability deserve a separate follow-up based on a well-chosen set of physical indicators. In particular there is a need for a clear indicator of the Earth's proximity to dangerous levels of environmental damage, such as those associated with climate change or the depletion of fishing stocks. This clearly added significant pressure to the need for a responsive environment statistics framework.
- B.22 Complementing the concept of sustainable development are two other concepts, "green economy" and "green growth". Green economy results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. The green economy is characterized by low environmental risks (e.g., low carbon), social inclusiveness and resource efficiency. The essence of this initiative is the stimulation of investment in green sectors of the economy while ameliorating those sectors that are environmentally unsustainable. According to UNEP, "a green economy can be defined as an economy that results in improved human well-being and reduced inequalities over the long term, while not exposing future generations to significant environmental risks and ecological scarcities." <sup>126</sup> A green economy "is characterized by substantially increased investments in economic sectors that build on and enhance the earth's natural capital or reduce ecological scarcities and environmental risks. These investments and policy reforms provide the mechanisms and the financing for the reconfiguration of businesses, infrastructure and institutions and the adoption of sustainable consumption and production processes. Such reconfiguration leads to a higher share of green sectors contributing to GDP, greener jobs, lower energy and resource

 <sup>&</sup>lt;sup>125</sup> See Recommendation 12 of the "Report by the Commission on the Measurement of Economic Performance and Social Progress". Stiglitz, J., Sen, A., and Fitoussi, J. Available from <u>http://www.stiglitz-sen-fitoussi.fr/documents/rapport\_anglais.pdf</u> (accessed 20 October 2013).
 <sup>126</sup> United Nations Environment Programme (2012). "Measuring Progress Towards an Inclusive Green Economy". Available from <a href="http://www.unep.org/greeneconomy/Portals/88/documents/research\_products/Measuring%20Progress%20report.pdf">http://www.unep.org/greeneconomy/Portals/88/documents/research\_products/Measuring%20Progress%20report.pdf</a> (accessed 30 January 2013).

intensive production, lower waste and pollution and significantly lower GHG emissions."<sup>127</sup> Targeted efforts and policies in a green economy have to be geared towards reducing environmental risks and scarcities while ensuring compatibility with reducing global poverty and social inequity. For example, in pursuing investment in renewable energy, care must be taken to ensure access to clean and affordable energy.

- B.23 Specific indicators for measuring green economy have not yet been clearly identified or agreed upon, but work in this area involving UNEP, OECD and the World Bank indicates that they will encompass the following broad areas:
  - i. Economic indicators: for example, share of investments or the share of output and employment in sectors that meet a sustainability standard, such as green GDP;
  - ii. Environmental indicators: for example, resource use efficiency or pollution intensity at either the sectoral or economy-wide level, such as, energy use/GDP, or water use/GDP; and
  - iii. Aggregate indicators of progress and well-being: for example, macroeconomic aggregates to reflect natural capital depreciation, including integrated environmental and economic accounting, or broader interpretations of well-being beyond the narrow definition of GDP per capita.
- B.24 A different but related concept is expressed by "green growth". According to the OECD, "green growth is about fostering economic growth and development while ensuring that the natural assets continue to provide the resources and environmental services on which our well-being relies" and it emphasizes that "it must catalyse investment and innovation which will underpin sustained growth and give rise to new economic opportunities".<sup>128</sup> A complete set of indicators including headline indicators had been proposed by OECD<sup>129</sup> in 2014. The indicators are structured with a measurement framework including the following groups:
  - i. Indicators for monitoring the environmental and resource productivity of the economy;
  - ii. Indicators describing the natural asset base;
  - iii. Indicators monitoring the environmental dimension of quality of life; and
  - iv. Indicators describing policy responses and economic opportunities.

<sup>&</sup>lt;sup>127</sup> United Nations Environment Programme. "Green Economy Report: A Preview". Available from

http://www.unep.ch/etb/publications/Green%20Economy/GER%20Preview%20v2.0.pdf (accessed 29 January 2013).

<sup>&</sup>lt;sup>128</sup> Organisation for Economic Cooperation and Development (2014). "OECD Green Growth Studies: Green Growth Indicators 2014". Available from <a href="http://www.oecd.org/greengrowth/greengrowthindicators.htm">http://www.oecd.org/greengrowth/greengrowth/greengrowthindicators.htm</a> (accessed 5 September 2014).

<sup>129</sup> Ibid.

### Conceptual approaches to structuring environment statistics

B.25 There are two conceptual approaches which show potential for organizing environment statistics and that can go beyond being academic pursuits. In different contexts and for distinct purposes, they have become preeminent for understanding interrelationships within the environment at highly complex levels. These are the natural capital approach and the ecosystem approach. Following is a short discussion of the basic principles of each of these two well-established lines of reasoning.

### Natural Capital Approach

- B.26 The natural capital approach has been defined as a means for identifying and quantifying the natural environment and associated ecosystem services leading to better decision-making for managing, preserving and restoring natural environments. Capital theory has played a large part in economic development theories. Society's total capital base is comprised of a number of different kinds of capital (natural, economic, human and social). In the form of land, natural capital has been included as one of the factors of production from the birth of economic thought. In fact, natural capital capital capital capital provides goods and essential functions to the economy, as well as services to humans and to other living beings.
- B.27 Natural capital performs four types of basic functions:
  - i. Provision of raw materials for production and consumption;
  - ii. Assimilation of the waste products of production and consumption;
  - iii. Provision of amenity services (cultural services); and
  - iv. Provision of basic life support functions on which human life depends.<sup>130</sup>
- B.28 This approach incorporates the stock concept of natural capital as well as a flow concept of provision of services. Long term economic development and sustainability depend on both of these factors which are critical to the survival of humankind and other species.
- B.29 The measurement of natural capital has been tried out in different ways. Notably, significant progress was attained by the World Bank's work about the real wealth and genuine savings of nations. Measuring natural capital can also be approached by using

 <sup>&</sup>lt;sup>130</sup> Dietz, Simon and Neumayer, Eric (2007). Weak and strong sustainability in the SEEA: concepts and measurement. Ecological Economics, 61
 (4). pp. 617-626. Available from <u>http://eprints.lse.ac.uk/3058/1/Weak\_and\_strong\_sustainability\_in\_the\_SEEA\_%28LSERO%29.pdf</u> (accessed 8 September 2014).

the SEEA-CF which provides a useful statistical framework to measure natural capital using the asset and the physical flow accounts.

- Furthermore, a joint UNECE/Eurostat/OECD Working Group on Statistics on B.30 Sustainable Development<sup>131</sup> reached a common understanding on the principles of how to measure sustainability and started to develop a small core set of indicators. The outcome of this work is presented in the publication, Measuring Sustainable Development.<sup>132</sup> To follow up on this work, a Joint UNECE/Eurostat/OECD Task Force on Measuring Sustainable Development (TFSD) was created, implicitly linked to and inspired by other initiatives such as "GDP and Beyond"<sup>133</sup> (European Commission), "Better Life Initiative: Measuring Well-being and Progress" (OECD) and the Sponsorship Group on "Measuring Progress, Well-being and Sustainable Development"<sup>134</sup> (European Statistical System).
- The Task Force published a report in 2014<sup>135</sup> presenting recommendations of the **B.31** Conference of European Statisticians on measuring sustainable development. The publication conveyed key messages about measuring sustainable development, the need for harmonization, and proposed a procedure to select potential indicators on transboundary impacts. It included a measurement framework aiming to link the SDI sets currently produced by national and international statistical organizations, and provided a basis for formulating a list of potential indicators. Three conceptual dimensions and 20 themes were distinguished covering environmental, social and economic aspects of sustainable development. Based on the measurement framework, a methodology to derive three indicator sets was proposed: a large set of 60 indicators selected on a conceptual basis; a large set of 90 indicators selected on a thematic basis including more detailed policy relevant indicators; and a small set of 24 potential indicators to communicate the main messages more efficiently to policymakers and the general public. Although the proposed sustainability themes are considered universal, there is scope for selecting country-specific indicators. An important conclusion in the report was that SDI sets should reflect the transboundary impacts of sustainable development, by highlighting

http://www.unece.org/fileadmin/DAM/stats/publications/Measuring\_sustainable\_development.pdf (accessed 13 October 2014). <sup>133</sup> Commission of the European Communities (2009). "GDP and Beyond". Available from <u>http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0433:FIN:EN:PDF</u> (accessed 1 August 2013).
 <sup>134</sup> European Statistical System (2011). "Measuring Progress, Well-being and Sustainable Development". Available from

<sup>&</sup>lt;sup>131</sup> United Nations Economic Commission for Europe (2014). Statistics on Sustainable Development. Available from http://www.unece.org/stats/sustainable-development.html (accessed 11 September 2014). <sup>2</sup> UNECE/OECD/Eurostat (2009). Measuring Sustainable Development. Available from

http://ec.europa.eu/eurostat/documents/42577/43503/SpG-Final-report-Progress-wellbeing-and-sustainable-deve (accessed 18 June 2015). <sup>135</sup> United Nations Economic Commission for Europe (2014). "Conference of European Statisticians Recommendations on Measuring Sustainable Development". Available from http://www.unece.org/fileadmin/DAM/stats/publications/2013/CES\_SD\_web.pdf (accessed 10 September 2014).

how a country in the pursuit of the well-being of its citizens may affect the well-being of citizens of other countries.

- B.32 The natural capital approach can be applied to different levels. Fundamental concepts such as strong and weak sustainability rely on the assessment of the stocks and flows of the different types of capital in any given territory, but methodological difficulties in measuring the different components of natural capital and its services can explain the slow progress in this matter. The natural capital approach is a strong foundation for structuring physical data without the need for monetary valuation, particularly to produce data about stocks and flows. Currently, statistical production based on monetary value appears to be scarce. Supplementary methodological problems arise from the choice of variables to be integrated into the stocks and services from nature, given the current incomplete scientific knowledge of many ecosystem dynamics and also given the effect of the permanent interrelations between nature and human activity.
- B.33 Statistical frameworks that enable monitoring of the amount and quality of natural assets (in spite of limitations relating to measurement) are therefore an invaluable tool for assessing and assigning relative importance to society's natural capital base. Natural capital puts the accent on the stocks of assets that need to be informed, as opposed to paying too much attention to measuring flows (i.e., pollutants), a long requested necessity for natural resource intensive countries.

### The Ecosystem Approach

- B.34 The ecosystem approach was originally conceived as the strategic concept for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way,<sup>136</sup> as opposed to per individual parts of the systems. A more holistic approach, where parts interacting together constantly modify everything else, the ecosystem view integrally considers spatially defined units (basins, forest, marine, dryland, etc.) at the local, national or global levels, applying appropriate scientific methodologies.
- B.35 The ecosystem approach has been used mostly for integrated natural resources management (forests, river basins, etc.) and more recently for integrated assessment purposes.

<sup>&</sup>lt;sup>136</sup> Convention on Biological Diversity, COP 5 Decision V/6, paragraph A.1. Available from <u>http://www.cbd.int/decision/cop/?id=7148</u> (accessed 23 November 2013).
- B.36 The assessment perspective has been implemented in the Millennium Ecosystem Assessment called for by the United Nations in 2001. The Millennium Ecosystem Assessment<sup>137</sup> uses an innovative framework that considers both the ecosystem and its services (provisioning, regulating, supporting and cultural). It reports on the status of 24 services, categorizing the ones that are in debt, identifying where stocks are running short and when the fabric of life is being compromised.
- B.37 The Millennium Ecosystem Assessment did not present a matrix for organizing their findings, but used 10 ecosystem categories and sub-categories for reporting the findings on different aspects and with distinct emphases. These reporting categories contain a number of ecosystems, and they are not mutually exclusive, as their areas can and do overlap. Ecosystems within each reporting category<sup>138</sup> share a suite of biological, climatic and social factors that tend to differ across categories. Within each category of ecosystems, an exhaustive global assessment is presented which includes ecosystem quality, changes in the ecosystem services produced and ecosystem trends. These reporting categories created by the Millennium Ecosystem Assessment, as well as its conceptual understanding of the relations between people and ecosystems, <sup>139</sup> showed potential first as a possible structuring set of ecosystem types, and finally as a rich conceptual construct behind the structure of the FDES 2013.
- B.38 As a conceptual construct, this approach sets out to value and recognize ecosystem services that would otherwise not be explicitly acknowledged and accounted for. It is based on the application of appropriate scientific methodologies, focused on levels of biological organization, which encompass the essential structure, processes, functions and interactions among organisms and their environment. It recognizes humans, with their cultural diversity, as an integral component of many ecosystems. As such, in principle it is realistic in promoting understanding of the environment and assessing the complex nature of interactions among the different components of the ecosystem. It delineates the environment into spatially recognizable units that are influenced by associated seasonality and flora, along with physical data such as elevation, humidity and drainage. However, the focus of the ecosystem approach is designed to trigger management interventions, which must invariably be carried out in an economic and political context. Consequently it has also attracted economic and political significance.

<sup>&</sup>lt;sup>137</sup> The objective of this assessment was to provide a clear, scientific picture of the current state of the Earth's ecosystems at multiple scales, deepening understanding of the relationship and linkages between ecosystems and human well-being, including economic, social and cultural aspirations (see Millennium Ecosystem Assessment (2005). "Ecosystems and Human Wellbeing: Synthesis", Washington D.C., Island Press. Available from. <u>http://www.millenniumassessment.org/documents/document.356.aspx.pdf</u> (accessed 9 August 2013)).

<sup>&</sup>lt;sup>139</sup> Ibid.

- B.39 The ecosystem approach is therefore an important conceptual framework that can be used in environment statistics to model the structure and contents of the information to be produced by any given country or at any scale. As such, the ecosystem approach embodies a compelling logic to which the national and global statistical systems must respond and reverberate through the economic, social and political spheres to ensure legitimate planetary awareness. The ecosystem approach is therefore a significant input into the development of the FDES, even though, for reasons of practicality at this point in time, its replication as the principal organizing statistical logic within the FDES would not make for success in the implementation of this Framework.
- B.40 Integrating the ecosystems approach, and the natural capital concept, The Economics of Ecosystems and Biodiversity (TEEB) study was set up in 2007 to assess the global economic costs of ecosystem degradation and biodiversity loss and to recommend solutions to policy makers, administrators, businesses and individuals. As such, it underscored economic and political characteristics. The study revealed that ecosystems are in fact invisible and that losses accruing to them are therefore largely invisible, e.g., loss of biodiversity is a major cause of loss of services of an ecosystem. These losses to the ecosystems are treated as externalities costs arising from activities that are not accruing to the persons or organizations carrying out the activities. Over time, these represent a significant diminution of natural capital. According to UNEP these losses "hurt the poor most because their livelihoods and incomes depend most on ecosystem services".<sup>140</sup>
- B.41 The FDES 2013 takes conceptual foundation in both the natural capital and the ecosystem approaches, not necessarily as its structural backbone but as complementary ways of thinking about and designing the content and building blocks of the components, topics and sub-topics that are contained in the FDES.

# Evolution of frameworks for environment statistics and environmental-economic accounting

### Environment statistics and indicator frameworks

<sup>&</sup>lt;sup>140</sup> United Nations Environment Programme (2010). "Our Planet, September 2010". Available from <u>http://www.unep.org/pdf/OP\_sept/2010/EN/OP-2010-09-EN-FULLVERSION.pdf</u> (accessed 5 August 2013).

B.42 Over the years, rising environmental concerns have served as a trigger for the generation of structured frameworks for identifying and arranging environment statistics that could adequately help the definition and the monitoring of policy goals and targets, and organize information on the environment and its sustainability. Following is a review of the major environment statistics and indicator frameworks which have relevance to the FDES formulation.

### The Stress-Response framework and its derivates

- B.43 The stress-response approach was developed in recognition of the inadequacy of the media approach which described the processes of environmental change by disaggregating them into the different environmental media (land, water, air, etc.). In an attempt to organize environmental data into a more structured framework, it focused on the impacts of human intervention within the environment (stress) and the environment's subsequent transformation (environmental response). The original approach was developed by Statistics Canada in 1979 as a "Structural Framework for the S-RESS".<sup>141</sup> The stress-response approach relates a set of activities that exert stress on the environment (such as waste generation, extraction of natural resources and the production of hazardous substances) to the following data categories:
  - i. Measures of stressors, that is, of human and natural activities which possess the potential to degrade the quality of the natural environment, to affect the health of man, to threaten the survival of species, to place pressures on non-renewable resources, and to cause a deterioration in the quality of human settlements;
  - ii. Measures of stress, that is, of the elements that place pressures on and contribute to the breakdown of the natural and human-made environment such as the emission of pollutants;
  - iii. Measures of environmental response, that is, of the observed effects of stress on the natural and human-made environment;
  - iv. Measures of collective and individual response, that is, of human's reactions to environmental changes such as environmental protection and conservation; and
  - v. Measures of stocks, that is of the stocks of natural resources, human-made structures and potentially hazardous substances.

