Framework for the Development of Environment Statistics (FDES) 2013
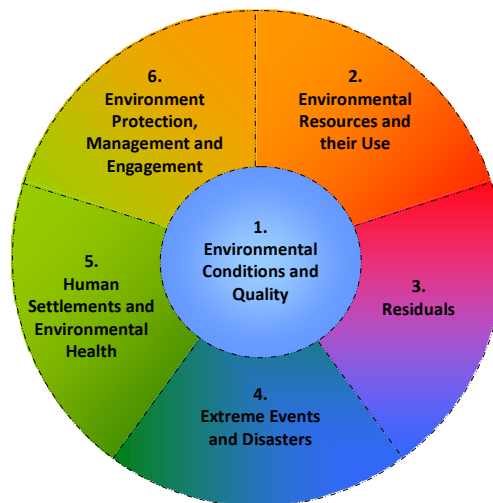
Prepared by the United Nations Statistics Division

DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS
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Framework for the Development of Environment Statistics (FDES) 2013

Final Draft

Prepared by the United Nations Statistics Division

The document should not be considered final and should not be quoted

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Acronyms

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

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

Preface

      This publication presents the Framework for the Development of Environment Statistics (FDES) 2013, which is the revised version to 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"[1] contains several references to the importance of data, information, and indicators and in particular, environmental data. The FDES 2013 is expected to contribute significantly to improved monitoring and measurement of the environmental dimension of sustainable development and to 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 both a multi-purpose and flexible tool that can be tailored to specific environmental policy concerns and priorities of the countries, as well as accommodate 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 Statistical Commission at its 44th session in February 2013 is expected to endorse the FDES 2013, including the Core Set of Environment Statistics, together with a plan of implementation.

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[1] Rio + 20 outcome document (http://daccess-dds-ny.un.org/doc/UNDOC/LTD/N12/436/88/PDF/N1243688.pdf?OpenElement)

Acknowledgements

(Chair of the UN Committee of Experts on Environmental-Economic Accounting). Experts from non-governmental organizations included: Marc Levy (Center for International Earth Science Information Network, Columbia University); Robin O'Malley (Heinz Center for Science, Economics and Environment); and Christian Layke (World Resources Institute).

The following experts provided additional feedback on the drafts of the FDES 2013: Sarah Kabaija (Uganda); Ole Gravgard Pedersen and Thomas Olsen (Denmark); Julie Hass (Norway), who also provided indispensable editorial help; Viveka Palm (Sweden), Daniel Clarke (formerly UNSD, currently United Nations Economic and Social Commission for Asia and the Pacific); Sachiko Tsuji (Food and Agriculture Organization of the United Nations); Jaap van Woerden (United Nations Environment Programme); and Carl Obst (Editor of the System of Environmental-Economic Accounting Central Framework).

It is also important to acknowledge the valuable contribution of countries and experts that participated in the Pilot Exercise carried out towards the final stage of the revision (August-September 2012) to refine the Core Set of Environment Statistics. Both developed and developing countries from all regions participated in the Pilot exercise. In all, twenty-five countries and two international organizations took part in the Pilot, including twenty developing countries (Belize, Brazil, Botswana, Cameroon, China, Costa Rica, Cote d'Ivoire, Cuba, Ecuador, India, Jamaica, Mexico, Nigeria, Philippines, Qatar, Mauritius, Sri Lanka, Venezuela, Vietnam and United Arab Emirates), five developed countries (Hungary, Italy, Netherlands, Sweden, United States) and two international organizations (Eurostat and UNEP).

Also, the FDES revision benefited greatly from comments, suggestions and substantive input from the 71 countries, areas and institutions that responded to the Global Consultation (September-November 2012) on the final draft of the FDES 2013. Countries who sent responses included Antigua and Barbuda, Australia, Belgium, Belize, Bhutan, Botswana, Brazil, Bulgaria, Cameroon, Canada, Cape Verde, Chile, China, Colombia, Croatia, Czech Republic, Dominican Republic, Ecuador, Finland, Georgia, Hong Kong-SAR of China, Hungary, India, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Latvia, Lesotho, Lithuania, Macao-SAR of China, Madagascar, Mauritius, Mexico, Montenegro, Myanmar, New Zealand, Nigeria, Norway, Palestine, Philippines, Poland, Qatar, Republic of Belarus, Romania, Russian Federation, Serbia, Sierra Leone, Slovenia, South Africa, South Sudan, Sri Lanka, Saint Vincent and the Grenadines, Suriname, Sweden, Switzerland, The Gambia, Togo, Turkey, United Kingdom, United Arab Emirates, Venezuela and Vietnam, while participating institutions included UN-ECLAC, ECOWAS, UN-ESCAP, Eurostat and the Environmental–Economic Accounting Section of UNSD.

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 interdisciplinary in nature. Their sources are dispersed over a variety of data collecting institutions, and similarly numerous methods are applied in their compilation. The field of environment statistics requires a proper framework to guide its development, coordination and organization.

1.4.   An environment statistics framework: (i) marks out the scope of environment statistics; (ii) facilitates a synthesized presentation of data from various subject areas and sources; (ii) suitably simplifies the complexity of the environment so as to render its measurement tractable; (iii) helps identify the range of statistics relevant to societal decision-making regarding the environment; (iv) is coherent with frameworks for statistics already used in other domains in order to facilitate the integration of environment statistics; and (v) is conceptually based.

Background

1.5.   *A Framework for the Development of Environment Statistics*[2] (FDES) was first published
in 1984 by the United Nations Statistics Division (UNSD), along with its subsequent
publications, *Concepts and Methods of Environment Statistics: Human Settlements
Statistics*[3] (1988) and *Concepts and Methods of Environment Statistics: Statistics of the
Natural Environment*[4] (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 Environmental 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
international organizations, specialized agencies and non-governmental organizations.[5]

The revision process

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

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[2] UNSD, "A Framework for the Development of Environmental Statistics". Available from
http://unstats.un.org/unsd/publication/SeriesM/SeriesM_78e.pdf (accessed 18 June 2012).
[3] UNSD, "Concepts and Methods of Environment Statistics: Human Settlements Statistics" (1988). Available from
http://unstats.un.org/unsd/publication/SeriesF/SeriesF_51e.pdf (accessed 18 June 2012).
[4] UNSD, "Concepts and Methods of Environment Statistics: Statistics of the Natural Environment" (1991). Available from
http://unstats.un.org/unsd/publication/SeriesF/SeriesF_57E.pdf (accessed 18 June 2012).
[5] UNSD, Expert Group on the Revision of the UN FDES. Available from http://unstats.un.org/unsd/environment/fdes/fdes_egm.htm (accessed 18
June 2012).

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 Core 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 71 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. It is broad and holistic in nature, covering the issues and aspects of the environment that are relevant for analysis, policy and decision making.

1.10.   The FDES 2013 targets a wide user community including environmental statisticians in national statistical offices (NSOs), environmental administration and management as well as other producers of environment statistics. It helps to mark out the roles of the different data producers, thus facilitating coordination.

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) or the sustainable development indicator 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, the relationship between environmental data, statistics, accounts and indicators. The typical sources of data, 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 of the FDES, explains the underlying fundamental concepts and how those concepts relate to the Framework. It describes the scope of the FDES and explains how the underlying concepts have been translated into the 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. Annexes B-D provide supporting information on the conceptual and policy developments since the publication of the FDES in 1984; on the major multilateral environmental agreements relevant to environment statistics; and on 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 the development of detailed methodological guidance for the Core Set of Environment Statistics and the Basic Set of Environment Statistics, including classifications, definitions and data collection and compilation methods. It will build on existing methodologies as well as on ongoing methodological work in the field of environment statistics and 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. 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 cuts across several disciplines and draws data from a wide range of
different sources. Besides the NSOs and environmental ministries, several other institutions
are key players in the production of data used in environment statistics. To effectively
produce environment statistics, statistical and environmental expertise, 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. Ongoing development and organization of
environment statistics can also be observed at national and international levels. However,
many countries still require substantial technical assistance and capacity building in
developing their national environment statistics programmes.

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. Ultimately, environment statistics aim at providing high quality statistical information
to improve knowledge of the environment, to support evidence-based policy and decision
making, and to provide information for the general public, as well as for specific user groups.

1.2 Scope of environment statistics

1.26.   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 to draw a
fine dividing line between these statistical areas. Social and economic statistics describing
processes or activities that have a direct impact on, or interact directly with, the environment
are widely used in environment statistics and they are within the scope of the FDES. Beyond

that, other relevant social and economic statistics are also required to put environmental issues in context and to facilitate the integrated analysis of environmental, social and economic processes. The use of consistent definitions and classifications among these fields helps their integration. When properly integrated, data and other inputs from these domains enrich the analysis of environment statistics.

1.3 Main uses and user groups of environment statistics

1.28. 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 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 and state of the environment reports.

1.4 Environmental data, statistics and indicators

1.31.   Environmental data are large amounts of unprocessed observations and measurements about the environment and related processes. They can be collected or compiled by statistical surveys (censuses or sample surveys) by NSOs or other parts of the national statistical system, or they may originate from administrative records, registers, inventories, monitoring networks, remote sensing, scientific research, and field studies.

1.32.   Environment statistics describe, aggregate, synthesize and structure environmental and other data according to statistical methods, standards and procedures. It is the role of environment statistics to process environmental data into meaningful statistics that describe the state and trends of the environment and the main processes affecting them. Not all environmental data are used in the production of environment statistics. The FDES provides a framework that identifies environmental data that fall within its scope and then contributes to structuring, synthesizing and aggregating the data into statistical series and indicators.

1.33.   Environmental indicators are used to synthesize and present complex statistics and are measures that summarize, simplify and communicate information. 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 values, evaluating specific programmes, demonstrating progress, measuring changes in a specific condition or situation over time, determining impact of programmes and conveying messages. Frameworks such as the DPSIR, or policy frameworks such as the MDGs or the sustainable development indicator frameworks are typically used for the identification and structuring of indicators.

1.34.   Environmental indices, a special type of indicators, are composite or more complex measures that combine and synthesize more than one 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.

1.35.   For specific analytical purposes, environment statistics may be organized and structured according to different analytical frameworks such as for instance the DPSIR framework, or 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.

1.36. Accounting frameworks, such as the SEEA, reorganize the relevant environment statistics according to stocks and flows within and between the environment and the economy based on national accounting principles, thus linking environment statistics with the System of National Accounts (SNA) and facilitating the analysis of relationships between the economy and the environment.

1.37. 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 can be produced and used as an integrated system which would increase synergy and consistency, as well as efficiency in the use of limited financial resources.

1.38. Geographically referenced information that includes digital maps, satellite and aerial imagery, and other sources of data that are linked to a location or a map feature, all structured in databases, will also add significantly to the quantity and quality of information that is organized within the context of environment statistics. GIS can be viewed as an integrating technology that helps to capture, manage, analyze, distribute and use a wide range of data with a spatial or locational component.

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 (e.g., satellite imaging of land use, 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 are both 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 will have agencies that are primarily responsible for the monitoring of environmental resources and conditions. They can be entities on their own right, or can be government agencies with other primary functions that will have departments that deal with environmental matters. These agencies will 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 modeling).

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.[6]

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.[7]

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

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[6] UNSD, "International Recommendations for Water Statistics", 2012. Available from http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf (accessed 24 October 2012).
[7] International Statistical Institute, "The Oxford Dictionary of Statistical Terms", Yadolah Dodge, ed. (Oxford University Press, 2003).

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.

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 statistical 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

1.50.   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. By satellite, aircraft, spacecraft, buoy, ship, balloon and helicopter images, data are created to analyze and compare vegetation rates, changes in the area of soil erosion, the extension of pollution, changes in land cover, or to estimate populations of different animal species. These can be mapped, imaged, tracked and observed. Remote sensing, combined with sufficient validation using actual measurements in the field, usually provides high quality data for environment statistics.

Monitoring systems

1.51.   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.

1.52.   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

1.53.   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_2 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.

1.54.   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.

1.55.   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.

1.56.   *Table 1.1: Types of sources of environment statistics and main characteristics*[8] 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.

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[8] UN ECLAC, "Methodological Guide for developing Environmental and Sustainable Development Indicators in Latin American and Caribbean Countries". Serie Manuales No. 61. Available from 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 (accessed 19 January 2013).