<sup>&</sup>lt;sup>141</sup> Rapport, David and Friend, Anthony (1979). "Towards a Comprehensive Framework for Environment Statistics: a Stress-response Approach", Ottawa, Statistics Canada.

- B.44 Work on the stress-response framework culminated in the introduction of the S-RESS framework which was later adapted and modified to be used as a similar sequence of columns in the main matrix of the 1984 FDES.
- B.45 The 1984 FDES framework was designed to reflect the sequence of action, impact and reaction that could trace the relationships among social and economic activities and natural events, their effects on the environment and the responses to these effects by public organizations and individuals. The FDES was used by many countries and was rendered operational in the UNSD's data collection for environment statistics at international level. Its main structure arranged environmental media as rows and positioned the sequence adapted from the stress-response on the columns, thus positioning topics on the resulting cells. These environment statistics topics were further developed to more disaggregated levels in annexes and separate publications.<sup>142</sup> One important shortcoming of the FDES was that practitioners and users could assume linearity in the relationships among the different stages of the sequence.
- B.46 Another of the environmental frameworks that has been widely used since the development of the FDES is the PSR framework. The PSR is itself an adaptation of the S-RESS framework, which was the culmination of work on the stress-response framework. The PSR framework basically recognized that human activities exert pressures (such as pollution emissions or land use changes) on the environment, which can in turn induce changes in the state of the environment (e.g., changes in ambient pollutant levels, habitat diversity, water flows, etc). Society then responds to these changes in pressures or state with environmental and economic policies and programmes intended to prevent, reduce or mitigate the pressures and/or environmental damage. The responses form a feedback loop to pressure, through human activities. In a wider sense, these steps form part of an environmental policy cycle that includes problem perception, policy formulation, and monitoring and policy evaluation.<sup>143</sup>
- B.47 PSR frameworks are useful for classifying and reporting existing data and the indicators that are derived from them are functional and well known. However, they are unable to reveal what statistical topics or even variables could be missing. Additionally, while

<sup>&</sup>lt;sup>142</sup> United Nations Statistics Division (1984). "A Framework for the Development of Environment Statistics". Available at <a href="http://unstats.un.org/unsd/environment/fdes.htm">http://unstats.un.org/unsd/environment/fdes.htm</a> (accessed 18 October 2013). United Nations Statistics Division (1988). "Concepts and Methods of Environment Statistics: Human Settlements Statistics – A Technical Report". Available at

http://unstats.un.org/unsd/publication/SeriesF/SeriesF\_51E.pdf (accessed 18 October 2013). United Nations Statistics Division (1991). "Concepts and Methods of Environment Statistics: Statistics of the Natural Environment – A Technical Report". Available at <u>http://unstats.un.org/unsd/publication/SeriesF/SeriesF\_57E.pdf</u> (accessed 18 October 2013).

<sup>&</sup>lt;sup>143</sup> Organisation for Economic Cooperation and Development (1993). Environment Monographs, No. 83. "OECD Core set of Indicators for Environmental Performance Reviews".

PSR-type frameworks tend to focus on the harmful aspects of the human-ecosystem relationship, they do not distinguish between beneficial and harmful stressors and impacts.<sup>144</sup> PSR frameworks also tend to suggest or at least have been interpreted as stating linear relationships in the human activity-environment interaction. This serves to obstruct the view of more complex relationships in ecosystems and in environment-economy interactions.

- B.48 A critical organizational development which intervened in the development of these frameworks and which influenced their development was the setting up of the United Nations CSD. Organized under the aegis of Agenda 21 as a tool for systematizing and representing the interrelationships encompassed by sustainable development, another early indicator framework for environment statistics, the Driving force State Response (DSR) Framework was developed. The DSR framework, which was derived from the PSR framework, was arranged according to the Agenda 21 chapters. Here, indicators were classified according to the "Driving force", "State" and "Response" characteristics, where "driving force" represented human activities, processes or patterns that impact on sustainable development; "state" indicators represented societal actions aimed at moving towards sustainable development.
- B.49 In practice, some countries found that the DSR framework was inadequate for the social, economic and institutional dimensions of sustainable development because of the length of the suggested working list of indicators and the unavailability of some national indicator sets. Furthermore, the indicators of sustainable development, organized in the economic, social and environment sections, do not facilitate its needed integration and therefore do not present a cohesive picture, but are rather a series of separate lists. Consequently, the use of the DSR framework was discontinued within the CSD work on SDIs.
- B.50 As a successor approach, in 2001, the CSD published its "Indicators of Sustainable Development: Guidelines and Methodologies", codifying the output of its work programme on indicators of sustainable development. This publication provided a detailed description of key sustainable development themes and sub-themes, proposing a framework and core set of indicators. This was a framework of 15 themes and 38 sub-

<sup>&</sup>lt;sup>144</sup> United Nations Statistics Division, Expert Group Meeting on the Revision of the FDES (2010). "Criteria for a Conceptual Framework for Developing Environment Statistics", Robert Smith and Michael Bordt, Statistics Canada. Available from http://unstats.un.org/unsd/environment/fdes/EGM1/EGM-FDES.1.14-

Criteria%20for%20a%20Conceptual%20Framework%20for%20Developing%20Environment%20Statistics%20-%20Robert%20Smith%20&%20Michael%20Bordt.pdf (accessed 27 November 2013).

themes for guiding national indicator development beyond the year 2001. Even though this organization was not done strictly along Agenda 21 chapters, its strength was that it managed to better satisfy its original intent by putting more emphasis on policy-oriented topics.

- B.51 More recently in 2007, a non-linear matrix-type of structure was adopted by the CSD, where each indicator could be relevant for different dimensions and themes of sustainable development. The division of indicators along the lines of four 'pillars' (social, economic, environmental and institutional) is no longer explicit in the newly revised core set or SDIs. This change emphasizes the multi-dimensional nature of sustainable development and reflects the importance of integrating its pillars. Consequently, new cross-cutting themes such as poverty and natural hazards were introduced and existing cross-cutting themes such as consumption and production patterns are better represented.
- B.52 The DPSIR framework is yet another framework that attempts to provide a logical organization to the different components of the environment:<sup>145</sup> Following are its components:

D - *Driving force* is underlying factors influencing a variety of relevant variables. P - *Pressure* indicators describe the variables which directly cause (or may cause) environmental problems.

S - *State* indicators show the current condition of the environment.

I - *Impact* indicators describe the ultimate effects of changes of state.

R - *Response* indicators demonstrate the efforts of society (i.e., politicians, decision-makers) to solve the problems.

B.53 Here, Driving force is the social, demographic and economic developments in societies and the corresponding changes in lifestyles and overall levels of consumption and production patterns. The major driving forces are population growth and changes in needs and activities of individuals. These driving forces provoke changes in overall levels of production and consumption and thereby exert pressure on the environment. The exerted pressure may manifest itself in various ways, e.g., the excessive use of natural resources; changes in land use; and emissions (of chemicals, waste, radiation, noise) to air, water and land. The Pressure component gives information on emissions, application of chemical and biological agents, and the use of land and other resources. The pressures exerted by society's patterns of production and consumption are subsequently transformed in a variety of natural processes that may result in changes in

<sup>&</sup>lt;sup>145</sup> European Environment Agency (2003). "Environmental Indicators: Typology and Use in Reporting". Chapter 3.1. Available from <u>http://www.iwrms.uni-jena.de/fileadmin/Geoinformatik/projekte/brahmatwinn/Workshops/FEEM/Indicators/EEA\_Working\_paper\_DPSIR.pdf</u> (accessed 4 November 2013).

the state of the environment. The State component gives information on the level, quality and/or quantity of physical phenomena, biological phenomena and chemical phenomena in a given area at a given point in time. Changes in the state of the environment may have environmental and economic impacts on ecosystems, and eventually on human health and the economic and social welfare of a society. The Impact component describes the relevance of changes in the state of the environment, as well as the corresponding implications for ecosystems, the economy and human well-being and health. Response refers to the reaction of the government, institutions, groups of people and individuals to undesired impacts on the environment in order to prevent, mitigate, ameliorate or adapt to changes in the environment. For example, responses may seek to change and/or redirect prevailing trends in consumption and production of goods and services, improve the monitoring and control of pollutants or to develop cleaner technologies.

- B.54 The Global (regional, national) Environment Outlooks (GEOs), led by UNEP, are produced using the DPSIR framework for analysis and involve stakeholders and collaborating academic and research centres which perform the assessment according to a documented methodology. In general, the core indicators data matrix is organized using a theme-issue row structure, with main themes being land, forest, biodiversity, freshwater, atmosphere, coastal and marine areas, disasters and urban areas.
- B.55 The evolution of these frameworks and their sequences has influenced the production of environmental statistics and indicators over the years at the global and national levels. Their contents, structure and conceptual underpinning, as well as the experiences of practitioners working with them in real life have been analyzed and considered partially and integrally as they can and have contributed to the revision of the FDES, particularly to the shape of its new structure and the scope of its contents.

## The System of Environmental-Economic Accounting (SEEA)

B.56 In 1987 the report of the Brundtland Commission, Our Common Future, made clear the links between economic and social development and the environment's capacity. Shortly afterwards, in 1992, the recommendations of the UN Conference on Environment and Development "Earth Summit" contained in Agenda 21 (UN 1992)<sup>146</sup> recommended that countries implement environmental-economic accounts at the earliest date.

<sup>&</sup>lt;sup>146</sup> United Nations "Agenda 21", (United Nations Conference on Environment & Development), Rio de Janeiro, Brazil, 3 to 14 June 1992. Available from <u>http://sustainabledevelopment.un.org/content/documents/Agenda21.pdf</u> (accessed 17 October 2013).

- B.57 In response, the UNSD published the handbook of national accounting – Integrated Environmental and Economic Accounting (UN 1993)<sup>147</sup>, commonly referred to as the SEEA. This handbook was issued as an "interim" version of work in progress since the discussion of relevant concepts and methods had not come to a final conclusion.
- B.58 As a result of the publication of the SEEA handbook, several developing and developed countries started experimenting on the compilation of SEEA-based data. The London Group on Environmental Accounting was created in 1994 under the auspices of the United Nations Statistical Commission to provide a forum for practitioners to share their experiences on developing and implementing environmental-economic accounts. Increased discussions on concepts and methods of environmental-economic accounting, accompanied with country experiences led to an increasing convergence of concepts and methods for various modules of the SEEA.
- B.59 The publication, Integrated Environmental and Economic Accounting - An Operational Manual (UN 2000)<sup>148</sup>, was published by UNSD and UNEP based on material prepared by the Nairobi group (a group of experts established in 1995 from national and international agencies and non-governmental organizations). This publication reflected the on-going discussion following the publication of the SEEA in 1993 and provided step-by-step guidance on the implementation of the more practical modules of the SEEA and elaborated the uses of integrated environmental and economic accounting in policy making.
- B.60 In parallel with this work, the international agencies in cooperation with the London Group worked on a revision of the 1993 SEEA. The revision process was carried out through a series of expert meetings and was built upon a wide consultation process. The revised SEEA, SEEA-2003, represented a considerable step forward in terms of breadth of material and harmonisation of concepts, definitions and methods in environmental and economic accounting. However, in a number of places the SEEA-2003 presented a number of different methodological options and also presented a range of country examples showing varying country practices. Thus the SEEA-2003 was never formally adopted as an international statistical standard and the SEEA was not recognised as a statistical system in its own right. Nonetheless, in general the SEEA-2003 has provided a

<sup>&</sup>lt;sup>147</sup> United Nations Statistics Division (1993). "Integrated Environmental and Economic Accounting (interim version)". Available from http://unstats.un.org/unsd/publication/SeriesF/SeriesF\_61E.pdf (accessed 17 October 2013). <sup>148</sup> United Nations Statistics Division (2000). "Integrated Environmental and Economic Accounting – An Operational Manual". Available from

http://unstats.un.org/unsd/publication/SeriesF/SeriesF\_78E.pdf (accessed 21 October 2013).

well-accepted and robust framework for the compilation of environmental and economic accounts that has been used by many countries around the world.

- B.61 Recognising the ever increasing importance of information on the environment and the need to place this information in an economic context that could be understood by central policy makers, the United Nations Statistical Commission agreed at its 38th session in February 2007 to start a second revision process. This process was managed under the auspices of the United Nations Committee of Experts on Environmental and Economic Accounting (UNCEEA). It was recognised that the content of the SEEA-2003 was substantially agreed in terms of both scope and treatment and hence the focus of the revision was to remain largely on those specific areas of the SEEA-2003 in which the level of understanding and agreement needed to be increased and agreed treatments determined. The London Group was given charge of the 21 issues identified for the revision of the SEEA. The newly formed Oslo Group on Energy Statistics was also involved in the discussion of issues pertaining to energy. The SEEA-CF represents the major outcome of the process.
- B.62 During the revision process it became clear that there remained certain aspects of the SEEA-2003 on which it was unlikely that agreement could be reached, in particular concerning the measurement of degradation and its valuation. Consequently, the United Nations Statistical Commission determined that the revision of the SEEA should proceed to develop a Central Framework covering those issues on which there was general international agreement and, also to develop material to cover those aspects on which agreement was not likely to be reached within the timeframes available and on which ongoing research and discussion would be required.
- B.63 Global consultation on the SEEA CF was completed in 2011 and it was adopted by the United Nations Statistical Commission, at its 43rd Session in 2012, as the "initial version of the international standard for environmental-economic accounts, subject to further revision, acknowledging that further improvements on measurement are necessary on specific issues"<sup>149</sup>. The SEEA CF was published in February 2014<sup>150</sup>.

<sup>&</sup>lt;sup>149</sup> United Nations Statistical Commission (2012). "Report on the Forty-Third Session, Economic and Social Council, Official Records 2012, Supplement No. 4". Available from <u>http://unstats.un.org/unsd/statcom/sc2012.htm</u> (accessed 10 September 2014).

<sup>&</sup>lt;sup>150</sup> United Nations, European Union, Food and Agriculture Organization of the United Nations, International Monetary Fund, Organisation for Economic Co-operation and Development, and World Bank (2014). "System of Environmental-Economic Accounting 2012- Central Framework". Available from <u>http://unstats.un.org/unsd/envaccounting/seeaRev/SEEA\_CF\_Final\_en.pdf</u> (accessed 10 September 2014).

- B.64 The SEEA-CF covers the interactions between the economy and the environment following an accounting structure similar to that of the SNA and uses concepts, definitions and classifications consistent with the SNA. A satellite account of the central SNA, the SEEA-CF incorporates flows between the economy and the environment, and highlights environmental activities and expenditures that are not shown explicitly in conventional national accounts presentations. The SEEA-CF also incorporates environmental assets both inside and outside of the scope of conventional economic measurement, and records stocks of environmental assets and changes in these stocks over time.
- B.65 The SEEA-CF is comprised of the following types of accounts: (i) supply and use tables in physical and monetary terms showing flows of natural inputs, products and residuals; (ii) asset accounts for individual environmental assets in physical and monetary terms showing the stock of environmental assets at the beginning and end of each accounting period and the changes in the stock; (iii) a sequence of economic accounts showing all economic flows between economic units; and (iv) functional accounts which highlight economic activities undertaken for environmental purposes.
- B.66 A second area of work complementing SEEA-CF is focused on accounting for the environment from the perspective of ecosystems, as presented in the SEEA Experimental Ecosystem Accounting, which is not an international standard. The unedited, white cover publication<sup>151</sup> states that ecosystem accounting is a relatively new and emerging field dealing with integrating complex biophysical data, tracking changes in ecosystems and linking those changes to economic and other human activity. Ecosystem accounting is a coherent and integrated approach to the assessment of the environment through the measurement of ecosystems, and measurement of the flows of services from ecosystems into economic and other human activity. The scale of ecosystem accounting may vary from specific land cover types, such as forests, to larger integrated areas such as river basins, and includes areas that may be considered relatively natural and those that may be heavily influenced by human activity, such as agricultural areas<sup>152</sup>. Ecosystem accounting goes beyond other approaches to economic and other human activity.

<sup>&</sup>lt;sup>151</sup> European Commission, Organisation for Economic Co-operation and Development, United Nations and World Bank (2013). "System of Environmental-Economic Accounting 2012: Experimental Ecosystem Accounting". White cover publication, pre-edited text subject to official editing; page ix. Available from <u>http://unstats.un.org/unsd/envaccounting/eea\_white\_cover.pdf</u> (accessed 10 September 2014).
<sup>152</sup> Ibid, page 1.

- **B.67** Also during the revision process, a need emerged for material covering potential extensions and applications of SEEA-based datasets, with the aim of promoting and supporting the widespread adoption of the SEEA among official statisticians, researchers and policy makers. To this end, the SEEA Applications and Extensions has been developed<sup>153</sup>. SEEA Applications and Extensions provides potential compilers and users of SEEA based environmental- economic accounts with material to show how this information can be used in decision making, policy review and formulation, analysis and research. SEEA Applications and Extensions is intended to provide a bridge between compilers and analysts allowing each to recognise the potential uses and the related measurement considerations. SEEA Applications and Extensions is a summary of the most common applications and extensions and does not provide complete coverage of all materials that may be relevant in the communication and dissemination of information on environmental-economic accounts. Since it is a summary guide to the use of SEEA based data, SEEA Applications and Extensions is not a statistical standard. The choice of topics and examples is intended to provide an indication of the possibilities and does not represent a basis for standardised reporting at national or international level.
- B.68 During the almost two decades of its evolution, the physical accounts have gained more importance in the development of the SEEA; therefore the SEEA has become one of the major users and uses of environment statistics. The methodological work carried out within the process of the revision of the SEEA has produced concepts, definitions and classifications that are also relevant for and have been taken into consideration in the revision of the FDES.

<sup>&</sup>lt;sup>153</sup> European Commission, Food and Agriculture Organization of the United Nations, Organisation for Economic Co-operation and Development, United Nations and World Bank (2013). "System of Environmental-Economic Accounting 2012: Applications and Extensions". White cover publication, pre-edited text subject to official editing; page vii. Available from <u>http://unstats.un.org/unsd/envaccounting/ae\_white\_cover.pdf</u> (accessed 11 September 2014).

# Annex C: Multilateral Environmental Agreements (MEAs)

- C.1 MEAs address, via international cooperation, environmental problems, especially those which have a transboundary nature or are global in scope. This Annex presents the most relevant global MEAs as they relate to the field of environment statistics presented in alphabetical order. Most environmental problems have a transboundary nature and often a global scope, and can only be addressed effectively through international cooperation. Therefore, it is of utmost importance to promote measures at international level to deal with regional or worldwide environmental problems, and in particular combating climate change.<sup>154</sup>
- C.2 For each of the selected MEAs, a synthetic depiction is presented, followed by a description of its implications in terms of potential demand for data and statistics. It is usually the case that for the most relevant MEAs, participant or signatory countries face the need to periodically report on progress either on a mandatory or voluntary basis.

## **Basel Convention**

- C.3 The late 1980s witnessed greater enforcement of environmental regulations in industrialized countries and consequent greater pressure to find environmentally responsible means of disposing of hazardous waste. This was a major impetus for drafting and adopting the Basel Convention.<sup>155</sup>
- C.4 During its first decade (1989-1999), the Basel Convention was principally devoted to setting up a framework for controlling the transboundary movements of hazardous wastes across international borders. It also developed criteria for "environmentally sound management (ESM)" (of such wastes) and established a Control System, based on prior written notification. In the 2000-2010 decade, the focus shifted from remedial to preventive aspects, with the following areas of concern being explicitly recognized:
  - i. Prevention, minimization, recycling, recovery and disposal of hazardous and other wastes, taking into account social, technological and economic concerns;
  - ii. Active promotion and use of cleaner technologies and production methods;
  - iii. Further reduction of movement of hazardous and other wastes;
  - iv. Prevention and monitoring of illegal traffic;

<sup>&</sup>lt;sup>154</sup> European Commission. "Environment – International Issues, Multilateral Environment Agreements". Available from <u>http://ec.europa.eu/environment/international\_issues/agreements\_en.htm</u> (accessed 19 April 2013).

<sup>&</sup>lt;sup>155</sup> Secretariat of the Basel Convention. Available from <u>http://www.basel.int</u> (accessed 30 November 2013).

- v. Improvement of institutional and technical capabilities through technology when appropriate especially for developing countries and countries with economies in transition;
- vi. Further development of regional centres for training and technology transfer;
- vii. Enhancement of information exchange, education and awareness-raising in all sectors of society; and
- viii. Cooperation and partnership with the public authorities, international organizations, the industry sector, non-governmental organizations and academic institutions.
- C.5 The Convention requires all Parties to submit information regarding wastes through annual reports to the Secretariat in a questionnaire format, covering the status of information in Part 1 and annual reporting in Part 2. To facilitate the national reporting the Secretariat has developed the Electronic Reporting System of the Basel Convention.<sup>156</sup> A data visualization tool was created to show, in an interactive way, data provided by the Parties to the Basel Convention on generation and transboundary movements of hazardous wastes and other wastes.<sup>157</sup>

## **Convention on Biological Diversity (CBD)**

- C.6 The CBD entered into force on 29 December 1993.<sup>158</sup> This Convention arose from a growing commitment, at the international level, to sustainable development. It represented a dramatic step forward in the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising from the use of genetic resources. The Convention requires Parties to present reports to the Conference of the Parties on measures that they have taken for the implementation of the provisions of the Convention and their effectiveness in meeting the objectives of the Convention. Guidelines for the national reports and many resource materials for the preparation of these reports can be found on the Convention's website.<sup>159</sup>
- C.7 At the 10<sup>th</sup> meeting of the Conference of the Parties, held in 2010, the Strategic Plan for Biodiversity 2011-2020 was adopted.<sup>160</sup> This Strategic Plan consists of an overarching

http://www.basel.int/Countries/NationalReporting/ElectronicReportingSystem/tabid/3356/Default.aspx (accessed 13 October 2014).

<sup>&</sup>lt;sup>156</sup> Basel Convention. Electronic Reporting System of the Basel Convention. Available from

<sup>&</sup>lt;sup>157</sup> Basel Convention. Data Visualization Tool for the Basel Convention on the Generation, Export and Import of Hazardous Wastes and Other Wastes. Available from <u>http://www.basel.int/Countries/NationalReporting/DataVisualizationTool/tabid/3216/Default.aspx</u> (accessed 13 October 2014).

<sup>&</sup>lt;sup>158</sup> Convention on Biological Diversity. History of the Convention. Available from <u>http://www.cbd.int/history/</u> (accessed 24 September 2014).

 <sup>&</sup>lt;sup>159</sup> Convention on Biological Diversity. Background. Available from <u>https://www.cbd.int/reports/national.shtml</u> (accessed 15 October 2014).
 <sup>160</sup> Convention on Biological Diversity. Strategic Plan for Biodiversity 2011-2020, including Aichi Biodiversity Targets. Available from <a href="http://www.cbd.int/sp/">http://www.cbd.int/reports/national.shtml</a> (accessed 15 October 2014).

framework of biodiversity, which includes 20 Aichi Biodiversity Targets organized under five strategic goals:

- i. Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society;
- ii. Reduce the direct pressures on biodiversity and promote sustainable use;
- iii. To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity;
- iv. Enhance the benefits to all from biodiversity and ecosystem services; and
- v. Enhance implementation through participatory planning, knowledge management and capacity-building.

The goals and targets comprise both aspirations for achievement at the global level, and a flexible framework for the establishment of national or regional targets. The global biodiversity indicators developed and brought together by the Biodiversity Indicators Partnership are the primary mechanism for monitoring progress towards the Strategic Plan and the Aichi Biodiversity Targets. In the first instance 17 of the 20 Aichi targets are covered by at least one of the BIP indicators. In the coming years the Partnership will endeavour to fill gaps and expand its set of indicators to ensure that comprehensive framework of global indicators is available to monitor progress towards the suite of Aichi Biodiversity Targets.<sup>161</sup>

## Convention on Fishing and Conservation of the Living Resources of the High Seas

C.8 The Convention on Fishing and Conservation of the Living Resources of the High Seas is an agreement that was designed to solve the problems involved in the conservation of living resources of the high seas through international cooperation, considering that because of the development of modern technology some of these resources are in danger of being overexploited. The summary of the provisions of the convention are<sup>162</sup>: all States have a duty to adopt, or cooperate with other States in adopting, measures necessary for the conservation of the living resources of the high seas (art. 1). Such measures should be formulated with a view to securing a supply of food for human consumption (art. 2). Coastal States have special interests in the high seas adjacent to their territorial seas and may unilaterally adopt conservation measures for such areas which shall be valid for other States if there is an urgent need for such measures, and if the measures are based on scientific findings and do not discriminate against foreign fishermen (arts. 6 and 7). The

<sup>&</sup>lt;sup>161</sup> Biodiversity Indicators Partnership (2012). The Indicators. Available from <u>http://www.bipindicators.net/globalindicators</u> (accessed 26 September 2014).

<sup>&</sup>lt;sup>162</sup> United Nations, Treaty Collection, Volume 559, Page 285. Available from

https://treaties.un.org/doc/Publication/UNTS/Volume%20559/v559.pdf (accessed 11 September 2014).

convention was opened for signature on 29 April 1958 in Geneva and entered into force on 20 March 1966.<sup>163</sup> No indicators have been put forward for measuring the performance of this treaty.

# Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

- CITES is an international agreement between governments.<sup>164</sup> Its aim is to ensure that C.9 international trade in specimens of wild animals and plants does not threaten their survival. The trade is diverse, ranging from live animals and plants to a vast array of wildlife products derived from them. Levels of exploitation of some animal and plant species are high and the trade in them, together with other factors, such as habitat loss, is capable of heavily depleting their populations and even bringing some species close to extinction. Many wildlife species in trade are not endangered, but the existence of an agreement to ensure the sustainability of the trade is important in order to safeguard these resources for the future. Because the trade in wild animals and plants crosses borders between countries, efforts to regulate it require international cooperation to safeguard certain species from over-exploitation. CITES provides varying degrees of protection to more than 30,000 species of animals and plants, whether or not they are traded as live specimens. CITES entered into force on 1 July 1975. Countries adopt their own domestic legislation to ensure that CITES is implemented at the national level. Parties to CITES are required to submit reporting on legislative, regulatory and administrative measures taken to enforce its provisions. National reporting is intended to be supportive of the monitoring of the following objectives of CITES:
  - i. Ensure compliance with and implementation and enforcement of the Convention;
  - ii. Secure the necessary financial resources and means for the operation and implementation of the Convention; and
  - iii. Contribute to significantly reducing the rate of biodiversity loss by ensuring that CITES and other multilateral instruments and processes are coherent and mutually supportive.
- C.10 Each Party shall prepare periodic reports on its implementation of the present Convention and shall transmit to the Secretariat, including an annual report and a biennial report. The standard formats for these reports and guidelines for their preparation and submission can

<sup>&</sup>lt;sup>163</sup> United Nations, Treaty Collection, Chapter XXI, Law of the Sea, Convention on Fishing and Conservation of the Living Resources of the High Seas. Available from https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg\_no=XXI-3&chapter=21&lang=en (accessed 11 September 2014). <sup>164</sup> Text of the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Available from

http://www.cites.org/eng/disc/text.php (accessed 6 August 2013).

be found on the Convention's website.<sup>165</sup> CITES trade data are accessible via the CITES trade database on the CITES website.<sup>166</sup>

## Convention on the Conservation of Migratory Species of Wild Animals (CMS)

- C.11 The CMS or Bonn Convention is an intergovernmental treaty that aims to conserve terrestrial, aquatic and avian migratory species throughout their range.<sup>167</sup> Concluded under the aegis of UNEP, it is concerned with the conservation of wildlife and habitats on a global scale. Its steadily growing membership includes Parties from Africa, Central and South America, Asia, Europe and Oceania.
- C.12 CMS Parties strive towards strictly protecting these animals, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them. Besides establishing obligations for each State joining the Convention, CMS promotes concerted action among the Range States of many of these species. CMS acts as a framework Convention. The Agreements may range from legally binding treaties to less formal instruments, such as Memoranda of Understanding, and can be adapted to the requirements of particular regions. The development of models tailored according to the conservation needs throughout the migratory range is a unique capacity of CMS.
- C.13 Submission of an annual report under specified guidelines is a requirement. This reporting covers imports, exports and re-exports of the animals covered under the Convention, including of manufactured products derived from those species. National Reports are the official documents by which countries report to the decision-making bodies of CMS and/or its instruments on the measures they have undertaken to implement the priorities of the instruments. National Reports provide an official record of national implementation of each instrument over time and collectively they draw the picture of the overall implementation of the instrument.<sup>168</sup> The CMS Family Online Reporting System is available on the CMS website.

# Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention)

<sup>&</sup>lt;sup>165</sup> Convention on International Trade in Endangered Species of Wild Fauna and Flora. Guidelines for the preparation and submission of CITES annual reports. Available from <u>http://cites.org/sites/default/files/eng/notif/2011/E019A.pdf</u> (accessed 15 October 2014).

<sup>&</sup>lt;sup>166</sup> Convention on International Trade in Endangered Species of Wild Fauna and Flora. CITES Trade Database. Available from <u>http://trade.cites.org/</u> (accessed 15 October 2014).

<sup>&</sup>lt;sup>167</sup> Convention on Migratory Species. About CMS. Available from <u>http://www.cms.int/en</u> (accessed 15 October 2014).

<sup>&</sup>lt;sup>168</sup> Convention on Migratory Species. National Reports. Available from <u>http://www.cms.int/en/documents/national-reports</u> (accessed 15 October 2014).

C.14 The Helsinki Convention on the Protection of the Marine Environment of the Baltic Sea Area was signed in 1992 by Czechoslovakia, Denmark, Estonia, the European Community, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden.<sup>169</sup> The Convention on the Protection of the Marine Environment of the Baltic Sea Area, 1992, entered into force on 17 January 2000.<sup>170</sup> The objective of this Convention was to establish a framework of regional cooperation in the Baltic Sea in order to reduce and prevent pollution in this region and promote the self-regeneration of its marine environment and preservation of its ecological balance. In accordance with the precautionary principle and the principles of the 'polluter pays' and sustainable management, the parties undertake to adopt legislative, administrative or other relevant measures to achieve this objective. In the Baltic Sea Action Plan, the Contracting Parties to the Helsinki Convention agreed to periodically evaluate whether the targets of the Action Plan have been met by using indicator based assessments. For this reason, HELCOM core indicators were introduced to regularly assess the status of the Baltic Sea marine environment against targets that reflect good environmental status.<sup>171</sup>

#### International Convention for the Prevention of Pollution from Ships (MARPOL)

- C.15 The International Convention for the Prevention of Pollution from Ships (MARPOL) is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. The MARPOL Convention was adopted on 2 November 1973 at IMO.<sup>172</sup> The Protocol of 1978 was adopted in response to a spate of tanker accidents in 1976-1977.<sup>173</sup> MARPOL has been updated by amendments through the years.
- C.16 The Convention includes regulations aimed at preventing and minimizing pollution from ships - both accidental pollution and that from routine operations - and currently includes six technical Annexes<sup>174</sup>: (i) Regulations for the Prevention of Pollution by Oil (entered into force 2 October 1983) -covers prevention of pollution by oil from operational measures as well as from accidental discharges; (ii) Regulations for the Control of

<sup>&</sup>lt;sup>169</sup> European Union, Treaties Office Database, Convention on the Protection of the Marine Environment of the Baltic Sea Area, 1992. Available  $from \ \underline{htp://ec.europa.eu/world/agreements/prepareCreateTreatiesWorkspace/treatiesGeneralData.do?step=0\&redirect=true&treatyId=543$ (accessed 11 September 2014).

<sup>)</sup> Ibid

<sup>&</sup>lt;sup>171</sup> HELCOM, Baltic Sea Environment Proceedings No. 136, HELCOM core indicators, Final report of the HELCOM CORESET project. Available from http://helcom.fi/Lists/Publications/BSEP136.pdf (accessed 11 September 2014). <sup>172</sup> IMO, International Convention for the Prevention of Pollution from Ships (MARPOL). Available from

 $<sup>\</sup>label{eq:http://www.imo.org/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-international-Convention-for-the-Prevention-of-Pollution-from-Ships-international-Convention-for-the-Prevention-of-Pollution-from-Ships-international-Convention-for-the-Prevention-of-Pollution-from-Ships-international-Convention-for-the-Prevention-of-Pollution-from-Ships-international-Convention-for-the-Prevention-of-Pollution-from-Ships-international-Convention-for-the-Prevention-of-Pollution-from-Ships-international-Convention-for-the-Prevention-of-Pollution-from-Ships-international-Convention-for-the-Prevention-of-Pollution-from-Ships-international-Convention-for-the-Prevention-of-Pollution-from-Ships-international-Convention-for-the-Prevention-of-Pollution-from-Ships-international-Convention-for-the-Prevention-of-Pollution-from-Ships-international-Convention-for-the-Pre$ (MARPOL).aspx (accessed 11 September 2014).