Table 1.1: Types of sources of environment statistics and main characteristics					
Type of source	**Examples of source**	**Examples of statistics**	**Examples of advantages**	**Examples of disadvantages**	**Challenges for developing countries**
Statistical surveys **1. 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
2. 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 representativeness 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
Administrative 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

Remote sensing	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	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
Monitoring 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	Costs 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

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1.6 Classifications, categories and other groupings relevant to environment statistics

1.57.   Statistical classifications are sets of discrete categories which may be assigned to a specific variable in a statistical survey or an administrative file and used in the production and presentation of statistics.[9]

1.58.   The field of environment statistics has no single, overarching, internationally agreed classification of the environment for statistical purposes. Instead, there are a number of co-existing and emerging classifications and categorizations for specific subject areas. 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.

1.59.   Standard economic and social-demographic statistical classifications, such as e.g., the International Standard Industrial Classification of All Economic Activities (ISIC)[10] and the Central Product Classification (CPC)[11], or the International Classification of Diseases (ICD)[12]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.

1.60.   The pioneering environment statistics classifications adopted by the Conference of European Statisticians (CES) between 1989 and 1996 have been used extensively for international data collection. These environment statistics classifications developed by the Economic Commission for Europe (ECE) are heterogeneous and most of them include more than one single hierarchical classification. They also include recommendations for definitions, measurement methods and tabulations. The ECE classifications for environment statistics include classifications of Water Use (1989), Land Use (1989), Wastes (1989), Ambient Air Quality (1990), Freshwater Quality for the Maintenance of Aquatic Life (1992), Marine Water Quality (1992), Environment Protection Activities and Facilities (1994), and Flora, Fauna and Biotopes (1996).

1.61.   More recent statistical classifications as well as less-formalized categorizations which pertain to specific sub-domains of environment statistics do exist and are in use. They are

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[9] UNSD, "Standard Statistical Classifications: Basic Principles". Available from http://unstats.un.org/unsd/class/family/bestprac.pdf (accessed 14 June 2012).
[10] UNSD, "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 2012).
[11] UNSD, "Central Product Classification, Ver. 2". Available from http://unstats.un.org/unsd/cr/registry/cpc-2.asp (accessed 15 June 2012).
[12] WHO, "International Classification of Diseases". Available from http://www.who.int/classifications/icd/en/ (accessed 19 June 2012).

classifications and categorizations developed by different international organizations and specialized agencies, intergovernmental organizations or non-governmental organizations. Examples are the FAO Land Cover Classification System, the UN Framework Classification for Energy and Mineral Resources, or the groupings and classifications developed for water statistics and for energy products in the relevant UN international recommendations.

1.62.   Many of the aforementioned classifications have been revised, adapted and used in the SEEA Central Framework, including the Classification of Environmental Activities (CEA) which covers the classes of activities that are considered to be environment protection and resource management activities, mostly used for producing statistics of environmental protection and resource management expenditure. Other examples are the categories of solid waste or the interim classifications of land use and land cover. More work on classifications regarding ecosystems and ecosystem services is being carried out as part of the development of the SEEA Experimental Ecosystem Accounts.

1.63.   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 – EM-DAT); classifications for protected areas and threatened species by United Nations Environment Programme's World Conservation Monitoring Centre (UNEP-WCMC) and the International Union for the Conservation of Nature (IUCN); the ecosystem reporting categories used by the Millennium Ecosystem Assessment; or the source categories for greenhouse gas emissions (GHGs) from the Inter-governmental Panel on Climate Change (IPCC).

1.64.   These classifications have been widely used by the UN ECE, the Organization for Economic Co-operation and Development (OECD), Eurostat, UNSD, and various regional and national bodies for international data collection. Ensuring harmonization of the different classifications and building bridges among them are among the most important roles of environmental statisticians.

1.65.   For more information on classifications used in environment statistics please see Chapter 3 and Annex A which contain the Basic Set of Environment Statistics. The Basic Set includes a column that lists commonly used classifications and 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[13] 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 data can still be produced at regular intervals if there are enough data points in each period to do so.

Spatial considerations

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[13] Air quality is measured by the concentrations of particulate matter (PM_{10}, $PM_{2.5}$) also known as suspended particulate matter (SPM), ground level ozone (O_3) or other pollutants depending on the specific city.

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.

1.8 Geospatial information and environment statistics

1.72.   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.

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

1.74.   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.).

1.75.   A GIS is a computer system capable of capturing, storing, analyzing, and displaying geographically referenced information.[14] Geospatial data can be acquired using a variety of technologies such as Global Positioning System (GPS) and Remote Sensing satellites. Land surveyors, census takers, aerial photographers, police, and even average citizens with a GPS-enabled cell phone can collect geospatial data using GPS or street addresses that can be entered into GIS. The attributes of the collected data, such as land-use information, demographics, landscape features, or crime scene observations, can be entered manually or, in the case of a land survey map, digitized from a map format to a digital format by electronic scanning. The final representation of the data is constructed by superimposing different layers of information as required by the analytical and/or policy requirements.

Figure 1.1: Example of GIS data layers or themes
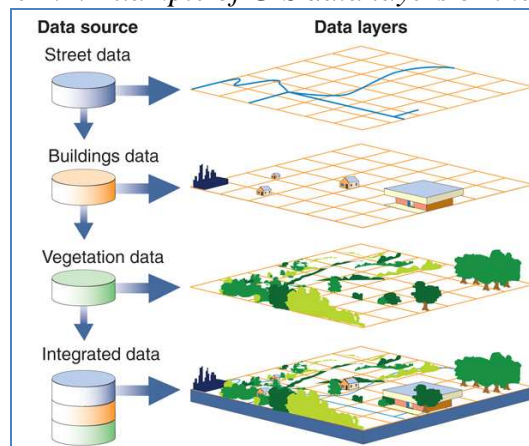
Source: GAO (2004).

1.76.   Remote sensing is a technique for gathering information about an object without coming into physical contact with it. It is the quantitative analysis of digital information where measurements can be made from ground, aircrafts or satellites. The information is carried by electromagnetic radiation. With remote sensing, skills are needed in digital image analysis where computer programming, image display tools and statistics, etc., are required for interdisciplinary work that might involve scientists and experts in various fields - biology, climatology, geology, atmospheric science, chemistry, oceanography, and more. With

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[14] Government Accountability Office, (2004), *Geospatial Information: Better Coordination Needed to Identify and Reduce Duplicative Investments*, http://www.gao.gov/assets/250/243133.pdf

satellite remote sensing, global issues can be addressed by monitoring regional and global changes.

1.77.   Earth observation[15], through measuring and monitoring, provides an insight and understanding into Earth's complex processes and changes. Earth observation includes measurements that can be made directly or by sensors in-situ or remotely (i.e., satellite remote sensing, aerial surveys, land or ocean-based monitoring systems) to provide key information to models or other tools to support decision making processes. Earth observation assists governments and civil society to identify and shape corrective and new measures to achieve sustainable development through original, scientifically valid assessments and early warning information on the recent and potential long-term consequences of human activities on the biosphere.

1.78.   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 must be transformed so they fit the same coordinates. GIS uses the processing power of a computer, together with geographic mapping techniques (cartography), to transform data from different sources onto one projection and one scale so that the data can be analyzed together.

1.9 Institutional dimension of environment statistics

1.79.   The institutional dimension of environment statistics is as important as technical capacity 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 involve numerous stakeholders, actors and producers. The problems 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

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[15] UNEP, "Early Warning Systems – A State of the Art Analysis and Future Directions" (2012). Available from http://na.unep.net/siouxfalls/publications/Early_Warning.pdf (accessed 1 October 2012).

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.   The legal framework. In most countries, the legal framework for the production of environment statistics commonly consists of statistical, environmental and other relevant sectoral legislation such as water, energy and agriculture. Each of these laws defines the mandate and competencies of the institutions in charge of each sector.

1.82.   Under national statistical legislation, commonly the NSO is the responsible authority for creating and coordinating the national statistical system. However, in most cases, the law does not explicitly refer to environment statistics, as this is a relatively new statistical domain. Moreover, in many cases it does not explicitly provide guidelines for statistical coordination among the relevant statistical parties at the national level nor spell out responsibilities and obligations. Nevertheless, since the environment is becoming increasingly important in the development agenda, NSOs have included the production of environment statistics in their programmes though sometimes without clarity on the supporting institutional arrangements.

1.83.   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 because different agencies are producing the same or similar statistics.

1.84.   Institutional development. 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.   Inter-institutional collaboration. 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 multi-stakeholder 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.　Institutional cooperation of national, regional and global bodies. The institutional challenges common in countries are also faced by international organizations that are involved in the production of environmental data and statistics. Not withstanding 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 characteristics of environment statistics and the FDES 2013

1.89.　The FDES 2013 addresses the characteristics and challenges of environment statistics by providing a conceptual foundation and organizing structure for environment statistics, identifying the scope of relevant statistics, and by indicating the availability of classifications, methodologies and the most common sources of data as well as the most relevant institutional stakeholders.

Chapter 2: Framework for the Development of Environment Statistics

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 statistical framework which can help in organizing the collection and compilation of environment statistics. It is relevant to, and recommended for use by, countries at any stage of development. 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.

2.2 Conceptual foundation of the FDES

2.3.   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 human sub-system as an integral part of the environment, and 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

Processes within the
environment

Processes within the
human sub-system

Interactions between the
environment and the
human sub-system
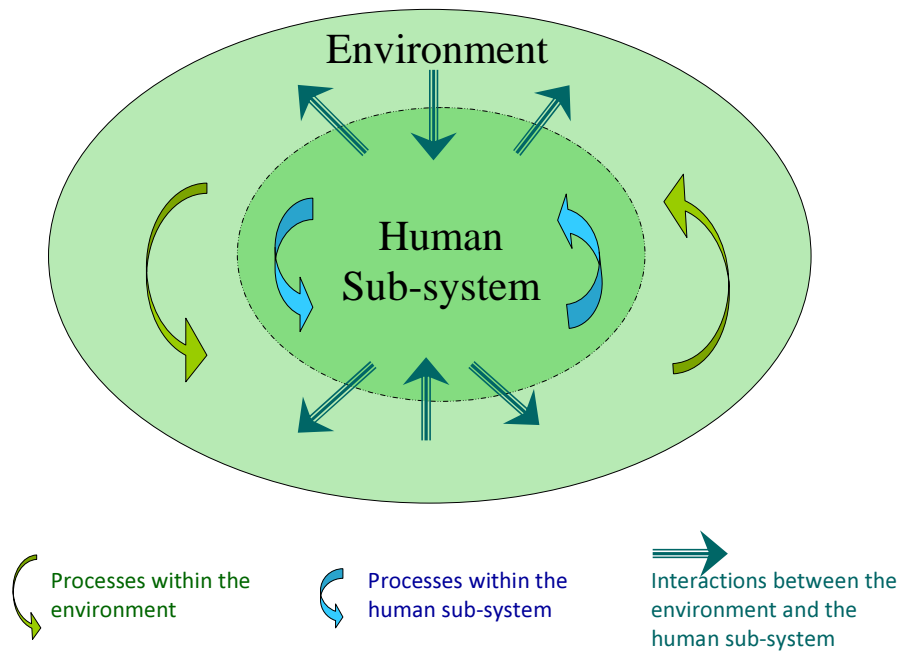
2.4.   Human wellbeing depends upon the living and non-living elements of the environment and
the goods and services they provide. People require the environment for survival and for
various social, cultural and economic purposes. The human sub-system uses the environment
for habitat, for obtaining important 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

Environmental
Conditions t_0

Human
Sub-system

Natural Processes

Human
Activities

Changes
over time

Environmental
Conditions t_1

Impacts from
the Changing
Environment
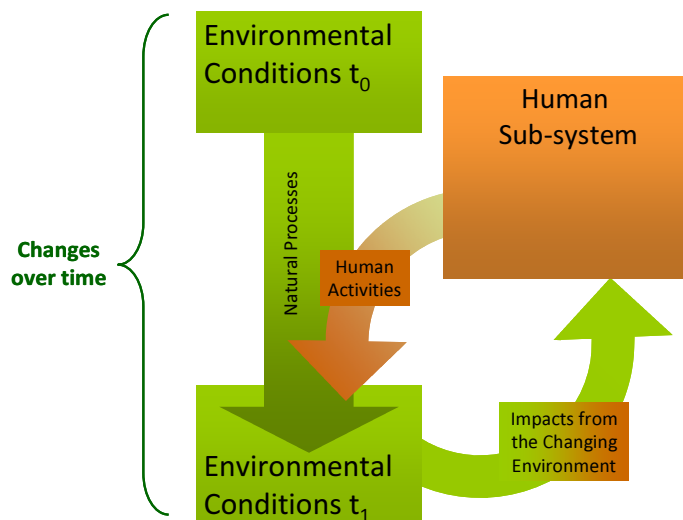
2.5.   Escalating human impacts on environmental systems worldwide have raised concerns about the consequences of environmental changes for the sustainability of human societies and also for human wellbeing. Conditions of the living and non-living environment, natural processes and the capacity of ecosystems 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

2.6.   The Millennium Ecosystem Assessment defines an ecosystem as "a dynamic complex of plant, animal and microorganism communities and the nonliving environment interacting as a functional unit."[16] Ecosystems are systems of interacting and interdependent relationships among their elements. They perform specific functions such as biochemical cycling, photosynthesis, including the cycling of energy, water, carbon and nutrients and cleansing of air and water.