<sup>174</sup> Ibid

Pollution by Noxious Liquid Substances in Bulk (entered into force 2 October 1983) details the discharge criteria and measures for the control of pollution by noxious liquid substances carried in bulk and no discharge of residues containing noxious substances is permitted within 12 miles of the nearest land; (ii) Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form (entered into force 1 July 1992) -contains general requirements for the issuing of detailed standards on packing, marking, labelling, documentation, stowage, quantity limitations, exceptions and notifications; (iv) Prevention of Pollution by Sewage from Ships (entered into force 27 September 2003) contains requirements to control pollution of the sea by sewage; the discharge of sewage into the sea is prohibited, except when the ship has in operation an approved sewage treatment plant or when the ship is discharging comminuted and disinfected sewage using an approved system at a distance of more than three nautical miles from the nearest land; (v) Prevention of Pollution by Garbage from Ships (entered into force 31 December 1988) - deals with different types of garbage and specifies the distances from land and the manner in which they may be disposed of; the most important feature of the Annex is the complete ban imposed on the disposal into the sea of all forms of plastics; (vi) Prevention of Air Pollution from Ships (entered into force 19 May 2005) -sets limits on sulphur oxide and nitrogen oxide emissions from ship exhausts and prohibits deliberate emissions of ozone depleting substances; designated emission control areas set more stringent standards for SOx, NOx and particulate matter.

C.17 IMO performance indicators have been brought forward with the aim of achieving safe shipping, secure shipping, environmentally sound shipping, efficient shipping, sustainable shipping, adoption of the highest practicable standards, implementation of instruments and capacity-building.<sup>175</sup>

# Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade

C.18 The Rotterdam Convention is a multilateral treaty to promote shared responsibilities during the process of importation of hazardous chemicals.<sup>176</sup> Adopted in September 1998 in Rotterdam, this Convention promotes open exchange of information and calls on exporters of hazardous chemicals to: use proper labelling, include directions on safe

<sup>&</sup>lt;sup>175</sup> IMO, Council 105<sup>th</sup> Session, Agenda Item 3(a), Strategy and Planning, (a) Monitoring of performance-Review of data measured against the performance indicators. Available from

http://www.imo.org/KnowledgeCentre/ShipsAndShippingFactsAndFigures/Statisticalresources/Documents/IMO%20Performance%20indicators %20C\_105-3(a)-1[1].pdf (accessed 12 September 2014).

<sup>&</sup>lt;sup>176</sup> Text of the Rotterdam Convention. Available from

http://www.pic.int/TheConvention/Overview/TextoftheConvention/tabid/1048/language/en-US/Default.aspx (accessed 24 November 2013).

handling, and inform purchasers of any known restrictions or bans. It fosters shared responsibility and joint efforts of the Parties to the Convention in international trade in hazardous chemicals to protect human health and the environment. Signatory nations can decide whether to allow or ban the importation of chemicals listed in the treaty, and exporting countries are obliged to make sure that producers within their jurisdiction comply. The Convention provides for procedures concerning: banned or severely restricted chemicals; severely hazardous pesticide formulations; obligations regarding the import and export of chemicals; and Parties cooperation and information exchange.

C.19 The Convention requires all Parties to submit to the Secretariat, as soon as possible and in any event no later than nine months after the date of dispatch of a decision guidance document, their decision concerning the future import of a chemical listed under the Convention. The Secretariat has developed the following two options: an on-line import response form that guides users through each section and provides assistance in completing it such as pointing to further sources of information; and a Word version of the form and instructions.<sup>177</sup> A database of import responses can be found on the Convention website.<sup>178</sup> According to the Convention, any exported chemical that is banned or severely restricted under the Convention must be accompanied by an export notification. The standard form for export notification can be found on the Secretariat website.<sup>179</sup>

#### **Stockholm Convention on Persistent Organic Pollutants (POPs)**

C.20 The Stockholm Convention is an international environmental treaty, signed in 2001 and effective from May 2004, that aims to eliminate or restrict the production and use of POPs.<sup>180</sup> POPs are defined as "chemical substances that persist in the environment, bioaccumulate through the food web, and pose a risk of causing adverse effects to human health and the environment".<sup>181</sup> In 1995, the Governing Council of UNEP called for global action to be taken on POPs.

<sup>&</sup>lt;sup>177</sup> Secretariat for the Rotterdam Convention (2010). "Form and Instructions". Available from

http://www.pic.int/Procedures/ImportResponses/FormandInstructions/tabid/1165/language/en-US/Default.aspx (accessed 13 October 2014). <sup>178</sup> Secretariat for the Rotterdam Convention (2010). "Database of Import Responses". Available from

http://www.pic.int/Procedures/ImportResponses/Database/tabid/1370/language/en-US/Default.aspx (accessed 13 October 2014). <sup>9</sup> Secretariat for the Rotterdam Convention (2010). "Form and Instructions". Available from

http://www.pic.int/Procedures/ExportNotifications/FormandInstructions/tabid/1365/language/en-US/Default.aspx (accessed 13 October 2014). Text on the Stockholm Convention on POPs. Available from http://chm.pops.int/Convention/ConventionText/tabid/2232/language/en-<u>GB/Default.aspx</u> (accessed 25 November 2013). <sup>181</sup> UNEP, "Persistent Organic Pollutants". Available from <u>http://www.chem.unep.ch/pops/</u> (accessed 4 August 2013).

- C.21 Parties to the Stockholm Convention have agreed to a process by which persistent toxic compounds can be reviewed and added to the Convention, if they meet certain criteria for persistence and transboundary threat. A first set of new chemicals to be added to the Convention was agreed in May 2009. Compliance is monitored through required national reporting by Parties under the Convention. Reporting information relates to the initial 12 pollutants and the nine additional new pollutants, as well as to listed chemicals. The Convention requires each Party to report on the measures it has taken to implement the provisions of the Convention including statistical data on its total quantities of production, import and export of each chemicals listed in the Annex A and Annex B of the Convention every four years. Parties can submit their national reports through the Stockholm Convention Electronic Reporting System available online.<sup>182</sup>
- C.22 In pursuing the goal of promoting synergies among the Rotterdam Convention, the Basel Convention and the Stockholm Convention, commitment has been made to the establishment of a clearing house mechanism that would service the monitoring and information needs of all three of these Conventions.<sup>183</sup> The intent is that these synergies would foster sound chemicals management of the relevant pollutants over their life-cycles.

### The Convention on the Protection and Use of Transboundary Watercourses

C.23 The Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) was adopted in Helsinki in 1992 and entered into force in 1996.<sup>184</sup> Almost all countries sharing transboundary waters in the region of the United Nations Economic Commission for Europe (UNECE) are Parties to the Convention. The Water Convention strengthens transboundary water cooperation and measures for the ecologically-sound management and protection of transboundary surface waters and groundwater. The Convention fosters the implementation of integrated water resources management, in particular the basin approach. The Convention's implementation contributes to the achievement of the Millennium Development Goals and other international commitments on water, environment and sustainable development. The Water Convention requires Parties to prevent, control and reduce transboundary impacts, use transboundary waters in a reasonable and equitable way and

<sup>&</sup>lt;sup>182</sup> Stockholm Convention on POPs (2008). Electronic Reporting System. Available from

http://chm.pops.int/Countries/Reporting/ElectronicReportingSystem/tabid/3669/Default.aspx (accessed 14 October 2014).

<sup>&</sup>lt;sup>183</sup> Text on the Stockholm Convention on POPs. Available from <u>http://chm.pops.int/Portals/0/Repository/COP4/UNEP-POPS-COP.4-</u> <u>19.English.PDF</u> (accessed 3 August 2013).

<sup>&</sup>lt;sup>184</sup> UNECE, Water Convention, About the Convention, Introduction, About the UNECE Water Convention. Available from <u>http://www.unece.org/env/water/text/text.html</u> (accessed 11 September 2014).

ensure their sustainable management. Parties bordering the same transboundary waters have to cooperate by entering into specific agreements and establishing joint bodies.

C.24 As a framework agreement, the Convention does not replace bilateral and multilateral agreements for specific basins or aquifers; instead, it fosters their establishment and implementation, as well as further development. The areas of work of the convention include: quantifying benefits of transboundary water cooperation, water-energy-food-ecosystems nexus, assessment of transboundary waters, water and adaptation to climate change, and water and industrial accidents. In 2003, the Water Convention was amended to allow accession by countries outside the UNECE region. The amendment entered into force on 6 February 2013, turning the Water Convention into a global legal framework for transboundary water cooperation. It is expected that countries outside the UNECE region will be able to join the Convention as of early 2014.<sup>185</sup> No specific indicators associated to this convention have been found, but there is a guide for implementing this convention. The Guide offers a comprehensive commentary to the Convention's provisions, providing explanations of the procedural, legal, administrative, technical and practical aspects of the Convention's requirements for appropriate implementation.<sup>186</sup>

# The Convention on Wetlands of International Importance, especially as Waterfowl Habitat (The Ramsar Convention)

C.25 The Ramsar Convention is an international treaty for the conservation and sustainable utilisation of wetlands.<sup>187</sup> Signed in 1971, it is an intergovernmental treaty that provides a framework for national action and international cooperation. It encourages the "wise use" of wetlands and the maintenance of their "ecological character".<sup>188</sup> It is intended to stem the progressive encroachment on and loss of wetlands now and in the future, recognising the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value. Parties are charged with identifying suitable wetlands for placement on the List of Wetlands of International Importance (also called 'Ramsar Sites'). The Convention requests relevant international bodies to prepare reports and statistics on matters which are essentially international in character affecting wetlands. It urges Parties to submit detailed National Reports to the Secretariat at least

<sup>&</sup>lt;sup>185</sup> UNECE, Water Convention, The UNECE Water Convention, Helsinki, 17 March 1992. Available from <u>http://www.unece.org/env/water.html</u> (accessed 11 September 2014).

<sup>&</sup>lt;sup>186</sup> UNECE, Water Convention, About the Convention, Implementation. Available from <u>http://www.unece.org/env/water/partnership/part.html</u> (accessed 11 September 2014).

<sup>&</sup>lt;sup>187</sup> Text of the Ramsar Convention. Available from <u>http://ramsar.rgis.ch/cda/en/ramsar-documents-texts-convention-on/main/ramsar/1-31-38%5E20671\_4000\_0\_</u> (accessed 18 June 2015).

<sup>&</sup>lt;sup>188</sup> The Ramsar Convention (2005). Resolutions on the 9<sup>th</sup> Meeting of the Conference of the Contracting Parties – Resolution IX.1 Annex A. Available from <u>http://ramsar.rgis.ch/cda/en/ramsar-documents-resol-resolution-ix-1-annex-a/main/ramsar/1-31-107%5E23536\_4000\_0</u> (accessed 18 June 2015).

six months before each ordinary meeting of the Conference, and this tradition has continued unbroken to this day.<sup>189</sup> National reporting covers a well-developed set of indicators on the ecological character of sites, the conservation status of wetlands, bird populations, etc., that cover its effectiveness at different levels of implementation.<sup>190</sup>

#### The International Treaty on Plant Genetic Resources for Food and Agriculture

- C.26 The International Treaty on Plant Genetic Resources for Food and Agriculture aims at recognizing the enormous contribution of farmers to the diversity of crops that feed the world, establishing a global system to provide farmers, plant breeders and scientists with access to plant genetic materials, and ensuring that recipients share benefits they derive from the use of these genetic materials with the countries where they have been originated. The Treaty came into force on 29 June 2004<sup>191</sup> and is crucial in the fight against hunger and poverty and essential for the achievement of Millennium Development Goals 1 and 7.<sup>192</sup>
- C.27 No country is self-sufficient in plant genetic resources; all depend on genetic diversity in crops from other countries and regions. International cooperation and open exchange of genetic resources are therefore essential for food security. The fair sharing of benefits arising from the use of these resources has for the first time been practically implemented at the international level through the Treaty and its Standard Material Transfer Agreement. The treaty benefits the farmers and their communities, through Farmers' Rights; the consumers, through a greater variety of foods, and of agriculture products, as well as increased food security, the scientific community, through access to the plant genetic resources crucial for research and plant breeding; International Agricultural Research Centres, whose collections the treaty puts on a safe and long-term legal footing, both the public and private sectors, which are assured access to a wide range of genetic diversity for agricultural development; and the environment, and future generations, because the treaty will help conserve the genetic diversity necessary to face unpredictable environmental changes, and future human needs. There are indicators for monitoring the

 <sup>&</sup>lt;sup>189</sup> <sup>189</sup> The Ramsar Convention. National Reports. Available from <u>http://ramsar.rgis.ch/cda/en/ramsar-documents-natl-rpts-national-reports-cop12/main/ramsar/1-31-121-592\_4000\_0\_</u> (accessed 18 June 2015).
 <sup>190</sup> International Expert Workshop on the 2010 Biodiversity Indicators and Post-2010 Indicator Development. Available from

<sup>&</sup>lt;sup>190</sup> International Expert Workshop on the 2010 Biodiversity Indicators and Post-2010 Indicator Development. Available from <u>http://www.cbd.int/doc/meetings/ind/emind-02/official/emind-02-08d-en.pdf</u> (accessed 4 November 2013).

 <sup>&</sup>lt;sup>191</sup> The International Treaty on Plant Genetic Resources for Food and Agriculture, History: Evolution of the Treaty. Available from <a href="http://www.planttreaty.org/content/history-evolution-treaty">http://www.planttreaty.org/content/history-evolution-treaty</a> (accessed 11 September 2014).
 <sup>192</sup> The International Treaty on Plant Genetic Resources for Food and Agriculture, The Importance of the International Treaty. Available from

<sup>&</sup>lt;sup>192</sup> The International Treaty on Plant Genetic Resources for Food and Agriculture, The Importance of the International Treaty. Available from <u>http://www.planttreaty.org/</u> (accessed 11 September 2014).

implementation of the second global plan of action for plant genetic resources for food and agriculture.<sup>193</sup>

## **The London Convention**

- C.28 The London Convention is one of the first international conventions for the protection of the marine environment from human activities. The Inter-Governmental Conference on the Convention on the Dumping of Wastes at Sea, which met in London in November 1972 at the invitation of the United Kingdom, adopted the London Convention which came into force on 30 August 1975.<sup>194</sup> Since 1977, it has been administered by the International Maritime Organization (IMO).<sup>195</sup> The London Convention contributes to the international control and prevention of marine pollution by prohibiting the dumping of certain hazardous materials. In 1996, Parties adopted a Protocol which represents a major change of approach to the question of how to regulate the use of the sea as a depository for waste materials. Rather than stating which materials may not be dumped, it prohibits all dumping, except for possibly acceptable wastes on the so-called "reverse list". This protocol entered into force in 2006.<sup>196</sup> The Protocol restricts all dumping except for a permitted list (which still require permits). The permitted substances are: dredged material, sewage sludge, fish waste, or material resulting from industrial fish processing operations, vessels and platforms or other man-made structures at sea, inert, inorganic geological material, organic material of natural origin, bulky items primarily comprising iron, steel, concrete and similar unharmful materials for which the concern is physical impact and limited to those circumstances, where such wastes are generated at locations, such as small islands with isolated communities, having no practicable access to disposal options other than dumping,  $CO_2$  streams from  $CO_2$  capture processes (added under the amendments adopted in 2006, which entered into force in 2007).<sup>197</sup>
- C.29 The London Protocol stresses a "precautionary approach", which requires that "appropriate preventative measures are taken when there is reason to believe that wastes or other matter introduced into the marine environment are likely to cause harm even when there is no conclusive evidence to prove a causal relation between inputs and their

<sup>193</sup> FAO (2012). Sixth Session of the Intergovernmental Technical Working Group on Plant Genetic Resources for Food and Agriculture, CGRFA/WG-PGR-6/12/2 Rev.1, Targets and indicators for plant genetic resources for food and agriculture. Available from http://www.fao.org/fileadmin/templates/agphome/documents/PGR/ITWG/ITWG/Working\_docs/CGRFA-WG-PGR-6.12.2\_Rev.1.pdf (accessed 11 September 2014).

<sup>&</sup>lt;sup>194</sup> IMO, Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter. Available from

http://www.imo.org/About/Conventions/ListOfConventions/Pages/Convention-on-the-Prevention-of-Marine-Pollution-by-Dumping-of-Wastesand-Other-Matter.aspx (accessed 11 September 2014).