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

2.8.   There is no internationally adopted standard classification of ecosystem services. Four main types of ecosystem services have been commonly distinguished:

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

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[16] Millennium Ecosystem Assessment, 2005. *Ecosystems and Human Wellbeing*. http://www.maweb.org/documents/document.356.aspx.pdf

2.9.   A Common International Classification of Ecosystem Services (CICES) is emerging within the frame of the work on the SEEA Experimental Ecosystem Accounts. For accounting purposes, the draft CICES distinguishes three main types of ecosystem services, namely provisioning, regulating and cultural services. The CICES lists those ecosystem services where a direct connection to humans can be established, therefore supporting services are considered embodied in the provisional, regulating and cultural services that they underpin.[17]

2.10.   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

2.11.   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.

Environmental conditions and quality

2.12.   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 events. It should be noted that in many cases it is not possible to establish direct cause-effect relationships between changes in environmental quality and the individual human activities or natural events, as the impact is the result of combined and cumulative 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.   The components of the environment that are affected by human use are ecosystems, land, and subsoil resources.

2.13.   <u>Ecosystems</u> offer provisional, 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

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[17] SEEA Experimental Ecosystem Accounts. Draft for discussion.

ecosystems, human activities can exert pressure on and cause significant change in the quality and integrity of ecosystems, affecting its capacity to continue to provide its services.

2.14.   Land provides space for natural ecosystems, human habitats and human activities. As this space is finite, the expansion of human activities can occur by reducing the space occupied by natural ecosystems, thus reducing the capacity of ecosystems to yield ecosystem goods and services for all living beings.

2.15.   Subsoil resources are underground deposits of various minerals that provide raw materials and sources of energy for humans. These subsoil elements, when considered as resources for human use, are fundamentally different from ecosystems in that they are non-renewable, therefore their use results in permanent depletion

Factors directly affecting the environment

2.16.   The factors affecting the conditions and quality of the environment can be both natural and anthropogenic.

2.17.   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.

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

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

Environment protection, management and engagement

2.20.   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

2.21.   The FDES organizes environment statistics into a structure consisting of components, sub-components, 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.

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

2.23.   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 with each other.

2.24.   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.

Figure 2.3: The components of the FDES
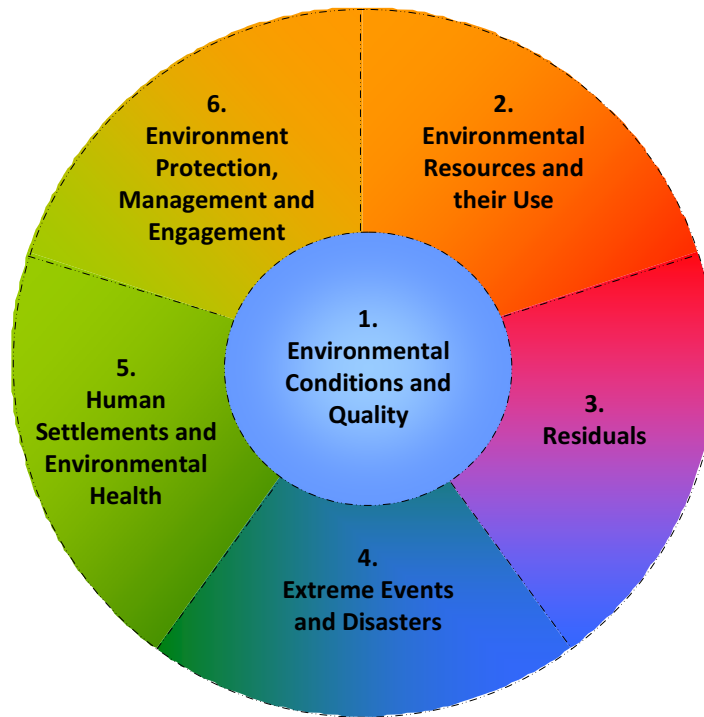
2.25.   The FDES uses a multi-level approach. The first level of the structure defines the six
fundamental components. Each individual FDES component is further broken down into its
respective sub-components (second level) and statistical topics (third level). Each level uses
numbering conventions as shown below in *Table 2.1*. The final level contains the actual
individual environment statistics.

Table 2.1: Hierarchical levels of the FDES			
1 digit	*2 digits*	*3 digits*	*4 or 5 digits*
Component	**Sub-component**	**Statistical Topic**	**Statistics**

2.26.   Each of the six components is broken down into sub-components that in turn contain relevant
statistical topics and individual statistics. The statistical topics represent the measurable
aspects of the components of the FDES.

2.27.   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.

2.28.   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.

2.29.   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.

2.30.   In line with the need to maintain the framework flexible and applicable, the levels can be adapted and enriched according to each country's requirements, priorities and circumstances. Some countries may need more or less detail of information; other countries may wish to exclude some topics completely.

2.31.   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.

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, subcomponents and statistical topics of the FDES as well as the most common statistics that are recommended for their measurement.

Table 2.2: Components and Sub-components of the FDES

Component 1: **Environmental Conditions and Quality**	Sub-component 1.1: Physical Conditions
	Sub-component 1.2: Land Cover, Ecosystems and Biodiversity
	Sub-component 1.3: Environmental Quality
Component 2: **Environmental Resources and their Use**	Sub-component 2.1: Non-energy Mineral Resources
	Sub-component 2.2: Energy Resources
	Sub-component 2.3: Land
	Sub-component 2.4: Soil Resources
	Sub-component 2.5: Biological Resources
	Sub-component 2.6: Water Resources
Component 3: **Residuals**	Sub-component 3.1: Emissions to Air
	Sub-component 3.2: Generation and Management of Wastewater
	Sub-component 3.3: Generation and Management of Waste
Component 4: Extreme Events and Disasters	Sub-component 4.1: Natural Extreme Events and Disasters
	Sub-component 4.2: Technological Disasters
Component 5: Human Settlements and Environmental Health	Sub-component 5.1: Human Settlements
	Sub-component 5.2: Environmental Health
Component 6: Environment Protection, Management and Engagement	Sub-component 6.1: Environment Protection and Resource Management Expenditure
	Sub-component 6.2: Environmental Governance and Regulation
	Sub-component 6.3: Extreme Event Preparedness and Disaster Management
	Sub-component 6.4: Environmental Information and Awareness

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 to produce environmental-economic accounts that link environment statistics with the SNA.

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

Note: Size of figures does not correlate to volume of data, statistics, indicators, etc.
DPSIR = Driving force-Pressure-State-Impact-Response
SEEA = System of Environmental-Economic Accounting
SNA = System of National Accounts
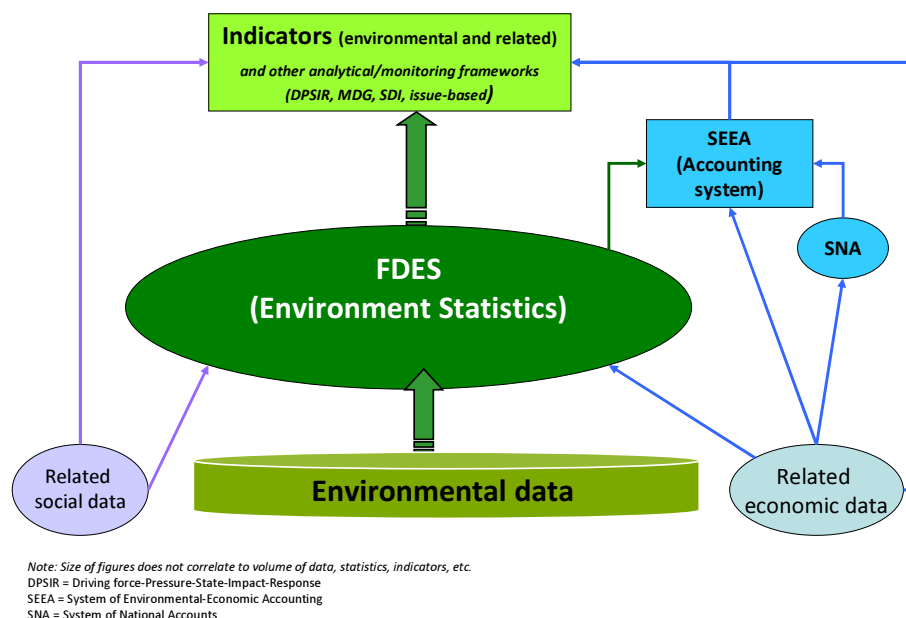
Relationship between the FDES and the SEEA

2.34.   The SEEA Central Framework describes the interactions between the economy and the environment, and the stocks and changes of stocks of environmental assets. At the heart of the SEEA Central Framework 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 43rd session in 2012 adopted the SEEA Central Framework 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 Central Framework, as illustrated by Figure 2.5.

Figure 2.5: The FDES and the SEEA Central Framework
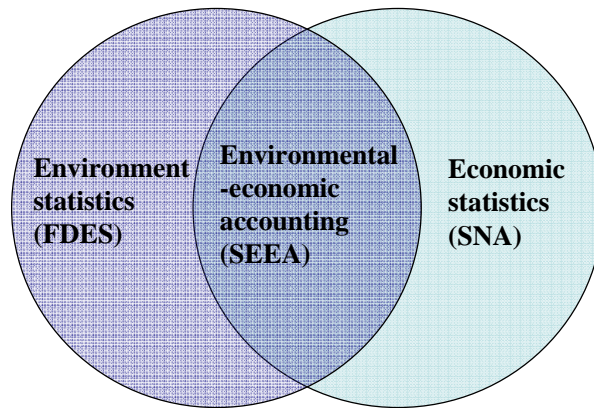
2.36. The SEEA Central Framework uses a great part of environment statistics by reorganizing them according to national accounting principles. One of the objectives of the FDES as a multipurpose framework is to provide, as much as possible, basic environment statistics necessary for the development of 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 was ensured to the extent possible with the SEEA.

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 Central Framework.

2.38. The SEEA Experimental Ecosystem Accounts (currently under development) will be a companion of the SEEA Central Framework. It extends the accounting to consider the measurement of flows of services to society provided by ecosystems and the measurement of ecosystem capital in terms of the capacity, and changes in capacity of ecosystems to provide those services in physical terms. It describes the valuation of ecosystems in so far as it is consistent with the market valuation principles of the SNA. Component 1 (Environmental conditions and quality) of the FDES contains statistics that can feed into the future ecosystem accounts.

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

2.39.   The Stress Response Environment Statistics System (S-RESS) framework was developed by Statistics Canada during the 1970s and 1980s and later adapted by the UN in the 1984 FDES and by the OECD. The Pressure-State-Response (PSR) and the DPSIR frameworks are adaptations of the S-RESS framework and are still in use today in many countries as well as internationally by UNEP, OECD and the European Environment Agency (EEA) for assessment and reporting purposes and for the categorization of indicators.

2.40.   The DPSIR 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. **I**mpacts are the effects of environmental degradation. **R**esponses refer to the responses by society to the environmental situation.

2.41.   It is often difficult, however, to distinguish human and natural stressors on the environment, and even more challenging to link a particular stressor to a specific impact. In the natural world, each process and state influences and is influenced, making it difficult to separate out the pressure, the state and the response. The DPSIR framework, however, is useful for grouping and reporting existing data and indicators.

2.42.   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.

2.43.   *Table 2.3* below summarizes key attributes of the six components of the FDES including a general description, the types of data that are included in each component, main sources and partners, as well as conceptual relationships between each component and other systems and frameworks. Geospatial information refers to statistics related to location or boundaries. Physical data refer to a variety of information that is measured in physical units, such as volume and area. Qualitative data refer to descriptions that rely primarily on qualitative characterizations, though sometimes including quantitative aspects, such as environmental engagement. Monetary data refer to information described in terms of monetary units, such as government expenditure on environment protection.