<sup>195</sup> Ibid 196 Ibid

<sup>197</sup> Ibid

effects".<sup>198</sup> It also states that "the polluter should, in principle, bear the cost of pollution" and emphasizes that Contracting Parties should ensure that the Protocol should not simply result in pollution being transferred from one part of the environment to another.<sup>199</sup> IMO performance indicators have been brought forward, with the aim of achieving safe shipping, secure shipping, environmentally sound shipping, efficient shipping, sustainable shipping, adoption of the highest practicable standards, implementation of instruments and capacity-building.<sup>200</sup>

## The World Heritage Convention

- C.30 A United Nations Educational, Science and Cultural Organization (UNESCO) World Heritage Site is a place (such as a forest, mountain, lake, desert, monument, building, complex, or city) that is listed by UNESCO as having special cultural or physical significance. The list is maintained by the international World Heritage Programme administered by the UNESCO World Heritage Committee which is composed of 21 of the States Parties to the Convention. They are elected by their General Assembly.<sup>201</sup>
- C.31 The programme catalogues, names, and monitors sites of outstanding cultural or natural importance to the common heritage of humanity. Under certain conditions, listed sites can obtain funds from the World Heritage Fund. The programme was founded with the Convention Concerning the Protection of World Cultural and Natural Heritage which was adopted by the General Conference of UNESCO on 16 November 1972. As of September 2012, 190 States Parties have ratified the Convention. Periodic reporting is intended to provide information on general policy development, status of services provided, scientific and technical studies and research and other aspects relating to the protection, conservation and presentation of the cultural and natural heritage. The Periodic Reporting process provides an assessment of the application of the World Heritage Convention by the States Parties as well as information about the sites to record possible changes in the state of conservation of sites. The Periodic Reports - submitted by the States Parties themselves – are prepared on a regional basis and are examined by the World Heritage Committee on a pre-established schedule based on a six-year cycle. For each of them, regional periodic reporting strategies are developed to ensure full

<sup>198</sup> Ibid

<sup>199</sup> Ibid

<sup>&</sup>lt;sup>200</sup> IMO, Council 105<sup>th</sup> Session, Agenda Item 3(a), Strategy and Planning, (a) Monitoring of performance-Review of data measured against the performance indicators. Available from

http://www.imo.org/KnowledgeCentre/ShipsAndShippingFactsAndFigures/Statisticalresources/Documents/IMO%20Performance%20indicators %20C\_105-3(a)-1[1].pdf (accessed 12 September 2014).

<sup>&</sup>lt;sup>201</sup> United Nations Educational, Scientific and Cultural Organization, World Heritage Convention. Available from <u>http://whc.unesco.org/en/convention/</u> (accessed 6 August 2013).

participation of States Parties, competent institutions and regional expertise. The final result of each regional strategy is a Regional State of the World Heritage Report.<sup>202</sup>

## **The Nagoya Protocol**

- C.32 The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity is an international agreement which aims at sharing the benefits arising from the utilization of genetic resources in a fair and equitable way. The sharing of the benefits is aimed to achieve by appropriate access to genetic resources and appropriate transfer of relevant technologies, taking into account all rights over those resources and technologies, and by appropriate funding to contribute to the conservation of biological diversity and the sustainable use of its components. It was adopted by the Conference of the Parties to the Convention on Biological Diversity (CBD) at its tenth meeting on 29 October 2010 in Nagoya, Japan.<sup>203</sup> Since adoption in 2010, 92 (48%) CBD Parties have signed the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization.<sup>204</sup> A number of countries are in the process of completing their internal procedures towards ratification. Fifty ratifications are required for the entry into force of the Protocol. The Nagoya Protocol will enter into force 90 days after the date of deposit of the fiftieth instrument of ratification.<sup>205</sup>
- C.33 The Nagoya protocol is important because it will create greater legal certainty and transparency for both providers and users of genetic resources by establishing more predictable conditions to access to genetic resources and by helping to ensure benefitsharing when genetic resources leave the contracting party providing the genetic resources. By helping to ensure benefit-sharing, the Nagoya Protocol creates incentives to conserve and sustainably use genetic resources, and therefore enhances the contribution of biodiversity to development and human well-being. Aichi Biodiversity Target 16 states that by 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.<sup>206</sup> The headline indicator (arising from Convention

<sup>&</sup>lt;sup>202</sup> United Nations Educational, Scientific and Cultural Organization, World Heritage Convention. Periodic Reporting. Available from http://whc.unesco.org/en/periodicreporting/ (accessed 15 October 2014).

Convention on Biological Diversity, Nagoya Protocol, About the Nagoya Protocol. Available from http://www.cbd.int/abs/about/default.shtml (accessed 11 September 2014).

<sup>&</sup>lt;sup>4</sup> Biodiversity Indicators Partnership, Ratification Status of the Nagoya Protocol. Available from

http://www.bipindicators.net/NagoyaProtocolratification (accessed 11 September 2014).

Ibid <sup>206</sup> Ibid

on Biological Diversity) for this protocol is trends in access and equity of benefit sharing of genetic resources.<sup>207</sup>

## The United Nations Convention on the Law of the Sea (UNCLOS)

- C.34 The UNCLOS is the international agreement that resulted from the third United Nations Conference on the Law of the Sea (UNCLOS III), which took place from 1973 through 1982.<sup>208</sup> The Convention defines the rights and responsibilities of nations in their use of the world's oceans, establishing guidelines for businesses, the environment, and the management of marine natural resources. The Convention, concluded in 1982, replacing four 1958 treaties. One of its implementing agreements, relating to the seabed and ocean floor and their sub-soils beyond the limits of national jurisdiction, came into force in 1996 and the other relating to fish stocks came into force in 2001.
- C.35 Enforcement of the Convention is facilitated by organizations such as the International Maritime Organization, the International Whaling Commission, and the International Seabed Authority (the last being established by the UN Convention).
- C.36 Aside from its provisions defining ocean boundaries, Article 145 of the Convention explicitly provides for protection of the marine environment. Yet other articles of the Convention relate to freedom of scientific research on the high seas and creation of a legal system for controlling the exploitation of mineral resources in deep seabed areas beyond national jurisdiction.<sup>209</sup> Following are the fishery-related UNCLOS sustainability indicators which have been posited by the FAO for monitoring of this Convention. The fishery-related indicators are:<sup>210</sup>
  - i. Yield-related indicators such as Catches, Catch value, Pelagic/Demersal ratio (P/D);
  - ii. Capacity-related indicators such as Fishing effort, Fishing intensity;
  - iii. Other economic indicators such as Investment, Level of subsidies;
  - iv. Technological indicators such as Lists of acceptable gear;
  - v. Social indicators such as Coastal populations and Ratio between fisheries and other revenues;
  - vi. Institutional indicators such as Per cent of fisheries covered by management committees;
  - vii. Ecosystem-related indicators such as Catch per unit of effort;

<sup>207</sup> Ibid

<sup>&</sup>lt;sup>208</sup> Text of the United Nations Convention on the Law of the Sea. Available from

http://www.un.org/Depts/los/convention\_agreements/texts/unclos/unclos\_e.pdf (accessed 17 October 2013).

<sup>&</sup>lt;sup>209</sup> Ibid.

<sup>&</sup>lt;sup>210</sup> FAO, "Land quality indicators and their use in sustainable agriculture and rural development, Indicators of Sustainable Development of Fisheries", Appendix 2. Available from <a href="http://www.fao.org/docrep/W4745E/w4745e0f.htm">http://www.fao.org/docrep/W4745E/w4745e0f.htm</a> (accessed 18 October 2013).

- viii. Resource demographic structure such as School size where relevant or Fat index;
  - ix. Biological diversity such as Existence of protected marine areas;
  - x. Water quality indicators such as Algae index or Release of nitrogen components and phosphates; and
- xi. Critical habitats indicators such as Area of live and dead coral.

## United Nations Convention to Combat Desertification (UNCCD)

- C.37 The UNCCD is a Convention to combat desertification and mitigate the effects of drought through national action programmes that incorporate long-term strategies supported by international cooperation and partnership arrangements.<sup>211</sup>
- C.38 The Convention, stemming from a direct recommendation of Agenda 21, was adopted in Paris in June 1994 and entered into force in December 1996.<sup>212</sup> It is the first and only international legally binding framework set up to address the problem of desertification. The Convention is based on the principles of participation, partnership and decentralization - the backbone of good governance and sustainable development.
- C.39 At the Conference of the Parties on its eighth session, the Parties to the Convention adopted the 10-year strategic plan and framework to enhance the implementation of the Convention for 2008-2018 (The Strategy).<sup>213</sup> The Strategy contains the "strategic objectives" to be achieved over the 10 years, and the "operational objectives" that guide the actions of short and medium-term effects. Parties are requested to report on progress made with their implementation of The Strategy, while the Committee for the Review of the Convention is given the responsibility of reviewing its implementation based on the reports by Parties, as well as those from other reporting entities. Parties can use the online reporting platform: Performance Review and Assessment of Implementation System.<sup>214</sup>
- The core set of impact indicators used for monitoring purposes are:<sup>215</sup> C.40

<sup>&</sup>lt;sup>211</sup> Text of the United Nations Convention to Combat Desertification. Available from <a href="http://www.unccd.int/en/about-the-convention/Pages/Text-">http://www.unccd.int/en/about-the-convention/Pages/Text-</a> overview.aspx (accessed 5 November 2013).

United Nations "Agenda 21", (United Nations Conference on Environment & Development), Rio de Janeiro, Brazil, 3 to 14 June 1992. Available from http://sustainabledevelopment.un.org/content/documents/Agenda21.pdf (accessed 17 October 2013).

<sup>&</sup>lt;sup>213</sup> UNCCD. The Reporting Process and the UNCCD 10-Year Strategy. Available from http://www.unccd.int/en/programmes/Capacitybuilding/CBW/Resources/Pages/5RC/ReportingandTheStrategy.aspx (accessed 14 October 2014).

UNCCD. Templates for the 2014 Reporting Exercise. Available from: http://www.unccd.int/en/programmes/Reporting-review-andassessment/Pages/reporting-templates.aspx (accessed 14 October 2014). <sup>215</sup> UNCCD. Report of the Conference of the Parties on its ninth session September to October 2009 ICCD/COP(9)/18/Add.1. Available from

http://archive.unccd.int/cop/officialdocs/cop9/pdf/18add1eng.pdf (accessed 22 October 2013).

- i. Decrease in the number of people negatively impacted by the process of desertification/land degradation and drought;
- ii. Increase in the proportion of households living above the poverty line in affected areas;
- iii. Reduction in the proportion of the population below the minimum level of dietary energy consumption in affected areas;
- iv. Reduction in the total area affected by desertification/land degradation and drought;
- v. Increases in net primary productivity in affected areas;
- vi. Increases in carbon stocks (soil and plant biomass) in affected areas; and
- vii. Areas of forest, agricultural and aquaculture ecosystems under sustainable management.

# United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol

C.41 The UNFCCC has the goal of preventing dangerous human interference with the climate system. Its immediate objectives included beginning "to cooperatively consider what they could do to limit average global temperature increases and the resulting climate change, and to cope with whatever impacts were, by then, inevitable."<sup>216</sup> A number of nations have approved an addition to the treaty, the Kyoto Protocol, which has more powerful (and legally binding) measures. The Kyoto Protocol, an international and legally binding agreement to reduce GHG emissions worldwide, entered into force in February 2005. With regard to national reporting/monitoring, the UNFCCC invited the IPCC to produce the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. These guidelines provide internationally agreed methodologies intended for use by countries to estimate greenhouse gas inventories to report to the UNFCCC. Reporting and review requirements under the Convention encompass the following elements:<sup>217</sup> national communications which are submitted by Annex I Parties every 4-5 years following decisions for each submission by the Conference of the Parties (COP); and national GHG inventories which are reported annually by Annex I Parties following reporting guidelines agreed by the COP and methodology developed by the Intergovernmental Panel on Climate Change (IPCC). GHG inventory data can also be found on the UNFCCC website.<sup>218</sup>

<sup>&</sup>lt;sup>216</sup> UNFCCC, Essential Background, The Convention and the Protocol. Available from <u>http://unfccc.int/essential\_background/items/6031.php</u> (accessed 19 October 2013).

<sup>&</sup>lt;sup>217</sup> UNFCCC. National Reports. Available from <a href="http://unfccc.int/national\_reports/items/1408.php">http://unfccc.int/national\_reports/items/1408.php</a> (accessed 15 October 2014).

<sup>&</sup>lt;sup>218</sup> UNFCCC. Greenhouse Gas Inventory Data. Available from <u>http://unfccc.int/ghg\_data/items/3800.php</u> (accessed 15 October 2014).

- C.42 The GHG emission and removal estimates are divided into main sectors, which are groupings of related processes, sources and sinks:
  - i. Energy
  - ii. Industrial Processes and Product Use
  - iii. Agriculture, Forestry and Other Land Use
  - iv. Waste
  - v. Other (e.g., indirect emissions from nitrogen deposition from non-agriculture sources)<sup>219</sup>

The IPCC is a scientific body whose purpose is to review and assess the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change, including response strategies.<sup>220</sup> It should be noted that it does not conduct any research nor does it monitor climate related data or parameters.

# Vienna Convention for the Protection of the Ozone Layer/ Montreal Protocol on Substances that Deplete the Ozone Layer

C.43 The Vienna Convention was adopted in 1985 and entered into force on 22 Sep 1988. The Vienna Convention did not require countries to take concrete actions to control ODSs. Instead, in accordance with the provisions of the Convention, the countries of the world agreed the Montreal Protocol on Substances that Deplete the Ozone Layer under the Convention to advance that goal.<sup>221</sup> The chief aim of the Montreal Protocol on Substances that Deplete the Ozone Layer under the production and use of man-made ODSs (chlorofluorocarbons, hydrochlorofluorocarbons, halons, methyl chloroform, carbon tetrachloride, methyl bromide, and others).<sup>222</sup> By agreeing to the terms of the Montreal Protocol, signatory nations commit to take actions to protect the ozone layer, hoping in the long-term to reverse the damage that has been done by the use of ODS. The Protocol requires all Parties to submit a detailed national ODS data report annually on the production, import and export of each of the controlled ODS. The data reporting forms, instructions and definitions can be downloaded from the

<sup>&</sup>lt;sup>219</sup> Intergovernmental Panel on Climate Change (2007). 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Introduction to the 2006 guidelines. Available from <u>http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1\_Volume1/V1\_1\_Ch1\_Introduction.pdf</u> (accessed 24 September 2014).

<sup>&</sup>lt;sup>220</sup> Intergovernmental Panel on Climate Change. Organization. Available from <u>http://www.ipcc.ch/organization/organization.shtml</u> (accessed 24 September 2014).

<sup>&</sup>lt;sup>221</sup> The Vienna Convention for the Protection of the Ozone Layer (2010-2011). Available from

http://ozone.unep.org/new\_site/en/vienna\_convention.php (accessed 13 October 2014).

<sup>&</sup>lt;sup>222</sup> The Montreal Protocol on Substances that Deplete the Ozone Layer (2000). Available from <u>http://ozone.unep.org/pdfs/Montreal-Protocol2000.pdf</u> (accessed 6 August 2013).

Ozone Secretariat website.<sup>223</sup> Data on, inter alia, the consumption and production of ODSs can be accessed from the Ozone Secretariat website. <sup>224</sup>

C.44 Among the MDGs, Goal 7 (Ensure environmental sustainability, Target 7A - Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources) identifies the consumption of ODS as one of its indicators on which reporting should be done.

<sup>&</sup>lt;sup>223</sup> United Nations Environment Programme, "Data Reporting and Tools" (2014). Available from

http://ozone.unep.org/en/data\_reporting\_tools.php (accessed 13 October 2014). 224 United Nations Environment Programme, "Data Access Centre" (2014). Available from http://ozone.unep.org/en/ods\_data\_access\_centre/ (accessed 13 October 2014).

# Annex D: Classifications and environment statistics

D.1 This annex provides supporting material for the most important and widely-used classifications, categories and other groupings relevant to the field of environment statistics. None of these should be considered as mandatory for reporting purposes.

## Classifications of land cover and land use

D.2 Considerable work has been done by FAO and partner agencies including UNEP and the EEA in the development of land cover and land use classifications. After a comprehensive global consultation process, a classification composed of 14 classes has been developed in the SEEA-CF.<sup>225</sup> These 14 classes have been generated using the LCCS, version 3 approach, created by FAO, and thus provide a comprehensive set of land cover types, mutually exclusive and unambiguous, with clear boundaries and systematic definitions.

# Table D.1: Land Cover Classification based on FAO LCCS (Interim)1 Artificial surfaces (including urban and associated areas)2 Herbaceous crops3 Woody crops4 Multiple or layered crops5 Grassland6 Tree covered areas7 Mangroves8 Shrub covered areas9 Shrubs and/or herbaceous vegetation, aquatic or regularly flooded10 Sparsely natural vegetated areas11 Terrestrial barren land12 Permanent snow and glaciers13 Inland water bodies14 Coastal water bodies and inter-tidal areas

<sup>&</sup>lt;sup>225</sup> United Nations, European Union, Food and Agriculture Organization of the United Nations, International Monetary Fund, Organisation for Economic Co-operation and Development, and the World Bank (2014). "System of Environmental-Economic Accounting 2012 - Central Framework". Available from

http://unstats.un.org/unsd/envaccounting/seeaRev/SEEA\_CF\_Final\_en.pdf (accessed 30 September 2014).

D.3 A reference framework for the classification of land use is provided in the SEEA-CF<sup>226</sup> as agreed after a comprehensive global consultation process. The development of the land use classification included in the SEEA-CF, led by 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.

1. Land				
		1.1.1.1 Cereals		
		1.1.1.2 Vegetables and melons		
	1.1.1 Land under	1.1.1.3 Temporary oilseed crops		
	temporary crops	1.1.1.4 Root/tuber crops with high starch or		
		inulin content		
		1.1.1.5 Temporary spice crops		
		1.1.1.6 Leguminous crops		
		1.1.1.7 Sugar crops		
		1.1.1.8 Other temporary crops		
	1.1.2 Land under tem	porary meadows and pastures		
114 1	1.1.3 Land with temp	orary fallow		
1.1 Agriculture	1.1.4 Land under	1.1.4.1 Fruit and nuts		
	permanent crops	1.1.4.2 Permanent oilseed crops		
		1.1.4.3 Beverage and permanent spice crops		
		1.1.4.4 Other permanent crops		
	1.1.5 Land under	1.1.5.1 Cultivated permanent meadows and		
	permanent	pastures		
	meadows and	1.1.5.2 Naturally grown permanent		
	pastures	meadows and pastures		
	1.1.6 Agricultural land under protective cover			
	1.2.1 Forest land	1.2.1.1 Primary regenerated forest		
1.2 Forestry		1.2.1.2 Other naturally regenerated forest		
		1.2.1.3 Planted forest		
	1.2.2 Other wooded land			
1.3 Land use for	1.3.1 Land use for hatcheries			
aquaculture	1.3.2 Managed grow-out sites on land			
	1.4.1 Mining and quarrying			
	1.4.2 Construction         1.4.3 Manufacturing			
1.4 Use of built	1.4.4 Technical infrastructure			
up and related	1.4.5 Transport and storage			
areas	1.4.6 Commercial, financial, and public services			
	1.4.7 Recreational facilities			

Table D.2: Classification of Land Use (Interim)

<sup>&</sup>lt;sup>226</sup> Ibid.

1.4.8 Residential		
1.5 Land used for maintenance and restoration of environmental functions		
1.6 Other uses of land, n.e.c		
1.7 Land not in use		
2. Inland waters		
2.1 Inland waters used for aquaculture or holding facilities		
2.2 Inland waters used for maintenance and restoration of environmental functions		
2.3 Other uses of inland waters n.e.c.		
2.4 Inland waters not in use		
3. Coastal waters		
3.1 Coastal waters used for aquaculture or holding facilities		
3.2 Coastal waters used for maintenance and restoration of environmental functions		
3.3 Other uses of coastal waters n.e.c.		
3.4 Coastal waters not in use		
4. Exclusive Economic Zone (EEZ)		
4.1 EEZ areas used for aquaculture or holding facilities		
4.2 EEZ areas used for maintenance and restoration of environmental functions		
4.3 Other uses of EEZ areas n.e.c		
4.4 EEZ areas not in use		

# Classification of environmental activities

D.4 The CEPA has been in place since 2000, covering the classes of activities pertaining to environment protection. Subsequent work to develop an overarching 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-CF.<sup>227</sup>

I. Environmental Protection				
1. Protection of ambient air and climate	1.1 Prevention of	1.1.1 for the protection of ambient air		
	pollution through			
	in-process	1.1.2 for the protection of climate and		
	modifications	ozone layer		
	1.2 Treatment of	1.2.1 for the protection of ambient air		
	exhaust gases and	1.2.2 for the protection of climate and		
	ventilation air	ozone layer		
	1.3 Measurement, control, laboratories and the like			
	1.4 Other activities			
	2.1 Prevention of pollution through in-process modifications			
	2.2 Sewerage networks			

Table D.3: Classification of Environmental Activities

<sup>&</sup>lt;sup>227</sup> Ibid.

2 Westernster	2.2 Westsweter the star and		
2. wastewater	2.3 Wastewater treatment		
management	2.4 Treatment of cooling water		
	2.5 Measurement, control, laboratories and the like		
	2.6 Other wastewater management activities		
	3.1 Prevention of pollution through in-process modifications		
2 Weste	3.2 Collection and transport		
J. Wasic	3.3 Treatment and	3.3.1 Thermal treatment	
management	disposal of	3.3.2 Landfill	
	hazardous waste	3.3.3 Other treatment and disposal	
	3.4 Treatment and	3.4.1 Incineration	
	disposal of non-	3.4.2 Landfill	
	hazardous waste	3.4.3 Other treatment and disposal	
	3.5 Measurement, c	ontrol, laboratories and the like	
	3.6 Other waste man	nagement activities	
4. Protection and	4.1 Prevention of pollutant infiltration		
remediation of	4.2 Cleaning up of s	soil and water bodies	
soil, groundwater	4.3 Protection of soil from erosion and other physical		
and surface water	degradation		
	4.4 Prevention and remediation of soil salinity		
	4.5 Measurement, c	ontrol, laboratories and the like	
	4.6 Other activities		
	5.1 Preventive in-	5.1.1 Road and rail traffic	
5 NI ' 1	process	5.1.2 Air traffic	
5. Noise and	modifications at		
vibration	the source	5.1.3 Industrial and other noise	
(excluding	5.2 Construction	5.2.1 Road and rail traffic	
workplace	of anti	5.2.2 Air traffic	
protection)	noise/vibration	5.2.3 Industrial and other noise	
· ,	facilities		
	5.3 Measurement, control, laboratories and the like		
	5.4 Other activities		
6. Protection of	6.1 Protection and r	ehabilitation of species and habitats	
biodiversity and	6.2 Protection of natural and semi-natural landscapes		
landscapes	6.3 Measurement, c	ontrol, laboratories and the like	
	6.4 Other activities		
7. Protection	7.1 Protection of ambient media		
against radiation	7.2 Transport and treatment of high level radioactive waste		
(excluding	7.3 Measurement, control, laboratories and the like		
external safety)	7.4 Other activities		
	8.1 Protection of	8.1.1 Protection of ambient air	
	ambient air and	8.1.2 Protection of atmosphere and climate	
	climate	L	
	8.2 Protection of water		

8 Persearch and	8 2 Wasta		
development for	8.5 Waste		
anvironmental	8.4 Protection of soil and groundwater		
protection	8.5 Abatement of noise and vibration		
protection	8.6 Protection of species and habitats		
	8.7 Protection against radiation		
	8.8 Other research on the environment		
9. Other	9.1 General	9.1.1 General administration, regulation	
environmental	environmental	9.1.2 Environmental management	
protection	administration and		
activities	management		
	9.2 Education, train	ing and information	
	9.3 Activities leading to indivisible expenditure		
	9.4 Activities n.e.c.		
	II. Resource ma	anagement (Interim)	
10. Management	10.1 Reduction of t	he intake of mineral and energy resources	
of mineral and	10.2 Reduction of n	ninerals use through the reduction of scraps	
energy resources	and the production	and consumption of recycled materials and	
	products and reduction of heat and energy losses and energy		
	savings		
	10.3 Measurement, control, laboratories and the like related to		
	mineral and energy resources		
	10.4 Other activities for the management of mineral and energy		
	resources		
	11.1 Reduction of the	he intake of timber resources	
	11.2 Reduction of the	he consumption of forest (wood and non	
11. Management	wood)-related products		
of timber	11.3 Reforestation a	and afforestation	
resources	11.4 Forest fires		
	11.5 Measurement,	control, laboratories and the like related to	
	natural timber resou	irces	
	11.6 Other activitie	s for the management of timber resources	
12. Management	12.1 Reduction of the intake of aquatic resources		
of aquatic	12.2 Replenishment of aquatic resources stocks		
resources	12.3 Measurement, control, laboratories and the like related to		
	aquatic resources		
	12.4 Other activitie	s for the management of aquatic resources	
13. Management	13.1 Reduction of t	he intake of biological resources (excl.	
of other	timber and aquatic	resources)	
biological	13.2 Replenishment of biological resources stocks (excl. timber		
resources (excl.	and aquatic resources)		
timber and	13.3 Measurement, control, laboratories and the like related to		
aquatic	biological resources stocks (excl. timber and aquatic resources)		
resources)	esources) 13.4 Other activities for the management of biological		
	(excl. timber and ac	juatic resources)	
	14.1 Reduction of t	he intake of water resources	

14. Management	14.2 Reduction of water losses and leaks, water reuse and	
of water	savings	
resources	14.3 Replenishment of water resources	
	14.4 Measurement, control, laboratories and the like related to water resources	
	14.5 Other activities	for the management of water resources
15. Research and	15.1 Mineral and energy resources	
development	15.2 Timber resources	
activities for	15.3 Aquatic resources	
resource	15.4 Other biological resources	
management	15.5 Water resources	
	15.6 Other R&D activities for natural resource management	
16. Other	16.1 General	16.1.1 General administration, regulation
resource	administration of	and the like
management	natural resources	16.1.2 Environmental management
activities	16.2 Education, training and information	
	16.3 Activities leading to indivisible expenditure	
	16.4 Activities n.e.c.	

- D.5 Environment statistics classifications developed and adopted by the Statistical Division of the UNECE between 1989 and 1996 have been used extensively for international data collection. The UNECE environment statistics classifications are heterogeneous and are not pure classifications in the traditional sense; most of them include more than one single hierarchical classification. They also include recommendations for definitions, measurement methods and tabulations. These classifications include:
  - i. UNECE Standard Statistical Classification of Water Use (1989);
  - UNECE Standard Statistical Classification of Marine Water Quality (1992) See Table D.4;
  - iii. UNECE Standard Statistical Classification of Surface Freshwater Quality for the Maintenance of Aquatic Life (1992) – See Table D.5;
  - iv. UNECE Standard Statistical Classification of Land Use (1989);
  - v. UNECE Standard Statistical Classification of Wastes (1989);
  - vi. UNECE Standard Statistical Classification of Ambient Air Quality (1990) See Table D.6;
  - vii. UNECE Standard Statistical Classification of Flora, Fauna and Biotopes (1996); and
  - viii. Single European Standard Statistical Classification of Environment Protection Activities and Facilities (1994).
Many of these classifications have been revised and taken over to be included in more recent classifications such as those on land cover, land use and environment protection activities (see Tables D.1-3). The following Tables 4-6 contain the UNECE classifications that are still in use in environment statistics and have global relevance.

#### **Classification of marine water quality**

Oxygen regime	Class interpretation:
Major criteria: Oxygen content in marine bottom	Class I: Excellent oxygen conditions for the maintenance of aquatic life.
waters	Class II: Good oxygen conditions for the maintenance of
	aquatic life Class III: Slight oxygen deficiencies cause occasional
	formation of hydrogen sulphide.
	Class IV: Chronic deficiencies of oxygen and frequent
	occurrence of hydrogen sulphide impair reproduction and cause other sublethal chronic impacts to aquatic life
	Class V: Frequent oxygen depletion leads to toxic levels
	of hydrogen sulphide with acute sublethal or lethal effects for aquatic life.
Eutrophication	Class interpretation:
Major criteria: Trophic state	Class I: Oligotrophic
of marine surface water and the best available expert	Class II: Mesothrophic
judgement regarding the	Class IV: Strongly eutrophic
impact of trophic state on	Class V: Hypertrophic
uquanc nje.	
Pollution by harmful	Class interpretation:
substances Major oritoria: Toricological	Class I: Approximate natural level or very low
impact on aquatic life as	background contamination.
established by US-EPA.	absence of observable effects ('no observable effects') on
	aquatic life.]
	Class III: [To be determined in accordance with
	not exceeding threshold levels in species.]
	Class IV: Chronic toxicity
	Class V: Acute toxicity
Pollution by radioactivity	Class interpretation:
Major criteria: [10 be determined]	[To be determined]

 Table D.4: UNECE Standard Statistical Classification of Marine Water Quality (1992)

# Classification of surface freshwater quality

 Table D.5: UNECE Standard Statistical Classification of Surface Freshwater Quality for the

 Maintenance of Aquatic Life (1992)

<u> </u>	
Oxygen regime	Class interpretation:
Oxygen regime Oxygen content, together with presence of oxygen- demanding substances, and the impact of oxygen content levels on aquatic life	Class interpretation: Class I: Constant near-saturation of oxygen content. Insignificant presence of oxygen demanding substances from the point of view of aquatic life. Class II: The oxygen saturation of water is good. Oxygen demanding substances do not normally disturb oxygen saturation. Class III: Oxygen deficiencies may occur in the hypolimnion. The presence of oxygen-demanding substances risks sometimes considerable negative impacts on aquatic life through the reduction of oxygen content. Class IV: Oversaturation of oxygen or oxygen deficiency occur in the epilimnion and oxygen deficiencies are frequent in the hypolimnion, possibly owing to chronic problems with the presence of oxygen- demanding substances. Class V: Acute problems occur in oxygen regime, i.e. oversaturation or oxygen deficiency in the epilimnion, and oxygen deficiency leading to anaerobic conditions in the hypolimnion. The high level of presence of oxygen- demanding substances may equally cause acute oxygen
	deficiencies.

Eutrophication	Class interpretation:
Major criteria: Trophic state	Class I: Clear, oligotrophic water with, at most, a very
and best available expert	slight, occasional anthropogenic pollution with organic
judgement regarding the	matter. Low nutrient content, provides spawning
impact of trophic state on	grounds for salmonids.
aquatic life, maintaining	Class II: Slightly polluted, mesotrophic water receiving
consistency between the three	small discharges of organic matter. The loadings may
variables	lead to slightly increased primary productivity.
	Class III: Moderately eutrophic water receiving
	considerable amounts of discharges of organic matter and
	nutrients. The level of primary production is
	considerable, and some changes in community structure,
	including fish species, can be observed.
	Class IV: Strongly eutrophic, polluted water, receiving
	discharges of organic matter, nutrients, and harmful
	substances. Algal blooms are common. Increased
	decomposition of organic matter together with
	stratification of water bodies may entail anaerobic
	conditions and fish kills. Mass occurrences of more
	tolerant species; populations of fish and benthic
	organisms are affected.
	Class V: Extensively polluted, hypertrophic water.
	Decomposers dominate over producers. Fish or benthic
Addification	Class intermetation
Acidification Major oritoria:	<u>Class interpretation:</u>
Major criteria. Toricological impact of	Class I: The buffering capacity of the water is very
acidity on aquatic life as	good.
established in US-FPA	Class II: The buffering capacity of the water is good.
practices	Class III: The buffering capacity is weak but keeps the
practices	acidity of the water at levels still suitable for most fish.
	Class 1v: The bullering capacity is exceeded, leading to
	Class V: The water is without huffering conscituted its
	class v. The water is without buffering capacity and its
	Class V: The water is without buffering capacity and its acidity is toxic for fish species.

Metals	Class interpretation:
Major criteria: Toxicological impact on aquatic life as established in US-EPA practices	Class I: No anthropogenic pollution with inorganic matter. Class II: Concentrations are below midpoint between natural and chronically toxic levels. Class III: Concentrations are above midpoint between natural and chronically toxic levels. Class IV: Excursions beyond chronic criteria concentrations occur, but do not establish chronically toxic conditions in terms of concentration levels, duration or frequency. Class V: Excursions beyond chronic criteria concentrations allow acutely toxic conditions in terms of concentration levels, duration or frequency
Chlorinated micropollutants and other hazardous substances Major criteria: Toxicological impact on aquatic life as established in US-EPA practices	Class interpretation: Class I: Not applicable Class II: Not applicable Class III: Loadings are evident, but concentrations are below chronic and acute criteria levels. Class IV: Excursions beyond chronic criteria concentrations occur, but do not establish chronically toxic conditions in terms of concentration levels, duration or frequency. Class V: Excursions beyond chronic criteria concentrations allow acutely toxic conditions in terms of concentration levels, duration or frequency.
Radioactivity Major criteria: Toxicological impact on aquatic life	<u>Class interpretation:</u> [To be determined after experience is gained through data collection and interpretation.]

### Classification of ambient air quality

	Tuble I	5.0. ONECE Sianaara Sialislical Classification of Amoleni Alf $Ql$	iaiii	y (1	990	)
Che	micals	and their relevance in measurement estimation				1
(E =	emissio	ns; $C = \text{concentrations}$ ; $I = \text{at impact stations}$ ; $B = at national or restricted by the subsequence of the stational or restricted by the subsequence of the stational or restricted by the subsequence of the stational or restricted by the$	gior	hal t	back	ground
statio	ns; $G =$	at global background stations)	Б	CI	CE	
			Е	CI	CE	9 G
1.	<u>Sulphu</u>	ur compounds				
	1.1	Sulphur oxides (incl. emissions of				
		hydrogen sulphide)	Х	Х	Х	
	1.2	Particulate sulphate			Х	Х
		•				
2.	<u>Oxidiz</u>	ed nitrogen compounds and oxidants				
	2.1	NO <sub>X</sub> (excluding nitrous oxide)	Х	Х	Х	
	2.2	Nitric acid and particulate nitrate		Х	Х	Х
	2.3	Ozone - tropospheric			Х	Х
		- stratospheric				Х
	2.4	Nitrous oxide (tropospheric)				Х
3.	Reduce	ed nitrogen compounds				
	3.1	Ammonia	Х	Х	Х	
	3.2	Particulate ammonium compounds		Х	Х	Х
4.	Inorga	nic carbon compounds				
	4.1	Carbon monoxide	Х	Х		х
	4.2	Carbon dioxide	Х			Х
5.	Haloge	ens and inorganic halogen compounds	Х		Х	
6.	<u>Volatile organic compounds<sup>228</sup></u> (incl. halogenated compounds)					
	6.1	Methane	Х			Х
	6.2	Non-methane compounds				
		6.2.1 Aldehydes	Х	Х	Х	
		6.2.2 CFCs	Х			Х
		6.2.3 Halons	Х			Х
		6.2.4 Other halogenated hydrocarbons	Х			Х

 Table D.6: UNECE Standard Statistical Classification of Ambient Air Quality (1990)

<sup>&</sup>lt;sup>228</sup> It may become possible to add relevant dioxins (toxic polychlorinated debenzo dioxins and furans) as a separate group under this heading once sufficiently reliable emission and/or concentration data become available.