Table 2.3: Main attributes of the components of the FDES				
	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	• Geospatial • Physical • Qualitative	• Monitoring and remote sensing data • Environmental, meteorological, hydrological, geological and geographical authorities or institutions	• State and Impact element in DPSIR • Experimental ecosystem accounts of the SEEA
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	• Physical • Geospatial	• Statistical surveys, administrative records, field surveys, land registers • Sector statistics on production and consumption activities, infrastructure • Remote sensing data • Statistics databases of respective national authorities and institutions such as mining, energy, agriculture, water and forest	• Driving force, Pressure and State elements in DPSIR • Asset and physical flow accounts of the SEEA Central Framework
Component 3: Residuals	Generation, management and discharge of residuals to air, water and soil	• Physical	• Administrative records • Estimates based on activity statistics and technical coefficients • Sector statistics • Monitoring data	• Pressure and Response elements in DPSIR • Physical flow accounts of the SEEA Central Framework
Component 4: Extreme Events and Disasters	Occurrence and impact of natural extreme events and disasters, and technological disasters	• Physical • Monetary • Geospatial	• Administrative records • Remote sensing • National emergency and disaster authorities • Seismic, meteorological monitoring and research centres • Industrial complexes that work with hazardous substances and processes	• Pressure, Impact and Response elements in DPSIR • Asset accounts of the SEEA Central Framework
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	• Geospatial • Physical	• Population and housing censuses, household surveys, administrative records, and remote sensing • Housing and urban planning and oversight authorities • Cartographic authorities • Transport authorities • For health, administrative records, the health authority	• 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	• Monetary • Qualitative	• Administrative records • Surveys • Entity producing government expenditure statistics • The statistical entity in charge of national or sub-national surveys • The environmental authority and other sector authorities	• Response element in DPSIR • Environmental activity accounts and related flows of the SEEA Central Framework

Chapter 3: Components of the FDES

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.   Chapter 3 is organized in six parts corresponding to each of the components of the FDES. Each component is subsequently structured by describing its sub-component and statistical topics. The description includes: relevance to environmental policy; scope and content; the type of data typically used or obtained in measurement; most common sources of data; and the main institutional stakeholders required for the production of the underlying environment statistics. 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.

3.3.   The Basic Set of Environment Statistics is not exhaustive but it contains the most important environment statistics in each topic, organized in three tiers, 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

3.4.   Component 1 includes statistics about the meteorological, hydrographical, geological, geographical, biological, as well as physical and 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.

3.5.   The source of the primary 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.

3.6.   Component 1 contains statistics relevant to the State and Impact elements of the DPSIR framework. It also provides basic statistics for the Experimental Ecosystem Accounts of the SEEA.

3.7.   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

3.8.   Sub-component 1.1: Physical Conditions, has been designed to capture those physical aspects of the environment which change slowly due to human influence. It contains statistics on meteorological, hydrographical, geological and geographical conditions. While the other sub-components are also part of the physical environment, their physical, biological or chemical characteristics can be influenced in the short to mid-term by human activities.

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

Topic 1.1.1: Atmosphere, climate and weather

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

3.11.   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.

3.12. Statistics on air quality are covered under Sub-component 1.3: Environmental Quality.

Topic 1.1.2: Hydrographical characteristics

3.13. This topic includes hydrographical information on the extent, location and characteristics of lakes, rivers, reservoirs, watersheds, seas, groundwater bodies 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, 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 freshwater resources and their use (contained in Component 2: Environmental Resources and their Use).

Topic 1.1.3: Geological and geographical characteristics

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

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

Topic 1.1.4: Soil characteristics

3.16. Soil is a fundamental part of the environment. It provides the physical base to support the production and cycling of biological resources, provides the foundation for buildings and infrastructure, is the source of nutrients and water for agriculture and forestry systems, provides a habitat for diverse organisms, plays an essential role in carbon sequestration, and

fulfils a complex buffering role against environmental variability, ranging from dampening diurnal and seasonal change in temperature and water supply to the storage and binding of a range of chemical and biological agents. The main environmental concerns about soil pertain to its degradation, erosion and depletion.

3.17.   Statistics on soil characteristics are an important tool for policy makers, particularly in countries that rely heavily on agriculture and forestry, for which the quality and amount of soil resources are very relevant.

3.18.   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[18] or the Harmonised World Soil Database[19]) and also many countries have produced a classification of their own soil types for national purposes.[20] 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.

3.19.   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, salinization, compacting, and acidification 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 estimation and modelling by research institutions and agricultural authorities.

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

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[18] FAO has described 30 soil types: acrisols, albeluvisols, alisols, andosols, anthrosols, arenosols, calcisols, cambisols, chernozems, cryosols, durisols, ferralsols, fluvisols, gleysols, gypsisols, histosols, kastanozems, leptosols, lixisols, luvisols, nitisols, phaeozems, planosols, plinthosols, podzols, regosols, solonchaks, solonetz, umbrisols and vertisols. FAO, "World Reference Base for Soil Resources". Available from http://www.fao.org/docrep/W8594E/w8594e03.htm#elements of the world reference base for soil resources (accessed 7 June 2012).
[19] Harmonised World Soil Database, Version 1.2, February 2012, describes 28 major soil groupings that can be used to categorise and map soils at a broad global scale. http://www.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/
[20] For example, the United States Department of Agriculture soil taxonomy includes 12 soil types: alfisol, andisols, aridisols, entisols, gelisols, histosols, inceptisols, mollisols, oxisols, spodosols, ultisols and vertisols. Available from http://soils.usda.gov/technical/soil_orders/ (accessed 7 June 2012).

3.21.   Soil pollution statistics are included under Topic 1.3.4: Soil pollution.

Sub-component 1.2: Land cover, Ecosystems and Biodiversity

3.22.   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." (FAO, 2005) 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.[21] It is also a measure of ecosystem health.

3.23.   Protected areas and species are included in this sub-component because of their inherent relation to 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.

3.24.   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.

3.25.   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 and in particular biomes around the world. Maintaining biodiversity and ecosystem health is necessary in order to preserve the genetic and ecosystem inheritance of a country, as well as its ecological productivity. This subsequently also protects the productivity of ecosystems for the use of the economy and society, which are largely dependent on the diversity of ecological systems for human livelihoods (e.g., production, distribution and consumption).

3.26.   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

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[21] UN, "Convention on Biological Diversity", Rio de Janeiro, 5 June 1992. Available from http://treaties.un.org/doc/Treaties/1992/06/19920605%2008-44%20PM/Ch_XXVII_08p.pdf (accessed 8 June 2012).

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 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.

3.27. 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

3.28. 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, usually satellite images or aerial photographs, that are interpreted and transformed into geospatial data and statistics (combined and validated by ground-truthing), mapping the different categories of land cover.

3.29. The Land Cover Classification System (LCCS)[22] has been developed by the FAO. 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, a classification composed of 14 classes has been developed in the SEEA Central Framework (included in Annex D).[23] These 14 classes have been generated using the LCCS approach and thus provide a comprehensive set of land cover types, mutually exclusive and unambiguous, with clear boundaries and systematic definitions. Furthermore, the identified classes are defined to be used as the basis for the development of ecosystem statistics. The aim of the classification is to provide a common framework to compile and aggregate land cover information available at the national level and make it comparable at the international level, and to provide a structure to guide data collection and the creation of land cover databases for countries in the process of establishing a land cover statistics domain.

Topic 1.2.2: Ecosystems

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

[23] UN, "System of Environmental-Economic Accounting", 2012. White cover publication, pre-edited text subject to official editing. Available from https://unstats.un.org/unsd/envaccounting/White_cover.pdf (accessed 10 June 2012).

3.30. This topic covers physical, descriptive and qualitative information and statistics about a country's main ecosystems, including their extent (area) and the conditions reflecting their state. The extent and conditions of the ecosystems determine their capacity to produce ecosystem services.

3.31. 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[24] are forest, mountain, cultivated, dryland, polar, inland water, marine, coastal, island, urban and other ecosystems . 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 and biomes in accordance with national or existing international definitions.

3.32. 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. Depending on the country, ecosystems and biomes can be subdivided into small homogenous units (in practice, land cover units which are homogenous considering provisioning ecosystem services) and broader spatial and statistical units reflecting socio-ecological systems.

3.33. For each ecosystem category, sets of statistics and indicators can be produced to capture baselines and trends over time and space. For example, The State of the Nation's Ecosystems (USA, Heinz Center[25]) organizes ecosystem indicators and related information, to the extent possible, into four categories. The first three categories are included within Component 1 while the fourth category, excluding cultural or recreational activities, has been incorporated into Components 2 and 3:

   i. Statistics on <u>extent (location and size) and pattern</u> 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 <u>chemical and physical characteristics</u> 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).

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[24] Millennium Ecosystem Assessment, 2005. Ecosystems and Human Well-being: Synthesis. Island Press, Washington, DC. Available at http://www.millenniumassessment.org/documents/document.356.aspx.pdf (accessed 9 August 2012)
[25] Heinz Center, "The State of the Nation's Ecosystems", 2008, USA. Key Ecosystem Characteristics. Available from http://www.heinzctr.org/Ecosystems_files/The%20State%20of%20the%20Nation%27s%20Ecosystems%202008.pdf (accessed 11 June 2012).

iii. Statistics on <u>biological components</u> provide information on the conditions of plants, animals and living habitats (e.g., species at risk of extinction and the percentage of species in a region that is not native).

iv. Statistics on <u>ecosystem goods and services</u> describe the flows that humanity derives from the natural world, or the ecosystem services (e.g., amount of timber harvested and participation in outdoor recreation).

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

Topic 1.2.3: Biodiversity

3.35. This topic includes statistics on the diversity of flora and fauna species (biota), on protected areas, and on protected flora and fauna species. Diversity of ecosystems is contained in Topic 1.2.2.

3.36. <u>Regarding flora and fauna, this topic</u> contains descriptive information on their existence, variety and trends in various populations and communities. Quantitative and complementary information on biodiversity in both terrestrial and marine environments, as well as their localization, are included here. The typical themes include the number and population of known species of flora and fauna (terrestrial, freshwater and marine), their status category with regard to their vulnerability, protected species, endemic species, and invasive species. 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[26] are based on the level of threat. The main categories are extinct; extinct in the wild; threatened; near threatened; and least concern.

3.37. <u>As for protected areas, t</u>his topic includes physical and descriptive information and statistics on protected terrestrial and marine areas within the country. The IUCN Protected Area Management Categories[27] 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.

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[26] IUCN Species Survival Commission, "Guidelines for Using the IUCN Red List Categories and Criteria. Available from http://intranet.iucn.org/webfiles/doc/SSC/RedList/RedListGuidelines.pdf (accessed 11 June 2012).
[27] http://www.iucn.org/about/work/programmes/pa/pa_products/wcpa_categories/

3.38. Statistics on flora and fauna species include the number of known species, their populations and the status of their vulnerability. Data on species populations are usually available on species of specific significance. Data are often obtained from expert and ad-hoc scientific studies and assessments, as well as research conducted by NGOs and the civil society. This can result in scattered and non-systematised data. When available and appropriate, portraying information through GIS can also be particularly useful.

3.39. The main source of data on protected areas is administrative records. Data can also be found in secondary databases and reports on the state of ecosystems or the state of the environment. These can usually be found under the responsibility of environmental authorities and are frequently produced for the national and sub-national levels.

Topic 1.2.4: Forests

3.40. Forests around the world play a central role in human societies, providing livelihoods for millions of people around the world. Forests offer timber, food, shelter, fuel and medicinal products and they also perform significant ecosystem functions such as hydrological regulation, soil protection, carbon sinks and biodiversity protection, among others. Therefore, it is crucial to understand the extent and characteristics of forests and to produce statistics about their diverse dimensions.

3.41. The most important statistics in this topic include forest area which can be organized by different forest type categories. Further statistics may include forest biomass and its carbon storage, and a characterization of forest ecosystems that exist in the country, including types, location, area and the main species of flora and fauna living in the forest, by IUCN category.

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

3.43. Statistics on forest area and its changes can be disaggregated by different forest types (e.g., primary forest, other naturally generated forest, planted forest, etc.). Forest area can also be disaggregated according to dominant tree species, age distribution, productivity, primary use of forest, areas under sustainable forest management, protected forests, etc. Changes 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). Statistics on timber and other forest resources and their use, are contained in Component 2: Environmental Resources and their Use.

Sub-component 1.3: Environmental Quality

3.44. 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.

3.45. 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.

3.46. 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.

3.47. When national or local maximum allowable levels of pollutants exist in countries, it can be important to compare these values with the actual measured pollutant levels. Statistics on frequency of occurrences or percent of pollution events above maximum allowable levels are usually more important measures of environmental quality than national aggregates or averages. The number and area of locations where maximum allowable levels are exceeded can however be important at the national level.

3.48. 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.

3.49.   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

3.50.   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.

3.51.   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 ECE Standard Statistical Classification of Ambient Air Quality (1990) lists the most important substances, parameters and variables that are recommended to be measured at impact, regional and background monitoring stations (See Annex D: Classifications and environment statistics).

3.52.   The national monitoring of air quality is usually limited on 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.

3.53.   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.

Topic 1.3.2: Freshwater quality

3.54.   Without good quality freshwater, ecosystems and humans cannot survive. In the water cycle, precipitation, aquifers, groundwater, lakes, rivers, coastal zones and oceans are all interconnected, therefore the choice of where to measure or monitor the pollutants and which pollutants to monitor will depend on local and national priorities, ecosystem characteristics and resources available. The identification of the pollutants that are most relevant for monitoring depends on 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.

3.55.   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. Although aquifers and groundwater are being polluted from percolates and infusion from above ground activities, it is difficult to develop representative or comprehensive information about it. Most monitoring stations and regular monitoring programmes are aimed at measuring specific pollutants found in surface freshwater, in specific zones or areas where important pollution problems exist.

3.56.   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.

3.57.   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.

3.58.   Data for water quality statistics are primarily produced by monitoring stations. Monitoring programmes are usually constructed when a policy or quality norm is set up for specific locations that show the most problematic signs of pollution. The data from these monitoring stations require further processing to produce environment statistics on the water quality of

specific locations. Typically the resulting environment statistics will be produced and be relevant for specific local areas or parts of rivers and lakes, and are not representative at the national level.

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

Topic 1.3.3: Marine water quality

3.60. 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.

3.61. 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.

3.62. Data sources for marine water quality statistics are typically either national or international monitoring stations, associated with scientific research. Monitoring programmes are usually constructed when the scientific interest for research is present, and/or when policy or quality norms are set up for specific areas that show the most problematic signs of marine pollution. The data from these monitoring stations require further processing to produce environment statistics on the water quality of specific locations.

3.63. 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.

3.64. The ECE Standard Statistical Classification of Marine Water Quality (1992) lists the most important pollutants, parameters and statistics needed to assess marine water quality. There are a number of important marine environment and marine water quality statistics which a country may track. Examples include concentrations of bio-pollutants, heavy metals, persistent toxins and radioactive substances, as well as coral bleaching. Producing statistics on the concentrations and effects of pollutants and waste in marine water bodies is of the

greatest importance to the health of ecosystems as well as to humans (see Annex D: Classifications and environment statistics).

Topic 1.3.4: Soil pollution

3.65.   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.

3.66.   Some of the most commonly measured soil pollutants include petroleum hydrocarbons (e.g., oil residuals and solvents), pesticides and heavy metals.

3.67.   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.

3.68.   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.

3.69.   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.[28] The relevant statistics include the number and area of contaminated, potentially contaminated, remediated and other sites.

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[28] JRC (2011): Guidelines for the collection of contaminated sites data through EIONET based on the draft International Standard ISO/DIS 10381-5.

3.70.   Noise pollution does not only exist in the most populated or busiest cities, but also everywhere where human activities are carried out, such as adjacent to highways, near airports and marine ports and around manufacturing, metal processing and mining establishments and construction sites. Noise pollution negatively affects the welfare and health of humans and also affects and changes biota, particularly fauna.

3.71.   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 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.

3.72.   Statistics on noise levels in urban settlements are also relevant to Component 5: Human Settlements and Environmental Health.

Table 3.1: Basic Set of Environment Statistics – Component 1: Environmental Conditions and Quality

	Component 1: Environmental Conditions and Quality			
Sub-component 1.1: Physical Conditions				
Topic	**Statistics and Related Information** (**Bold Text - Core Set/Tier 1**; Regular Text - Tier 2; *Italicized Text - Tier 3*)	**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
Topic 1.1.1: Atmosphere, climate and weather (CONTINUES ON NEXT PAGE)	a. Temperature		• National • Sub-national	• World Meteorological Organization (WMO) • Intergovernmental Panel on Climate Change (IPCC) • National Oceanic and Atmospheric Administration (NOAA)/ National Aeronautics and Space Administration (NASA)
	1. **Monthly averages**	Degrees		
	2. **Minimum monthly average**	Degrees		
	3. **Maximum monthly average**	Degrees		
	b. Precipitation (also in 2.6.1.a)			
	1. **Annual averages**	Height		
	2. **Long-term annual averages**	Height		
	3. Monthly averages	Height		
	4. Minimum monthly value	Height		
	5. Maximum monthly value	Height		
	c. Relative humidity			
	1. Minimum monthly value	Number		
	2. Maximum monthly value	Number		
	d. Pressure		• National • Sub-national • By station	
	1. *Minimum monthly value*	Pressure unit		
	2. *Maximum monthly value*	Pressure unit		
	e. Wind speed		• National • Sub-national	
	1. *Minimum monthly value*	Speed		
	2. *Maximum monthly value*	Speed		

Table 3.1: Basic Set of Environment Statistics – Component 1: Environmental Conditions and Quality (continued)

Component 1: Environmental Conditions and Quality				
Sub-component 1.1: Physical Conditions				
Topic	**Statistics and Related Information** (**Bold Text - Core Set/Tier 1**; Regular Text - Tier 2; *Italicized Text - Tier 3*)	**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
Topic 1.1.1: Atmosphere, climate and weather (CONTINUED FROM PREVIOUS PAGE)	f. Solar radiation		▪ National ▪ Sub-national	▪ World Meteorological Organization (WMO) ▪ Intergovernmental Panel on Climate Change (IPCC) ▪ National Oceanic and Atmospheric Administration (NOAA)/ National Aeronautics and Space Administration (NASA)
	1. *Average daily value*	Area, Energy unit		
	2. *Average monthly value*	Area, Energy unit		
	3. *Number of hours with sunshine*	Number	▪ National ▪ Sub-national ▪ By month and per year	
	g. UV radiation		▪ National ▪ Sub-national	▪ WHO-UV Radiation Index ▪ WMO-UV Radiation
	1. *Maximum daily value*	Area, Energy unit		
	2. *Average daily value*	Area, Energy unit		
	3. *Maximum monthly value*	Area, Energy unit		
	4. *Average monthly value*	Area, Energy unit		
	h. Occurrence of El Niño, La Niña events, when relevant			
	1. *Occurrence*	Number		
	2. *Location*	Location		
	3. *Time period*	Time period		

Component 1: Environmental Conditions and Quality				
Sub-component 1.1: Physical Conditions				
Topic	**Statistics and Related Information** (**Bold Text - Core Set/Tier 1**; Regular Text - Tier 2; *Italicized Text - Tier 3*)	**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
Topic 1.1.2: **Hydrographical** **characteristics**	a. Lakes		▪ By watershed/ river basin ▪ National ▪ Sub-national	▪ United Nations Statistics Division (UNSD): International Recommendations for Water Statistics (IRWS) ▪ UN-Water
	1. *Surface area*	Area, Depth, Location		
	2. *Location*			
	b. Rivers			
	1. *Length*	Length		
	2. *Location*	Location		
	c. Reservoirs			
	1. *Surface area*	Area, Volume		
	2. *Location*	Location		
	d. Watersheds			
	1. **Description of main watersheds**	Area, Descriptive, Location		
	e. Seas		▪ National, within coastal waters or EEZ	
	1. Coastal waters	Area		
	2. Territorial sea	Area		
	3. Exclusive Economic Zone (EEZ) (2.3.1.d)	Area		
	4. *Sea level*	Depth		
	5. *Location*	Location		
	6. *Area of sea ice*	Area		
	f. Groundwater		▪ By watershed ▪ National ▪ Sub-national ▪ Renewable ▪ Non-renewable ▪ By salinity levels	
	1. *Aquifers*	Depth, Descriptive, Number, Volume		
	g. Glaciers	Area, Volume	▪ National ▪ Sub-national	

Component 1: Environmental Conditions and Quality				
Sub-component 1.1: Physical Conditions				
Topic	**Statistics and Related Information** (**Bold Text - Core Set/Tier 1**; Regular Text - Tier 2; *Italicized Text - Tier 3*)	**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
Topic 1.1.3: Geological and geographical information	a. Geological, geographical and geomorphological conditions of terrestrial areas and islands		▪ National	▪ UNSD: Demographic Yearbook ▪ UN Food and Agriculture Organization of the United Nations (FAO) ▪ Center for International Earth Science Information Network (CIESIN)
	1. Length of border	Length		
	2. **Area of country or region**	Area		
	3. Geographical location	Location		
	4. Number of islands	Number		
	5. Area of islands	Area		
	6. Location of islands	Location		
	7. *Main geomorphological characteristics of islands*	Descriptive		
	8. *Spatial distribution of land relief*	Descriptive, Location		
	9. *Characteristics of landforms* (e.g., location, area and height, as applicable, for plains, hills, plateaus, dunes, volcanoes, mountains, sea mounts, etc.)	Descriptive		
	10. *Area of rock types*	Area		
	11. *Location of rock types*	Location		
	12. *Area of tectonic plates*	Area		
	13. *Location of tectonic plates*	Location		
	14. *Length of fault lines*	Length		
	15. *Location of fault lines*	Location		
	b. **Coastal area** (includes area of coral reefs, mangroves, etc.) (also in 2.3.1.c)	Area, Descriptive		
	c. **Length of marine coastline**	Length		
Topic 1.1.4: Soil characteristics	a. Soil characterization		▪ By location ▪ By soil type ▪ National ▪ Sub-national	▪ FAO and the International Institute for Applied Systems Analysis (IIASA) Harmonized World Soil Database ▪ International Soil Reference and Information Centre (ISRIC) World Data Centre for Soils ▪ United Nations Convention to Combat Desertification (UNCCD) ▪ FAO Global Assessment of Human-induced Soil Degradation (GLASOD)
	1. **Area of soil types**	Area		
	b. Degradation			
	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		
	c. Nutrient content of soil, measured in levels of:		▪ By soil type ▪ By nutrient ▪ National ▪ Sub-national	
	1. Nitrogen (N)	Concentration		
	2. Phosphorus (P)	Concentration		
	3. *Calcium (Ca)*	Concentration		
	4. *Magnesium (Mg)*	Concentration		
	5. *Potassium (K)*	Concentration		
	6. *Zinc (Zn)*	Concentration		

Component 1: Environmental Conditions and Quality				
Sub-component 1.2: Land Cover, Ecosystems and Biodiversity				
Topic	**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 1.2.1: Land cover	a. Extent and spatial distribution of main land cover categories		▪ By type of land cover (e.g., artificial surfaces including urban and associated areas; herbaceous crops; woody crops; multiple or layered crops; grassland; tree covered areas; mangroves; shrub covered areas; shrubs and/or herbaceous vegetation, aquatic or regularly flooded; sparsely natural vegetated areas; terrestrial barren land; permanent snow and glaciers; inland water bodies; and coastal water bodies and inter-tidal areas)[a] ▪ National ▪ Sub-national	▪ FAO Land Cover Classification System ▪ System of Environmental-Economic Accounting (SEEA) Central Framework (2012) land cover categories ▪ European Environment Agency (EEA)
	1. **Area of land cover**	Area		
	2. **Location of land cover**	Location		
(a) SEEA land cover categories, based on FAO Land Cover Classification System (http://unstats.un.org/unsd/envaccounting/seearev/Chapters/cAnnex.pdf)				