7.	Heavy metals (to be specified) X X X							
8.	Suspended particulate matter X X X X						Х	
9.	Chemi	ical compo	osition of pr	ecipitation water			X	Х
<b>Em</b> 1.	<b>issions</b> Emissi	[tons/ye	ear] stationary se	ources				
	1.1	By proce	ess					
		<ul> <li>1.1.1 Combustion of fuels</li> <li>1.1.1.1 In power plants</li> <li>1.1.1.2 In industrial establishments, excl. power plants</li> <li>1.1.1.3 In other economic activities and domestic heating</li> </ul>						
		1.1.2	Other prod 1.1.2.1 1.1.2.2	cesses, incl. evaporation In industrial sources In non-industrial and domestic sources				
	1.2	By activi	ity <sup>229</sup>					
		1.2.1 1.2.2 1.2.3 1.2.4 1.2.5 1.2.6 1.2.7	Agricultur Mining an Manufactu Manufactu Manufactu Manufactu Manufactu	ral etc. (ISIC 01) d quarrying (ISIC 10-14) ure of paper and paper products (ISIC 21) ure of coke oven products (ISIC 231) ure of refined petroleum products (ISIC 232) ure of chemicals and chemical products (ISI ure of rubber and plastics products (ISIC 25) ure of other non metallic mineral products (	2) [C 24) [)			
	1.2.9	<ul> <li>1.2.8 Manufacture of other non-metallic mineral products (ISIC/26)</li> <li>2.9 Manufacture of basic iron and steel (ISIC 271)</li> <li>1.2.10 Manufacture of basic precious and non-ferrous metals (ISIC/272)</li> <li>1.2.11 Electricity, gas, steam and hot water supply (ISIC 40)</li> <li>1.2.12 Other economic activities</li> <li>1.2.13 Households</li> </ul>						
	1.3	By availa	ability of cle	eaning				
		1.3.1 1.3.2	Without c With clear	leaning ning or equivalent device				
2.	Emissi	ion from n	nobile sourc	<u>es</u>				
	2.1 From road transport							

<sup>&</sup>lt;sup>229</sup> United Nations Statistics Division. "International Standard Industrial Classification of All Economic Activities, Rev. 3". Available from <a href="http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=2">http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=2</a> (accessed 16 July 2013).

- 2.1.1 Using motor spirit (gasoline)
- 2.1.2 Using gas (diesel) oil
- 2.1.3 Using other fuels
- 2.2 From railway transport
- 2.3 From other transport
- 2.4 From other mobile sources

Emissions should at this time be reported on the following materials:

- Sulphur oxides, incl. hydrogen sulphide [in units of SO<sub>2</sub>]
- NO<sub>X</sub>, excl. nitrous oxide [in units of NO<sub>2</sub>]
- Ammonia
- Carbon monoxide
- Carbon dioxide [in units of CO<sub>2</sub>]
- Total volatile organic compounds, incl. halogenated compounds
- Lead
- Mercury
- Cadmium
- Suspended particulate matter

Emission data on items 1.1.1.1 to 1.1.1.3 should be broken down by type of fuel as follows:

- Coal and coal products
- Products obtained from petroleum refineries
- Natural gas
- Other fuels

### **Concentrations in ambient air**

- 2.1 Concentrations at impact stations
  - 2.1.1 Sulphur oxides [expressed as SO<sub>2</sub>]
  - 2.1.2 Nitrogen oxides [expressed as NO<sub>2</sub>]
  - 2.1.3 Carbon monoxide
  - 2.1.4 VOCs (to be specified)
  - 2.1.5 Lead
  - 2.1.6 Mercury
  - 2.1.7 Cadmium
  - 2.1.8 Suspended particulate matter
- 2.2 Concentrations at national/regional background stations

- 2.2.1 Sulphur oxides [expressed as SO<sub>2</sub>]
- 2.2.2 Particulate sulphate
- 2.2.3 Nitrogen oxides [expressed as NO<sub>2</sub>]
- 2.2.4 Nitric acid and particulate nitrate
- 2.2.5 Ozone (tropospheric)
- 2.2.6 Ammonia
- 2.2.7 Particulate ammonium compounds
- 2.2.8 VOCs (to be specified)
- 2.2.9 Chemical composition of precipitation (pH/H+ ammonium, nitrate, chloride and sulphate ions, sodium, potassium, magnesium and calcium ions, conductivity)
- 2.3 Concentrations at global background stations
  - 2.3.1 Ozone (stratospheric)
  - 2.3.2 Carbon dioxide
  - 2.3.3 Methane
  - 2.3.4 CFCs
  - 2.3.5 Halons
  - 2.3.6 Nitrous oxide
  - 2.3.7 Suspended particulate matter

### **Depositions**

- 3.1 Wet acidifying deposition
  - 3.1.1 Sulphur dioxide and sulphate expressed in sulphur content
  - 3.1.2 Nitrogen dioxide, nitric acid and nitrate expressed in nitrogen content
  - 3.1.3 Ammonia and ammonium compounds expressed in nitrogen content
  - 3.1.4 pH/H+

Note: Other deposition indicators may be added, once their development is sufficiently advanced.

#### **Classification of disasters**

D.6 The classifications to be used in the FDES to organize statistics on natural disasters are based on the Centre for Research on the Epidemiology of Disasters Emergency Disasters Database (CRED EMDAT). The types of data to be registered in this component of environment statistics, at the most disaggregated variable level, can include, for each calendar year or other appropriate time frame:

1. Identification	1.1 Name or denomination (if any)				
	1.2 Location and course, spatial trajectory or				
	occurrence				
	1.3 Magnitude (scale)				
	1.4 Date				
	1.5 National declaration of disaster				
	1.6 Maps and pictures - hyperlink				
	<b>1.7 Appeal for international assistance</b>				
2. Type of natural	2.1 Disaster sub-group				
disaster					
	2.2 Disaster main type				

Table D.7: Record for individual natural disaster occurrence

				0	v
	Disaster Sub-group	Di	isaster Main Type		Disaster Sub-type
1	Geophysical	1.1	Earthquake	1.1.1	Ground shaking
				1.1.2	Tsunami
		1.2	Mass movement		
		1.3	Volcanic activity	1.3.1	Ash fall
				1.3.2	Lahar
				1.3.3	Pyroclastic flow
				1.3.4	Lava flow
				•	
2	Meteorological	2.1	Storm	2.1.1	Extra-tropical storm
				2.1.2	Tropical storm
				2.1.3	Convective storm
		2.2	Extreme	2.2.1	Cold wave
			temperature	2.2.2	Heat wave
				2.2.3	Severe winter conditions
		2.3	Fog		·
	·	·	·		
3	Hydrological	3.1	Flood	3.1.1	Coastal flood
				3.1.2	Riverine flood
	-	•	-		

Table D.8: CRED EMDAT classification of disasters<sup>230</sup>

<sup>&</sup>lt;sup>230</sup> CRED EMDAT, "Classification of disasters". Available from <u>http://www.emdat.be/new-classification</u> (accessed 9 June 2015).

				3.1.3	Flash flood
				3.1.4	Ice jam flood
		3.2	Landslide	3.2.1	Avalanche (snow, debris,
					mudflow, rockfall)
		3.3	Wave action	3.3.1	Rogue wave
				3.3.2	Seiche
				·	-
4	Climatological	4.1	Drought		
		4.2	Glacial lake		
			outburst		
		4.3	Wildfire	4.3.1	Forest fire
				4.3.2	Land fire: brush, bush, pasture
	1		1		
5	Biological	5.1	Epidemic	5.1.1	Viral disease
				5.1.2	Bacterial disease
				5.1.3	Parasitic disease
				5.1.4	Fungal disease
				5.1.5	Prion disease
		5.2	Insect infestation	5.2.1	Grasshopper
				5.2.2	Locust
		5.3	Animal accident		
-			Т	611	Airburst
6	Extraterrestrial	6.1	Impact	0.1.1	7 HIOUISt
6	Extraterrestrial	6.1 6.2	Space weather	6.2.1	Energetic particles
6	Extraterrestrial	6.1 6.2	Space weather	6.2.1 6.2.2	Energetic particles Geomagnetic storm

#### **Classification of protected areas**

D.7 Through its World Commission on Protected Areas (WCPA), the IUCN has provided the international guidelines on the categorisation of protected areas for nearly a quarter of a century.<sup>231</sup> These categories are internationally recognised and facilitate a global system

<sup>&</sup>lt;sup>231</sup> United Nations Environment Programme, World Conservation Monitoring Centre, "IUCN Management Categories". Available from <a href="http://www.iucn.org/about/work/programmes/gpap-home/gpap-quality/gpap-pacategories/">http://www.iucn.org/about/work/programmes/gpap-home/gpap-quality/gpap-pacategories/</a> (accessed 14 November 2013).

for defining, recording and classifying protected areas and the wide variety of specific aims they might embody. Acknowledged on an international level and often incorporated into national legislation, the categories below are based upon the management objectives of a protected area.

Ia: Strict Nature	Category Ia are strictly protected areas set aside to protect biodiversity
Reserve	and also possibly geological/geomorphological features, where human
	visitation, use and impacts are strictly controlled and limited to ensure
	protection of the conservation values. Such protected areas can serve
	as indispensable reference areas for scientific research and monitoring.
Ib: Wilderness Area	Category Ib protected areas are usually large unmodified or slightly
	modified areas, retaining their natural character and influence, without
	permanent or significant human habitation, which are protected and
	managed so as to preserve their natural condition.
II: National Park	Category II protected areas are large natural or near natural areas set
	aside to protect large-scale ecological processes, along with the
	complement of species and ecosystems characteristic of the area,
	which also provide a foundation for environmentally and culturally
	compatible spiritual, scientific, educational, recreational and visitor
	opportunities.
III: Natural	Category III protected areas are set aside to protect a specific natural
Monument or	monument, which can be a landform, sea mount, submarine cavern,
Feature	geological feature such as a cave or even a living feature such as an
	ancient grove. They are generally quite small protected areas and often
	have high visitor value.
IV: Habitat/Species	Category IV protected areas aim to protect particular species or
Management Area	habitats and management reflects this priority. Many category IV
	protected areas will need regular, active interventions to address the
	requirements of particular species or to maintain habitats, but this is
	not a requirement of the category.
V: Protected	A protected area where the interaction of people and nature over time
Landscape/Seascape	has produced an area of distinct character with significant ecological,
Landscape/Seascape	biological, cultural and scenic value: and where safeguarding the
	integrity of this interaction is vital to protecting and sustaining the
	area and its associated nature conservation and other values.
VI: Protected area	Category VI protected areas conserve ecosystems and habitats,
with sustainable use	together with associated cultural values and traditional natural
of natural resources	resource management systems. They are generally large, with most of
	the area in a natural condition, where a proportion is under sustainable
	natural resource management and where low-level non-industrial use
	of natural resources compatible with nature conservation is seen as
	one of the main aims of the area.

#### Table D.9: IUCN classification of protected areas

D.8 The IUCN Red List Categories and Criteria are intended to be an easily and widely understood system for classifying species at high risk of global extinction. The general aim of the system is to provide an explicit, objective framework for the classification of the broadest range of species according to their extinction risk.<sup>232</sup>



Figure D.1: Structure of the IUCN Red List Categories<sup>233</sup>

 <sup>&</sup>lt;sup>232</sup> IUCN Species Survival Commission, 2014, "2001 IUCN Red List Categories and Criteria version 3.1. Available from <a href="http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria">http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria</a> (accessed 25 September 2014).
 <sup>233</sup> IUCN Species Survival Commission, 2014, "Guidelines for Using the IUCN Red List Categories and Criteria. Available from <a href="http://jr.iucnredlist.org/documents/RedListGuidelines.pdf">http://jr.iucnredlist.org/documents/categories-and-criteria/2001-categories-criteria</a> (accessed 25 September 2014).

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Selected Terms used in the FDES

#### Note to the user

This glossary aims to provide an easily accessible alphabetic list of selected terms used in the FDES. These terms originate in the FDES with particular or distinct attributes. They occur at different levels of complexity and provide context and supplementary information in diverse ways. The terms are presented here along with the paragraph numbers in which they appear in the text of the FDES.

Each term is accompanied with an explanation which may represent an actual definition, a simple description or provide other relevant contextual information considered useful in furthering understanding.

For practical purposes, the original institutional references for the definitions of the terms are excluded from this list. In each instance they can however be found in the original paragraph of the FDES that is cited at the end of the entry.

In some cases, terms which have been separated from their original context have a recontextualised explanation or supplemental content found in other paragraphs in order to enrich the explanation being provided. For this reason, the wording used in this list may vary slightly from that employed in the text of the FDES.

#### A

**Afforestation** is the establishment of forest through planting and/or deliberate seeding on land that, until then, was not classified as forest. It implies a transformation from non-forest to forest. From a resource accounting perspective, afforestation is defined by SEEA-CF as the increase in the stock of forest and other wooded land due to either the establishment of new forest on land that was previously not classified as forest land, or as a result of silvicultural measures such as planting and seeding. (paras. 3.109 and 3.119)

**Agri-environmental indicators** (AEI) are indicators able to describe and assess state and trends in the environmental performance of agriculture to furnish useful indications to scientists and policymakers about the state of the environment, about the effects of different policies, as well as about the efficiency in the use of budgets in terms of environmental outcomes. (para. 5.67 and 5.68)

**Airborne diseases and conditions** associated with the environment are caused or worsened by exposure to unhealthy levels of pollutants (such as PM, SO2 or O3), usually found in urban settlements, and in particular in those cities with weaker air quality regulations and/or enforcement capabilities. (para. 3.250)

**Aquaculture** is the farming of aquatic organisms, including fish, molluscs, crustaceans and aquatic plants. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. (para. 3.127)

**Aquatic resources** comprise fish, crustaceans, molluscs, shellfish, aquatic mammals, and other aquatic organisms that are considered to live within the boundaries of the Exclusive Economic Zone (EEZ) of a country throughout their lifecycles, including 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. (para. 3.123)

### B

**Biodiversity** is the variability among 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. It is also a measure of ecosystem health. (para. 3.23)

**Biological resources** are renewable resources that are capable of regeneration through natural (non-managed or managed) processes. Biological resources include timber and aquatic resources and a range of other animal and plant resources (such as livestock, orchards, crops and wild animals), fungi and bacteria. (para. 3.114)

**Biome**: A biome is a distinctive community of plants, animals, fungi, etc. that occupy a distinct region, and is often referred to as an ecosystem. (para. 3.33)

**Biota** is defined as all animal and plant life of a particular region or time. Biotic (living) factors function with the abiotic (non-living) factors to form a complex unit such as an ecosystem. (para. 3.35)

### С

**Climate change** is a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. Climate change occurs through a chain of events and can be observable at all levels, from local to global. Climate process drivers are emissions of GHGs that are associated with current production and consumption patterns, which are heavily dependent on fossil fuels for energy and transportation. (paras. 5.25 and 5.29)

**Climate change adaptation** is 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. (paras. 5.29 and 5.32)

**Climate change evidence** refers to the different processes that substantiate the occurrence of changing climate patterns and at the global, regional and local levels. The evidence of global warming and climate change is unequivocal, including increased global temperatures, changing weather patterns, more intense extreme events, rising sea levels, shrinking ice sheets and glacial retreats. (para. 5.29)

**Climate change mitigation** refers to efforts to reduce or prevent emission of greenhouse gases, and may involve using new technologies, incorporating and increasing renewable energies, making older equipment more energy efficient, and changing management practices or consumer behaviour. Protecting natural carbon sinks like forests and oceans, or creating new sinks through silviculture or green agriculture are also elements of mitigation. (para. 5.30)

**Climate change related statistics** refer to environmental, social and economic data that measure the human causes of climate change, the impacts of climate change on human and natural systems, the efforts of humans to avoid the consequences as well as their efforts to adapt to these consequences. (para. 5.35)