Component 1: Environmental Conditions and Quality				
Sub-component 1.2: Land Cover, Ecosystems and Biodiversity				
Topic	**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 1.2.2: Ecosystems	a. General ecosystem characteristics, extent and pattern		• By ecosystem (e.g., Marine, Coastal, Inland Water, Forest, Dryland, Island, Mountain, Polar, Cultivated, Urban)[b]	Millennium Ecosystem Assessment
	1. **Area of ecosystems**	Area		• UN Convention on Biological Diversity
	2. Location within country	Location		• UNECE Standard Statistical Classification of Flora, Fauna and Biotopes (1996)
	3. *Proximity of relevant ecosystem to urban areas and cropland*	Location		• The International Union for the Conservation of Nature (IUCN) Red List of Threatened Species
	b. Ecosystems' chemical and physical characteristics		• By biome	• Convention on Wetlands of International Importance, especially as Waterfowl Habitat (The Ramsar Convention)
	1. *Nutrients*	Concentration	• By habitat	
	2. *Carbon*	Concentration	• By biogeographical region	
	3. *Pollutants*	Concentration		
	c. Biological components of ecosystems (also in 1.2.3.a-b)		• By river basin	
	1. Biota (flora and fauna)	Number	• National	
	2. Endemic species	Number	• Sub-national	
	3. Biodiversity (aggregated measure of diversity of flora and fauna)	Number		
	4. **Threatened species**	Number		
Topic 1.2.3: Biodiversity	a. Flora - terrestrial, freshwater and marine (also in 1.2.2.c)		• By class (e.g., mammals, fishes, birds, reptiles, etc.)	• Millennium Ecosystem Assessment
	1. **Number of known species by status category**	Number		• UN Convention on Biological Diversity
	2. Species population	Number		• IUCN Red List of Threatened Species
	3. Number of endemic species	Number	• By ecosystem (Marine, Coastal, Inland Water, Forest, Dryland, Island, Mountain, Polar, Cultivated, Urban)[b]	• UN Economic Commission of Europe (ECE) Standard Statistical Classification of Flora, Fauna and Biotopes (1996)
	4. Number of invasive alien species	Number		• FAO FISHSTAT (Species population and number of invasive alien species)
	5. *Habitat fragmentation*	Area, Descriptive, Location, Number		
	b. Fauna - terrestrial, freshwater and marine (also in 1.2.2.c)		• By biome	
	1. **Number of known species by status category**	Number	• By habitat	
	2. Species population	Number	• By status category (e.g., threatened)	
	3. Number of endemic species	Number	• National	
	4. Number of invasive alien species	Number	• Sub-national	
	5. *Habitat fragmentation*	Area, Descriptive, Location, Number		
	c. Protected areas		• By management category [c]	• IUCN Protected Area Management Categories
	1. **Protected terrestrial (including inland water) and marine area** (also in 1.2.4.a)	Area	• By ecosystem	• UNSD: Millennium Development Goal (MDG) Indicator 7.6 Metadata
			• By biome	
			• By habitat	
			• National	
			• Sub-national	
	d. Protected species		• By relevant species	• IUCN Red List of Threatened Species
	1. Number of terrestrial, freshwater and marine protected flora species	Number	• By ecosystem	• UNSD: MDG Indicator 7.7 Metadata
	2. Number of terrestrial, freshwater and marine protected fauna species	Number	• By biome	
			• By habitat	
			• By status category	
			• National	
			• Sub-national	
	e. Other		• By status category	• Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
	1. *Trade in wildlife and captive-bred species*	Descriptive, Mass, Number	• National	
			• Sub-national	

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

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

Component 1: Environmental Conditions and Quality				
Sub-component 1.2: Land Cover, Ecosystems and Biodiversity				
Topic	**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 1.2.4: Forests	a. Forest area (also in 1.2.1.a and 1.2.2.a)		▪ By forest type, as appropriate ▪ National ▪ Sub-national	▪ FAO Global Forest Resources Assessment (FRA) ▪ UN Forum on Forests (UNFF) Monitoring, Assessment and Reporting (MAR) ▪ UNSD: MDG Indicator 7.1 Metadata ▪ Montreal Process (Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests) ▪ State of Europe's Forests (Forest Europe/UNECE-FAO Forestry and Timber Section)
	1. **Total**	Area		
	2. Natural	Area		
	3. Planted	Area		
	4. Protected forest area (also in 1.3.1.c)	Area		
	5. **Area deforested**	Area		
	6. Area reforested	Area		
	7. Area afforested	Area		
	8. Forest area affected by fire	Area		
	9. *Natural growth*	Area		
	b. Forest biomass			
	1. Total	Volume		
	2. *Carbon storage in living forest biomass*	Mass		

Component 1: Environmental Conditions and Quality				
Sub-component 1.3: Environmental Quality				
Topic	**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 1.3.1: Air quality	a. Breathable particles		• Sub-national • Daily maximum • Monthly maximum and average • Yearly maximum and average	• World Health Organization (WHO) • UNECE Standard Statistical Classification of Ambient Air Quality (1990)
	1. **Concentration levels of particulate matter (PM$_{10}$)**	Concentration		
	2. **Concentration levels of particulate matter (PM$_{2.5}$)**	Concentration		
	3. Maximum allowable levels	Concentration		
	4. Number of days where maximum allowable levels were surpassed per year	Number		
	b. Breathable gases			
	1. **Concentration levels of tropospheric ozone (O$_3$)**	Concentration		
	2. **Concentration levels of carbon monoxide (CO)**	Concentration		
	3. Maximum allowable levels	Concentration		
	4. Number of days where maximum allowable levels were surpassed per year	Number		
	c. Ambient concentrations of other relevant pollutants			
	1. **Concentration levels of sulphur dioxide (SO$_2$)**	Concentration		
	2. **Concentration levels of nitrogen oxides (NO$_X$)**	Concentration		
	3. Concentration levels of heavy metals	Concentration		
	4. Concentration levels of non-methane volatile organic compounds (NMVOCs)	Concentration		
	5. *Concentration levels of dioxins*	Concentration		
	6. *Concentration levels of furans*	Concentration		
	7. Other pollutants	Concentration		
	8. Maximum allowable levels	Concentration		
	9. Number of days where maximum allowable levels were surpassed per year	Number		
	d. Global atmospheric concentrations of climate process drivers			
	1. Global atmospheric concentration levels of carbon dioxide (CO$_2$)	Concentration		
	2. Global atmospheric concentration levels of methane (CH$_4$)	Concentration		

Component 1: Environmental Conditions and Quality				
Sub-component 1.3: Environmental Quality				
Topic	**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 1.3.2: Freshwater quality	a. Nutrients and chlorophyll		▪ By water body ▪ By watershed/river basin ▪ By point measurement ▪ By type of water resource	▪ UNECE Standard Statistical Classification of Freshwater Quality for the Maintenance of Aquatic Life (1992) ▪ UN Environment Programme Global Environment Monitoring System - Water (UNEP GEMS-Water) ▪ WHO
	1. **Concentration of nitrates in freshwater bodies**	Concentration		
	2. **Concentration of phosphates in freshwater bodies**	Concentration		
	3. Concentration of chlorophyll A in freshwater bodies	Concentration		
	4. Maximum allowable levels	Concentration		
	b. Organic matter in freshwater bodies			
	1. **Biochemical oxygen demand (BOD) in freshwater bodies**	Concentration		
	2. Chemical oxygen demand (COD) in freshwater bodies	Concentration		
	3. Maximum allowable levels	Concentration		
	c. Pathogens			
	1. **Concentration of faecal coliforms in freshwater bodies**	Concentration		
	2. Maximum allowable levels	Concentration		
	d. Metals (e.g., mercury, lead, nickel, arsenic, cadmium)			
	1. Concentrations in the sediment and water	Concentration		
	2. Concentrations in freshwater organisms	Concentration		
	3. Maximum allowable levels	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 Aquatic Life (1992) ▪ UN Environment Programme Global Environment Monitoring System - Water (UNEP GEMS-Water) ▪ Stockholm Convention
	1. Concentrations in the sediment and water	Concentration		
	2. Concentrations in freshwater organisms	Concentration		
	3. Maximum allowable levels	Concentration		
	f. Physical and chemical characteristics			▪ UNECE Standard Statistical Classification of Freshwater Quality for the Maintenance of Aquatic Life (1992) ▪ UN Environment Programme Global Environment Monitoring System - Water (UNEP GEMS-Water)
	1. pH/Acidity/Alkalinity	Concentration, Level		
	2. Temperature	Degrees		
	3. *Total suspended solids (TSS)*	Concentration		
	4. Salinity	Concentration		
	5. Dissolved oxygen (DO) in freshwater bodies	Concentration		
	g. Plastic waste and other freshwater debris			
	1. Amount of plastic waste and other debris in freshwater	Area, Mass		

Component 1: Environmental Conditions and Quality				
Sub-component 1.3: Environmental Quality				
Topic	**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 1.3.3: Marine water quality (CONTINUES ON NEXT PAGE)	a. Nutrients and chlorophyll		▪ By coastal zone, delta, estuary or other local marine environment ▪ Sub-national ▪ National ▪ Supranational ▪ By point measurement ▪ By type of water resource	▪ UNECE Standard Statistical Classification of Marine Water Quality (1992) ▪ NOAA/NASA ▪ UNEP Regional Seas Programme
	1. **Concentration of nitrates in marine water bodies**	Concentration		
	2. **Concentration of phosphates in marine water bodies**	Concentration		
	3. Concentration of chlorophyll A in marine water bodies	Concentration		
	4. Maximum allowable levels	Concentration		
	b. Organic matter in marine water bodies			
	1. **Biochemical oxygen demand (BOD) in marine water bodies**	Concentration		
	2. Chemical oxygen demand (COD) in marine water bodies	Concentration		
	3. Maximum allowable levels	Concentration		
	c. Pathogens			
	1. Concentration of faecal coliforms in recreational marine waters	Concentration		
	2. Maximum allowable levels	Concentration		
	d. Metals (e.g., mercury, lead, nickel, arsenic, cadmium)			
	1. Concentrations in the sediment and water	Concentration		
	2. Concentrations in marine organisms	Concentration		
	3. Maximum allowable levels	Concentration		
	e. Organic contaminants (e.g., PCBs, DDT, pesticides, furans, dioxins, phenols, and radioactive waste)			▪ UNECE Standard Statistical Classification of Marine Water Quality (1992) ▪ NOAA/NASA ▪ UNEP Regional Seas Programme ▪ Stockholm Convention
	1. *Concentrations in the sediment and water*	Concentration		
	2. *Concentrations in marine organisms*	Concentration		
	3. *Maximum allowable levels*	Concentration		
	f. Physical and chemical characteristics			▪ UNECE Standard Statistical Classification of Marine Water Quality (1992) ▪ NOAA/NASA ▪ UNEP Regional Seas Programme
	1. *pH/Acidity/Alkalinity*	Concentration, Level		
	2. Temperature	Degrees		
	3. *Total suspended solids (TSS)*	Concentration		
	4. *Salinity*	Concentration		
	5. Dissolved oxygen (DO) in marine water bodies	Concentration		
	6. *Density*	Density		
	g. Coral bleaching			
	1. **Area affected by coral bleaching**	Area		

Table 3.1: Basic Set of Environment Statistics – Component 1: Environmental Conditions and Quality (continued)

Component 1: Environmental Conditions and Quality				
Sub-component 1.3: Environmental Quality				
Topic	**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 1.3.3: Marine water quality (CONTINUED FROM PREVIOUS PAGE)	h. Plastic waste and other marine debris		▪ By coastal zone, delta, estuary or other local marine environment ▪ Sub-national ▪ National ▪ Supranational ▪ By point measurement	▪ UNECE Standard Statistical Classification of Marine Water Quality (1992) ▪ NOAA/NASA ▪ UNEP Regional Seas Programme
	1. *Amount of plastic waste and other debris in marine waters*	Area, Mass		
	i. Red tide			
	1. *Occurrence*	Number		
	2. *Impacted area*	Area		
	3. *Location*	Location		
	4. *Duration*	Duration		
	j. Oil pollution			
	1. *Area of oil slicks*	Area		
	2. *Amount of tar balls*	Area, Diameter, Number		
Topic 1.3.4: Soil pollution	a. Sites affected by pollution		▪ Sub-national ▪ By type of pollutant ▪ By source	
	1. Contaminated sites	Area, Number		
	2. Potentially contaminated sites	Area, Number		
	3. Remediated sites	Area, Number		
	4. Other sites	Area, Number		
Topic 1.3.5: Noise	a. Levels of noise from specific sources	Intensity, Level	▪ Sub-national	▪ WHO
	b. Levels of noise in specific locations	Intensity, Level		
	c. Maximum allowable levels from different sources or in specific surrounding locations	Intensity		

3.2 Component 2: Environmental Resources and their Use

3.73. Component 2 is closely related to the asset and physical flow accounts of the SEEA Central Framework[29] on which, where relevant, the terms and definitions are based. Environmental resources (or assets as they are referred to in the SEEA Central Framework) are the living and non-living constituents of the earth together comprising the biophysical environment that may provide benefits to humanity. Environmental resources include: subsoil resources (non-energy and energy minerals); land; soil resources; biological resources; and water resources. They can be naturally renewable (e.g., fish, timber or water) or non-renewable (e.g., minerals).

3.74. 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.

3.75.   In Component 2, statistics on environmental resources and their use are focused on measuring stocks and changes in stocks of these resources. Changes in the stocks of environmental resources include additions and reductions, from both anthropogenic and natural activities. In the case of non-renewable resources, 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.

3.76. Statistics regarding the most important human activities related to the use of environmental resources help identify the possibilities for policy intervention. Under Component 2, the activities that directly extract, abstract, harvest or restructure individual environmental resources, are included. These activities have additional impacts on the environment beyond the direct use of individual environmental resources. Examples of 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.

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[29] UN, "System of Environmental-Economic Accounting", 2012. White cover publication, pre-edited text subject to official editing. Available from https://unstats.un.org/unsd/envaccounting/White_cover.pdf (accessed 10 June 2012).

3.77. Statistics on the generation, management and discharge of residuals related to the use of environmental resources are covered in Component 3: Residuals.

3.78. 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 Central Framework.

3.79. Component 2 contains six sub-components that correspond to the main categories of environmental resources:
   i.   Sub-component 2.1: Non-energy Mineral Resources;
   ii. Sub-component 2.2: Energy Resources;
   iii. Sub-component 2.3: Land;
   iv. Sub-component 2.4: Soil Resources
   v.   Sub-component 2.5: Biological Resources; and
   vi. Sub-component 2.6: Water Resources.

Sub-component 2.1: Non-energy Mineral Resources

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

3.80. Stocks of non-energy mineral resources are defined as the amount of known deposits of non-metallic and metallic mineral resources. Classes of known deposits include: commercially recoverable deposits; potential commercially recoverable deposits; as well as non-commercial and other known deposits. The minerals in question vary from metal ores (including precious metals and rare earths), to stone, sand and clay, chemical and fertilizer minerals, salt and various other minerals such as gemstones, abrasive minerals, graphite, asphalt, natural solid bitumen and quartz and mica.

3.81. These non-energy 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.

3.82. Non-energy mineral resources are extracted from the environment typically through mining and quarrying. These activities fall in ISIC Rev. 4 under Section B – Mining and quarrying.

Extraction can be achieved by different methods such as underground or surface mining. Extraction of non-energy mineral resources reflects the quantity of the resource physically removed from the deposit during a period of time, usually one year. The difference between the opening and closing stocks of non-energy mineral resources for a particular year are mostly the result of extraction. However, new discoveries, reappraisals and reclassifications of stocks, as well as catastrophic losses, can also influence the difference between opening and closing stocks.

3.83. Main sources of statistics about non-energy mineral resource stocks are geological surveys and inventories and economic statistics on mining and quarrying. The institutional partners in the data collection will be the mining and energy authorities at the national and sub-national levels. Data are also available from governing commercial bodies such as gemstone and metallic mineral bourses and manufacturers' associations.

Topic 2.1.2: Production and trade of non-energy minerals

3.84. The contribution of mining and quarrying of non-energy minerals to the value of goods and services produced by many countries is substantial. The outputs are non-energy 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 non-energy minerals 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.

3.85. Activities engaged in the production of non-energy 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 national statistical offices.

Sub-component 2.2: Energy Resources

Topic 2.2.1: Stocks and changes of mineral energy resources

3.86. Mineral energy resources are environmental resources which cannot be renewed in any human timescale, therefore their extraction and use in the economy results in the depletion of the resource, limiting their availability for future generations. Statistics on the magnitude of

their stocks through time are required in order to assist in the sustainable management of these resources.

3.87. Stocks of mineral 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 deposits include: commercially recoverable deposits; potential commercially recoverable deposits; as well as non-commercial and other known deposits.

3.88. Extraction of mineral energy resources reflects the quantity of the resource physically removed from the deposit during a period of time, usually one year. The difference between the opening and closing stocks of mineral energy resources for a particular year are mostly the result of extraction. New discoveries, reappraisals and reclassifications of stocks, as well as catastrophic losses, can also influence the difference between opening and closing stocks.

3.89. Main sources of statistics about mineral energy resource stocks are geological surveys and inventories, while the institutional partners in the data collection will be the mining and energy authorities at the national and sub-national levels. Main sources of statistics about extraction of mineral resources are economic statistics on mining as well as energy statistics.

Topic 2.2.2: Production and consumption of energy from non-renewable and renewable sources

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

3.91. Total energy production originates from non-renewable and renewable sources. These constitute key environment statistics that can assist when analysing the sustainability of the energy mix at the national level.

3.92. The stocks of renewable energy resources are not subject to depletion in a similar manner to non-renewable energy resources. Additionally, their stocks can not be accurately measured, except for biomass. 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.

3.93. Renewable energy is transformed from sources that replenish this flow. It is also cleaner than non-renewable energy and its carbon footprint is substantially less than fossil fuel energies. Global statistics show the progressive consumption of renewable energy resources is increasing, but still constitute an insufficient proportion of the total energy supply worldwide.

3.94. Renewable energy includes solar (photovoltaic and thermal), hydroelectric, geothermal, tidal action, wave action, ocean thermal, wind and biomass, all of which are naturally replenished, even though their flow may be limited.

3.95. A specific source of energy is waste such as municipal solid waste, plastics, tyre-derived fuels and other discarded combustible materials. Part of the waste used for energy production is renewable (biomass).

3.96. The main sources of statistics on the production and consumption of energy are energy statistics and energy balances that are available from national energy authorities or NSOs in most countries. The most important statistics cover the production of energy by the different types of non-renewable and renewable energy sources, production of primary and secondary energy, the total consumption of energy, as well as the amount of electricity produced and the installed capacities for electricity production.

3.97. The production of energy from non-renewable and renewable sources is captured under the economic activities ISIC Rev. 4, Section C, Division 19 Manufacture of coke and refined petroleum products; and Section D, Division 35 Electricity, gas, steam and air conditioning supply. Energy products resulting from extraction and transformation activities can be classified according to the Standard International Energy Product Classification (SIEC) contained in the *International Recommendations for Energy Statistics* (IRES)[30].

Sub-component 2.3: Land

3.98. Statistics on land use fulfil a basic informational need of governments, policy makers, analysts and civil society. 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

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[30] UNSD, "International Recommendations for Energy Statistics". Available from http://unstats.un.org/unsd/energy/ires/default.htm (accessed 10 November 2012).

are land cover (see Topic 1.2.1: Land cover) and land use. These aspects are strictly related: while land cover describes the biophysical aspect of land, land use refers to the functional aspects of land. Changes in land cover can be the result of natural processes and of land use changes. Generally, the total area of a country will remain unchanged from one period to the next. Hence, changes in the stocks of land will comprise changes within and between stocks in different classes of land cover and land use (land restructuring).

3.99. The total area of a country is the area enclosed by its inland borders and, if applicable, the sea.[31] 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

3.100. 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.

3.101. A reference framework for the classification of land use is provided in the SEEA Central Framework[32] as agreed after a comprehensive global consultation process. The development of the land use classification included in the SEEA, led by the FAO, has been based on practices already in use in major international and national land use databases adjusted to meet the different needs which have arisen during the global consultation process on this issue. The aim of the land use classification presented in the SEEA is twofold: (i) to provide a reference framework for the compilation and aggregation of data at the international level; and (ii) to provide guidance to countries in the process of establishing a land use classification scheme. For more information, see Annex D: Classifications and environment statistics.

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[31] 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 2012).

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

3.102. Changes in land use can be reflected by statistics on changes within and between the different land use classes. Changes in land use will redistribute the area of the country among the land use categories. If presented in a matrix form, the information will show how increase or decrease in one category contributes to the decrease or increase of other land use categories. Land cover statistics can also be presented in a similar fashion. Cross-combination of land use and land cover categories show what kind of economic activities are carried out in the different land cover areas. Changes in land use frequently result in changes of land cover, however, land under different land cover categories will also increase or decrease due to managed or natural expansion or regression. Statistics on land cover and its changes also give information about the extent of different ecosystems (see also Topic 1.2.2: Ecosystems).

Sub-component 2.4: Soil Resources

3.103. 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.

3.104. The relevant statistics cover the stocks of soil resources and their changes (additions and reductions) in terms of area and volume, by soil type.

3.105. 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.

Sub-component 2.5: Biological Resources

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

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

Topic 2.5.1: Timber resources and their use

3.108. Timber resources can be natural or cultivated and are important environmental resources in many countries. They provide inputs for construction and the production of furniture, cardboard, cellulose, paper and other products. They are also a source of fuel and an important sink for carbon. Timber resources are defined by the volume of trees, living and dead, which can still be used for timber or fuel. This includes all trees regardless of diameter or tops of stems. The general proxy that should be considered for determining the volume of timber resources is the volume that is commercially usable.

3.109. Stocks of timber resources increase due to natural growth, new plantations or growth derived from management of plantations, and are measured as the gross annual increase. Stocks decrease due to removals of timber, natural losses and catastrophic losses. Timber resources may also change due to the increase of forest land, or changes in management practices (reclassification). The volume of timber removals can also be disaggregated according to the type of forestry product (e.g., industrial roundwood, fuelwood, etc.) or by tree species. Stock changes should be estimated separately for natural and cultivated timber resources.

3.110. The most important economic activity responsible for the use and management of timber resources is Forestry and logging (ISIC Rev 4, Section A, Division 02). This division includes: growing of standing timber; planting, replanting, transplanting, thinning and conserving of forests and timber tracts; growing of coppice, pulpwood and fire wood; operation of forest tree nurseries; production of 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.

3.111. 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.

3.112. The use of timber products in the economy and by households can be captured in physical and monetary supply and use tables originating from national accounts and also from forestry,

manufacturing, energy and trade statistics. Linking timber resources to their use in the economy and to the SNA is the subject of the SEEA Central Framework.

Topic 2.5.2: Aquatic resources and their use

3.113. Aquatic resources include fish, crustaceans, molluscs, shellfish and other aquatic organisms such as sponges and seaweed, as well as aquatic mammals such as whales. Aquatic resources are subject to harvest for commercial reasons as well as part of recreational and subsistence fishing activities. The abundance and health of natural aquatic resources in inland and marine waters are also increasingly affected by water pollution and by the degradation of habitats. The dual impacts of excessive exploitation levels and habitat degradation result in the loss, or reduction, of the goods and services provided by the aquatic ecosystems, as well as a loss of biodiversity and genetic resources.

3.114. The aquatic resources for a given country comprise those resources that are considered to live within the EEZ of a country throughout their lifecycles, both coastal and inland fisheries. Migrating and straddling fish stocks are considered to belong to a given country during the period when those stocks inhabit its EEZ.

3.115. Aquatic resources may be either cultivated or natural biological resources. Aquatic resources produced within aquaculture facilities (for breeding or for harvest) are considered cultivated biological resources. All other aquatic resources harvested as part of capture production processes are considered natural biological resources. Changes in the stocks of aquatic resources are the result of growth in stocks, total removals, natural and catastrophic losses. Stock changes should be estimated separately for: natural and cultivated resources; the most important aquatic groups/species; and marine and freshwater groups/species. Aquaculture activities may also include the application of colorants, pellets, antibiotics, fungicides, hormones and other substances. Statistics on these aspects of aquaculture are very important to assess their impact on the environment.

3.116. The FAO International Standard Statistical Classification for Aquatic Animals and Plants (ISSCAAP) is commonly used for statistics on aquatic resources.[33] 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.[34] The measurement of discarded catch is an important component in fully understanding the linkages between economic activity and the impact on aquatic resources.

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[33] International Standard Statistical Classification for Aquatic Animals and Plants.
ftp://ftp.fao.org/fi/document/cwp/handbook/annex/AnnexS2listISSCAAP2000.pdf
[34] Coordinating Working Party on Fishery Statistics, Handbook of Fishery Statistical Standards.
ftp://ftp.fao.org/FI/DOCUMENT/cwp/handbook/annex/AnnexB1CatchConcepts.pdf

3.117. The most important economic activity related to the use and management of aquatic resources is Fishing and aquaculture (ISIC Rev. 4, Section A, Division 03). This division includes capture fishery and aquaculture, covering the use of fishery resources from marine, brackish or freshwater environments, with the goal of capturing or gathering fish, crustaceans, molluscs and other marine organisms and products (e.g., aquatic plants, pearls, sponges, etc.).

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

Topic 2.5.3: Crops

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

3.120. 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.

3.121. In terms of environment statistics, this topic covers statistics about main crop types, annual and perennial crops, different planting methods, monoculture and resource-intensive crops, the application of genetically modified organisms as well as organic farming production. Area harvested is especially important when measuring sown or planted areas (gross) versus harvested areas (net). (FAO, 2012)[35] Fertilizers play a key part in the yield and quantity of

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[35] FAO, 2012. *Crops Statistics – concepts, definitions and classification*s.
http://www.fao.org/fileadmin/templates/ess/ess_test_folder/documents/Production_trade/definitions/Crops_statistics_concepts_definitions_classifications.doc

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.

Topic 2.5.4: Livestock

3.122. Livestock are animal species that are raised by humans for commercial purposes, consumption, or labour (ISIC Rev 4, Section A, Division 01). Usually raised in agricultural settings, typical livestock species include cows, poultry, pigs and sheep. Rising incomes and growing populations, especially in the developing world, have led to higher demands in livestock products, including milk, eggs and meat, driving growth in the livestock sector. (FAO, 2006)[36] Nonetheless, livestock rearing is associated with multiple environmental effects. Livestock production contributes to greenhouse gas 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.