**Corporate, non-profit institution and household environment protection and resource management expenditure** includes corporate, non-profit institution and household environmental expenditure whose primary aim is to protect the environment and manage its resources. Statistics on this topic usually require the use of specific surveys of establishments in different sectors and industries. (para. 3.271)

**Crops** refer to plants or agricultural produce grown for food or other economic purposes, such as clothes or livestock fodder (ISIC Rev. 4, Section A, Division 01). (para. 3.131)

**Cultivated biological resources** cover animal resources yielding repeat products and tree, crop and plant resources yielding repeat products whose natural growth and regeneration are under the direct control, responsibility and management of an institutional unit. (para. 3.116)

#### D

**Deforestation** is the conversion of forest to another land use or the long-term reduction of the tree canopy cover below the minimum 10 per cent threshold. Deforestation implies the long-term or permanent loss of forest cover and implies transformation into another land use. Such a loss can only be caused and maintained by a continued human-induced or natural perturbation. Deforestation includes areas of forest converted to agriculture, pasture, water reservoirs and urban areas. The term specifically excludes areas where the trees have been removed as a result of harvesting or logging, and where the forest is expected to regenerate naturally or with the aid of silvicultural measures. From a resource accounting perspective, deforestation is defined by SEEA-CF as the decrease in the stock of forest and other wooded land due to the complete loss of tree cover and transfer of forest land to other uses (as agricultural land, land under buildings, roads, etc.) or to no identifiable use. (paras. 3.109 and 3.119)

**Depletion**, in physical terms, is the decrease in the quantity of the stock of natural resources that is due to the extraction of the natural resource by economic units occurring at a level greater than that of regeneration. (para. 3.78)

**Disasters** are unforeseen and often sudden event that cause great damage, destruction and human suffering. They often surpass local capacities to respond to them and require external assistance at the national or international level. A disaster is often described as a result of exposure to an extreme event. Depending on their cause, disasters can be both natural and technological. (para. 3.195)

**Dissipative losses** are material residues that are an indirect result of production and consumption activity. (para. 3.160)

**Dissipative uses of products** cover products that are deliberately released to the environment as part of production processes. (para.3.159)

**Driving Forces – Pressure – State – Impact – Response (DPSIR) framework** is an analytical framework that is based on the causal relationship between its D-P-S-I-R components. **D**riving 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. Impacts are the effects of environmental degradation. **R**esponses refer to the responses by society to the environmental situation. (para. 2.41)

#### Е

**Economic territory** is the area under effective control of a single government. It includes the land area of a country, including islands, airspace, territorial waters and territorial enclaves in the rest of the world. Economic territory excludes territorial enclaves of other countries and international organizations located in the reference country. (para. 1.72)

**Ecosystem** is a dynamic complex of plant, animal and microorganism communities and their non-living environment interacting as a functional unit. (para. 2.8)

**Ecosystem services** are the benefits supplied by the functions of ecosystems and received by humanity. (para. 2.9)

**Emissions** are substances released to the environment by establishments and households as a result of production, consumption and accumulation processes. (para. 3.156)

**Emissions to air** are gaseous and particulate substances released to the atmosphere by establishments and households as a result of production, consumption and accumulation processes. (para. 3.164)

**Emissions to water** are substances released to water resources by establishments and households as a result of production, consumption and accumulation processes. (para. 3.17)

**Energy production** refers to the capture, extraction or manufacture of fuels or other energy products in forms which are ready for general consumption. Energy is produced for human use in a number of different ways, depending on its source. Total energy production originates from non-renewable and renewable sources. (paras. 3.96 and 3.97). Energy production includes the production of primary and secondary energy. Primary energy refers to energy sources as found in their natural state as opposed to derived or secondary energy, which is the result of the transformation of primary sources. (para. 3.98)

**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. These activities include the protection of ambient air and climate, wastewater management, waste management, protection and remediation of soil, groundwater and surface water, noise and vibration abatement, protection of biodiversity and landscapes, protection against radiation, research and development for environmental protection and other environmental protection activities. (para. 3.264)

**Environment statistics** structure, synthesize and aggregate environmental and other data according to statistical methods, standards and procedures. The scope of environment statistics covers biophysical aspects of the environment and those aspects of the socio-economic system that directly influence and interact with the environment. (paras. 1.26 and 1.33)

**Environmental awareness** involves the progressive understanding of environmental issues, and the realization of the connections between human actions, development, sustainability and the human responsibility in these processes. Environmental awareness entails the realization that humans and ecosystems co-exist in a shared environment which is ultimately the biosphere. Awareness fosters pro-environmental attitudes and predispositions for action and changed behaviour. (para. 3.298)

**Environmental data** are large amounts of unprocessed observations and measurements about the environment and related processes. (para. 1.32)

**Environmental education** refers to the process of sharing and constructing environmental information and knowledge, as well as information on how humans interact with the environment. Environmental education is realized through a variety of programmes including formal and informal education and training, directed towards different audiences. It can be curriculum and classroom based or experiential, and provided on-site or in community settings by government agencies or NGOs. Environmental education is an integral part of education for sustainable development. (para. 3.294)

**Environmental engagement** involves the progression of transforming perception and attitudes into concrete, pro-environmental actions. Individual and social participation and engagement in different environmental processes aimed at improving and protecting the local and global environment are a concrete manifestation of understanding, motivation and commitment towards protecting and improving the environment which is expressed through actual behaviour. (para. 3.302)

**Environmental Goods and Services Sector (EGSS)** consists of a heterogeneous set of producers of technologies, goods and services that: (i) measure, control, restore, prevent, treat, minimise, research and sensitise environmental damages to air, water and soil as well as problems related to waste, noise, biodiversity and landscapes. This includes 'cleaner' technologies, goods and services that prevent or minimise pollution; and (ii) measure, control, restore, prevent, minimise, research and sensitise resource depletion. This results mainly in resource-efficient technologies, goods and services that minimise the use of natural resources. (para. 3.268)

**Environmental health** focuses on how environmental factors and processes impact and change human health. It can be defined as an interdisciplinary field that focuses on analysing the relation between public health and the environment. From the health perspective, WHO states that "environmental health addresses all the physical, chemical, and biological factors external to a person, and all the related factors impacting behaviours. It encompasses the assessment and control of those environmental factors that can potentially affect health. It is targeted towards preventing disease and creating health-supportive environments [...]". (para. 3.244)

**Environmental indicators** are used to synthesize and present complex environment statistics to summarize, simplify and communicate relevant information in this domain. (para. 1.34)

**Environmental indices** are composite or more complex measures that combine and synthesize more than one environmental indicator or statistic that are weighted according to different methods. (para. 1.35)

**Environmental information** describes quantitative, qualitative or geographically referenced facts representing the state of the environment and its changes as described in the different components of the FDES. Quantitative environmental information is generally produced in the form of data, statistics and indicators, and it is generally disseminated through databases,

spreadsheets, compendia and yearbook type products. Qualitative environmental information consists of descriptions (e.g. textual, pictorial) of the environment or its constituent parts that cannot be adequately represented by accurate quantitative or geographically referenced descriptors. Geographically referenced environmental information provides facts on the environment and its components using digital maps, satellite imagery and other sources linked to a location or map feature. (paras. 1.31 and 3.290)

**Environmental perception** refers to the concepts, attitudes and evaluations of persons and groups towards the environment, both as a whole or with respect to specific environmental issues. Decisions, judgments and actions are made by individuals and communities upon subjective perceptions of environmental information and experiences. Information is therefore "filtered" by people's values and attitudes, and transformed into perception in a culturally specific manner. (para. 3.298)

**Environmental regulation and instruments** refer to social responses aiming to regulate and establish acceptable limits for protecting the environment and human health. They entail both direct regulation as well as economic instruments. Direct regulation instruments include environmental and related laws, standards, limits and their enforcement capacities. They can be measured through statistics about regulated pollutants, licensing systems, applications for licences, quotas for biological resource extraction, as well as budget and the number of staff dedicated to enforcement of environmental regulations. Economic instruments may be exemplified by the existence and number of green/environmental taxes, environmental subsidies, eco-labelling and certification, as well as emission permits. (para. 3.277)

**Environmental resources** (assets) are the naturally occurring living and non-living components of the Earth, together comprising the biophysical environment, which may provide benefits to humanity. Environmental resources include natural resources (such as sub-soil resources (mineral and energy), soil resources, biological resources and water resources) and land. They can be naturally renewable (e.g., fish, timber or water) or non-renewable (e.g., minerals). (para. 3.76)

**Extreme events** are events that are rare within their statistical reference distribution at a particular location. An extreme event is normally as rare or rarer than the 10th or 90th percentile. (para. 3.195)

### F

**Fauna:** The animal life of a particular region or time. It is generally regarded as that which is naturally occurring and indigenous. (para. 3.35)

**Flora:** The plant life of a particular region or time. It is generally regarded as that which is naturally occurring and indigenous. (para. 3.35)

**Forest** is land spanning more than 0.5 hectares with trees higher than 5 metres and a canopy cover of more than 10 per cent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use. (para. 3.42)

#### G

**Genetic resources** are defined as genetic material of plants, animals or microorganisms containing functional units of heredity that are of actual or potential value as a resource for future generations of humanity. (para. 3.133)

**Geographic Information System (GIS)** is an integrating technology that helps to capture, manage, analyze, visualize and model a wide range of data with a spatial or locational component. (para. 1.51)

**Geospatial information** presents the location and characteristics of different attributes of the atmosphere, surface and sub-surface. It is used to describe, display and analyze data that have discernible spatial aspects, such as land use, water resources and natural disasters. Geospatial information allows for the visual display of different statistics in a map-based layout, which can make it easier for users to work with and understand the data. The ability to overlay multiple data sets using software, for instance on population, environmental quality, and environmental health, allows for a deeper analysis of the relationship among these phenomena. (para. 1.73)

**Government environment protection and resource management expenditure** includes government expenditure whose primary aim is to protect the environment and manage its resources. (para. 3.269)

**Groundwater** comprises water that collects in porous layers of underground formations known as aquifers. (para. 3.145)

### H

**Human settlements** refer to the totality of the human community, whether people live in large cities, towns or villages. They encompass the human population that resides in a settlement, the physical elements (e.g., shelter and infrastructure), services (e.g., water, sanitation, waste removal, energy and transport), and the exposure of humans to potentially deleterious environmental conditions. (para. 3.219)

### I

**Improved drinking water source** includes the use of: piped water into dwelling, plot or yard; public tap or standpipe; borehole or tube well; protected dug well; protected spring; rainwater collection and bottled water (if a secondary available source is also improved). (para. 3.227)

**Improved sanitation facility** is defined as one that hygienically separates human excreta from human contact. Improved facilities include flush or pour flush toilets or latrines connected to a sewer, -septic tank or -pit; ventilated improved pit latrines; pit latrines with a slab or platform of any material which covers the pit entirely, except for the drop hole and composting toilets or latrines. (para. 3.228)

**Institutional dimension of environment statistics** refers to the institutional factors necessary for the development and strengthening of the sustained production, dissemination and use of environment statistics. It comprises the legal framework that establishes the mandates and roles of main partners, the institutional setting and institutional development level of environment statistics units, and the existence and effectiveness of inter-institutional cooperation and coordination mechanisms at the national level and with specialized international agencies. (para. 1.79)

**Institutional strength**: 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. (para. 3.275)

**In-stream water use** refers to the use of water without moving it from its source or to the use when water is immediately returned with little or no alteration. (para. 3.148)

## K

**Known mineral deposits** include: commercially recoverable deposits; potential commercially recoverable deposits; as well as non-commercial and other known deposits. (para. 3.84)

### L

**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. From the resource perspective, 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. (paras. 2.16 and 3.102)

Land cover is the observed (bio) physical cover on the earth's surface. (para. 3.23)

**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. (para. 3.104)

**Livestock** are animal species that are raised by humans for commercial purposes, consumption, or labour (ISIC Rev 4, Section A, Division 01). (para. 3.135)

## М

**Multilateral Environmental Agreements** address, via international cooperation, environmental problems, especially those which have a transboundary nature or are global in scope. It is
usually the case that for the most relevant MEAs, participant or signatory countries face the need to periodically report on progress either on a mandatory or voluntary basis. (paras. C.1 and C.2)

## Ν

**Natural biological resources** consist of animals, birds, fish and plants that yield both once-only and repeat products for which natural growth and/or regeneration is not under the direct control, responsibility and management of institutional units. (para. 3.115)

**Nuclear radiation-related diseases and conditions:** The related diseases and health conditions can be acute or chronic. They 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. Exposure to nuclear radiation could occur from a nuclear explosion or from an accident involving a nuclear reactor. (paras. 3.2556and 3.257)

# 0

**Other non-cultivated biological resources**: These resources may include wild berries, fungi, bacteria, fruits, sap and other plant resources that are harvested (ISIC Rev. 4, Section A, class 0230) as well as wild animals that are trapped or killed for production, consumption and trade (ISIC Rev. 4, Section A, class 0170). (para. 3.140)

**Other Wooded Land** is land not classified as "Forest", spanning more than 0.5 hectares; with trees higher than 5 metres and a canopy cover of 5-10 per cent, or trees able to reach these thresholds in situ; or with a combined cover of shrubs, bushes and trees above 10 per cent. It does not include land that is predominantly under agricultural or urban land use. (para. 3.42)

# Р

**Protected Area Management Categories** are based on the strictness of protection and serve as the classification for protected areas. The main categories are strict nature reserve; wilderness area; national park; natural monument or feature; habitat/species management area; protected landscape/seascape; and protected area with sustainable use of natural resources. (para. 3.38)

# R

**Remote sensing** is the science of obtaining information about objects or areas from a distance, typically from aircraft or satellites. (para. 1.50)

**Renewable energy** is captured from sources that replenish themselves. It includes solar (photovoltaic and thermal), hydroelectric, geothermal, tidal action, wave action, marine (non-tidal currents, temperature differences and salinity gradients), wind and biomass energy, all of which are naturally replenished, even though their flow may be limited. (para. 3.95)

**Renewable water resources** of a country are generated by precipitation and inflows of water from neighbouring territories and reduced by evapotranspiration. (para. 3.145)

**Residuals** are flows of solid, liquid and gaseous materials, and energy, that are discarded, discharged or emitted by establishments and households through processes of production, consumption or accumulation. (para. 3.154)

**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. (para. 3.265)

**Reused water** is wastewater supplied to a user for further use with or without prior treatment. (para. 3.157)

## S

**Slums** are housing 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. (para. 3.237)

**Soil** 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. The main environmental concerns about soil pertain to its degradation through, inter alia, soil erosion or nutrient depletion. (para. 3.17)

**Soil resources** comprise the top layers (horizons) of soil that form a biological system. (para. 3.111)

**Stocks of non-renewable energy resources** are defined as the amount of known deposits of mineral energy resources. (para. 3.92)

**Stocks of mineral resources** are defined as the amount of known deposits of non-metallic and metallic mineral resources. (para. 3.84)

**Sub-soil resources** are underground deposits of various minerals that provide raw materials and sources of energy for humans. These sub-soil 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 (para. 2.17)

**Surface water** comprises all water that flows over or is stored on the ground's surface regardless of its salinity levels. Surface water includes water in artificial reservoirs, lakes, rivers and streams, snow, ice and glaciers. (para. 3.145)

# Т

**Technological disasters** may arise as a result of human intent, negligence or error, or from faulty or failed technological applications. There are three types of technological disasters. These are: industrial accidents which cover accidents associated with chemical spill, collapse, explosion, fire, gas leak, poisoning, radiation and other; transport accidents which cover accidents associated with air, road, rail, and water; and miscellaneous accidents which cover accidents associated with collapse, explosion, fire, and other disasters of varied origin. (paras. 3.204 and 3.206)

**Timber resources** are defined by the volume of trees, living and dead, which can still be used for timber or fuel. (para. 3.117)

**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). (para. 3.254)

**Toxic substance-related diseases and health problems** include, but are not limited to, chronic illnesses of the respiratory system (such as pneumonia, upper and lower respiratory diseases, asthma and chronic obstructive pulmonary diseases), cancer, infertility, and congenital anomalies or malformations. (para. 3.254)

# V

**Vector borne diseases** are transmitted by organisms (e.g., insects and arachnids) that carry viruses, bacteria, protozoa and other pathogens. 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. (para. 3.252)

# W

Waste covers discarded materials that are no longer required by the owner or user. (para. 3.158)

Wastewater is discarded water that is no longer required by the owner or user. (para. 3.157)

**Water abstraction** is the amount of water that is removed from any source, either permanently or temporarily, in a given period of time. 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. (para. 3.147)

**Water-related diseases and conditions** result from micro-organisms and chemicals in the water humans drink. They include, but are not limited to diseases caused by biological contamination such as gastroenteritis infections caused by bacteria, viruses and protozoa, and water borne parasite infections. (para. 3.251)

**Water resources** consist of fresh and brackish water, regardless of their quality, in inland water bodies including surface water, groundwater and soil water. (para. 3.145)