3.123. 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.

3.124. 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.

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[36] FAO, 2006. *Livestock Impacts on the environment*. http://www.fao.org/ag/magazine/0612sp1.htm

3.125. The main source of data for livestock statistics is usually the agricultural authority or the NSO.

Topic 2.5.5: Wild, uncultivated biological resources (other than fish and timber)

3.126. Although the vast majority of biological resources are cultivated, there is a range of naturally occurring biological resources which provide inputs to the economy and form an important part of biodiversity. Environmentally relevant statistics on this topic focus on the use and management of these resources as this can affect biological diversity. These resources may include wild berries, fungi, bacteria, fruits, sap and other plant resources that are harvested (ISIC Rev. 4, Section A, group 0230) as well as wild animals that are trapped or killed for production, consumption and trade. This topic excludes timber and fish, as they are included in Topics 2.5.1 and 2.5.2 respectively.

3.127. Today, wild animals are disappearing at alarming rates due to poaching, habitat and overuse of natural resources amongst other reasons. (World Wildlife Federation, 2012)[37] The conservation of key habitats and landscapes and the species within them is key in order to prevent further biodiversity loss. Furthermore, 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.[38] Trade that is detrimental to the survival of a species and does not allow the species to live in a consistent level in its ecosystem has to be managed and measured. This can involve measuring imports and exports of such species for trade, how many wild animals are killed or trapped for food or sale, permits issued for hunting wild animals, as well as the total number of animals killed under these permits. Finally, non-wood forest products and other plants are also covered in this topic.

3.128. The main source of data and the institutional partners for wild biological resources statistics include the environmental, natural resources and wildlife authorities, as well as the government agency responsible for hunting.

Sub-component 2.6: Water Resources

3.129. 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 freshwater resources; monitoring abstraction from key

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[37] World Wildlife Federation, 2012. *Protecting Wildlife.* http://www.worldwildlife.org/species/
[38] CITES, 2008. *Non-detriment findings.* http://www.cites.org/eng/prog/ndf/index.php

water bodies to prevent overutilization; ensuring equitable usage of abstracted water; and tracking the volume of water returned to the environment.

3.130. The International Recommendations for Water Statistics (IRWS)[39] provides the definitions and groupings for the purposes of statistics on water resources and their use.

Topic 2.6.1: Water resources

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

3.132. Statistics on water resources include the volume of water generated within the country or territory as the result of precipitation, the volume of water lost to evapotranspiration, the inflow of water from other territories, and the outflow of water to other territories or the sea. The statistics are sourced from hydrometeorological and hydrological monitoring, measurements and models. Statistics on the quality of water in water bodies are discussed under Topic 1.3.2: Freshwater quality and Topic 1.3.3: Marine water quality.

Topic 2.6.2: Abstraction, use and returns of water

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

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

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[39] United Nations, 2012. *International Recommendations for Water Statistics.* http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf

3.135. In-stream water use refers to the use of water *in situ*, without abstracting it from its source that is, moving it from its natural cycle. A very important type of in-stream water use is the ecological use, that is, the water used as a habitat for living organisms. All human in-stream water uses, similarly to off-stream uses, have significant effects with regard to the ecological use of the same water resources. Examples of in-stream water use are transportation, hydropower generation, fishing, recreation and tourism, and waste loading (pollution dilution). In-stream activities are usually measured in terms of the intensity of the use. In-stream uses of water are covered under Topic 2.5.2: Aquatic resources and their use; Topic 2.2.2: Production and use of energy from non-renewable and renewable resources; Topic 3.2.3: Discharge of wastewater to the environment. Statistics on water transport, tourism and recreation can be used to indicate the pressures these activities put on water resources.

3.136. 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 Component 3, Sub-component 3.2: Generation and Management of Wastewater.

3.137. 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.

Table 3.2: Basic Set of Environment Statistics – Component 2: Environmental Resources and their Use

Component 2: Environmental Resources and their Use				
Sub-component 2.1: Non-energy Mineral Resources				
Topic	**Statistics and Related Information** (**Bold Text - Core Set/Tier 1**; Regular Text - Tier 2; *Italicized Text - Tier 3*)	**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
Topic 2.1.1: Stocks and changes of non-energy mineral resources	a. Non-energy mineral resources		▪ By mineral ▪ National ▪ Sub-national	▪ United Nations Framework Classification for Energy and Mineral Resources (UNFC) ▪ SEEA Central Framework (2012) Asset and physical flow accounts ▪ ISIC Rev. 4, Section B, Division 05-08
	1. **Stocks of commercially recoverable resources**	Mass, Volume		
	2. New discoveries	Mass, Volume		
	3. *Upward reappraisals*	Mass, Volume		
	4. *Upward reclassifications*	Mass, Volume		
	5. **Extraction**	Mass, Volume		
	6. *Catastrophic losses*	Mass, Volume		
	7. *Downward reappraisals*	Mass, Volume		
	8. *Downward reclassifications*	Mass, Volume		
	9. Stocks of potentially commercially recoverable resources	Mass, Volume		
	10. *Stocks of non-commercial and other known resources*	Mass, Volume		
Topic 2.1.2: Production and trade of non-energy minerals	a. Production of non-energy minerals	Mass, Volume		
	b. Imports of non-energy minerals	Currency, Mass, Volume		
	c. Exports of non-energy minerals	Currency, Mass, Volume		

Component 2: Environmental Resources and their Use				
Sub-component 2.2: Energy Resources				
Topic	**Statistics and Related Information** (**Bold Text - Core Set/Tier 1**; Regular Text - Tier 2; *Italicized Text - Tier 3*)	**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
Topic 2.2.1: Stocks and changes of mineral energy resources	a. Mineral energy resources		▪ By resource (e.g., natural gas, crude oil and natural gas liquids, oil shale, natural bitumen and extra heavy oil (includes oil extracted from oil sands), coal and lignite, peat, non-metallic minerals except for coal or peat, uranium and thorium ores, and other metallic minerals) ▪ National ▪ Sub-national	▪ UNSD: International Recommendations for Energy Statistics (IRES) ▪ Asset and physical flow accounts in SEEA Central Framework (2012) ▪ International Energy Agency (IEA) Energy Statistics Manual ▪ ISIC Rev. 4, Section B, Divisions 05-08 ▪ UNFC
	1. **Stocks of commercially recoverable resources**	Mass, Volume		
	2. New discoveries	Mass, Volume		
	3. *Upward reappraisals*	Mass, Volume		
	4. *Upward reclassifications*	Mass, Volume		
	5. **Extraction**	Mass, Volume		
	6. *Catastrophic losses*	Mass, Volume		
	7. *Downward reappraisals*	Mass, Volume		
	8. *Downward reclassifications*	Mass, Volume		
	9. Stocks of potentially commercially recoverable resources	Mass, Volume		
	10. *Stocks of non-commercial and other known resources*	Mass, Volume		
	11. **Imports of energy minerals**	Currency, Mass, Volume		
	12. **Exports of energy minerals**	Currency, Mass, Volume		

Component 2: Environmental Resources and their Use				
Sub-component 2.2: Energy Resources				
Topic	**Statistics and Related Information** (**Bold Text - Core Set/Tier 1**; Regular Text - Tier 2; *Italicized Text - Tier 3*)	**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
Topic 2.2.2: Production and use of energy from non-renewable and renewable sources	a. Production of energy from non-renewable and renewable sources		▪ By non-renewable resource (e.g., petroleum, natural gas, coal, fission fuels, non-sustainable firewood, waste, other non-renewables) ▪ By renewable resource (e.g., solar, wind, geothermal, hydropower and ocean resources, solid biomass, biogas and liquid biofuels) ▪ National ▪ Sub-national	▪ IEA Energy Statistics Manual ▪ UNSD: IRES ▪ Joint Wood Energy Enquiry (UNECE-FAO Forestry and Timber Section)
	1. **Total**	Energy unit, Mass, Volume		
	2. **Non-renewable sources**	Energy unit, Mass, Volume		
	3. **Renewable sources**	Energy unit, Mass, Volume		
	b. Production of energy		▪ By primary energy resource (e.g., petroleum, natural gas, coal, hydroenergy, geothermal, fission fuels, cane products, other primary) ▪ By secondary energy resource (e.g., electricity, liquefied petroleum gas, gasoline/alcohol, kerosene, diesel oil, fuel oil, coke, charcoal, gases, other secondary) ▪ National ▪ Sub-national	
	1. **Primary energy production**	Energy unit, Mass, Volume		
	2. **Secondary energy production**	Energy unit, Mass, Volume		
	c. **Total use of energy**	Energy unit, Mass, Volume	▪ By energy source ▪ By household ▪ By ISIC economic activity ▪ National ▪ Sub-national	
	d. Electric energy		▪ By energy source ▪ National ▪ Sub-national	
	1. **Electricity production**	Energy unit		
	2. **Installed capacities**	Energy unit		

Component 2: Environmental Resources and their Use				
Sub-component 2.3: Land				
Topic	**Statistics and Related Information** (**Bold Text - Core Set/Tier 1**; Regular Text - Tier 2; *Italicized Text - Tier 3*)	**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
Topic 2.3.1: Land use	a. **Land use area**	Area	▪ By land use category (e.g., agriculture, forestry, aquaculture, built up and related area, land used for maintenance and restoration of environmental functions, other land use not elsewhere classified, land not in use, aquaculture, maintenance and restoration of environmental functions, other inland water use not elsewhere classified, inland water not in use) ▪ National ▪ Sub-national	▪ FAO ▪ ECE Standard Classification of Land Use (1989) ▪ SEEA Central Framework (2012) Annex 1
	b. **Area of inland water use**	Area	▪ By inland use category (e.g., aquaculture, maintenance and restoration of environmental functions, other inland water use not elsewhere classified, inland water not in use) ▪ National ▪ Sub-national	
	c. **Coastal area** (includes area of coral reefs, mangroves, etc.) (also in 1.1.3.b)	Area	▪ National	
	d. Exclusive Economic Zone (EEZ) (also in 1.1.2.e and 1.1.3.c)	Area		
	e. Land ownership	Area	▪ By ownership category ▪ National ▪ Sub-national	▪ FAO
	f. *Area of land under organic farming*	Area	▪ National ▪ Sub-national	▪ FAO Inter-departmental Working Group on Organic Agriculture
	g. Area of land under sustainable forest management	Area		▪ Forest Stewardship Council
	h. *Area of land under agroforestry*	Area		
	i. Land use change		▪ By land use category (see 2.3.1.a above for examples) ▪ National ▪ Sub-national	▪ FAO ▪ ECE Standard Classification of Land Use (1989)
	1. Increase of area within category	Area		
	2. Decrease of area within category	Area		
	3. **Change of land use category by origin and destination**	Area		

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Table 3.2: Basic Set of Environment Statistics – Component 2: Environmental Resources and their Use (continued)

Component 2: Environmental Resources and their Use				
Sub-component 2.4: Soil Resources				
Topic	**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 2.4.1: Soil resources	Statistics in this topic are under development.			
Sub-component 2.5: Biological Resources				
Topic 2.5.1: Timber resources and their use	a. Timber resources		▪ By type (e.g., natural or planted)	▪ FAO Forest Resources Assessment
	1. **Stocks of timber resources**	Volume	▪ National	▪ State of Europe's Forests (Forest Europe/UNECE-FAO Forestry and Timber Section)
	2. Natural growth	Volume	▪ Sub-national	
	3. Fellings	Volume		▪ UNECE/FAO Joint Working Party on Forest Statistics, Economics and Management
	4. Removals	Volume		▪ ISIC Rev. 4, Section A, Division 02
	5. *Felling residues*	Volume		▪ FAOSTAT database
	6. *Natural losses*	Volume		
	7. *Catastrophic losses*	Volume		
	8. *Reclassifications*	Volume		
	b. Amount used of:		▪ National	
	1. Fertilizers	Area, Mass, Volume	▪ Sub-national	
	2. Pesticides	Area, Mass, Volume		
	c. Forest production	Volume	▪ By type of product (e.g., timber, industrial roundwood, fuelwood, pulp, chips) ▪ National ▪ Sub-national	▪ Central Product Classification (CPC) ▪ Joint Forest Sector Questionnaire (UNECE/FAO/Eurostat International Tropical Timber Organization [ITTO]) ▪ FAO/ITTO/UNECE/Eurostat Inter-secretariat Working Group on Forest Sector Statistics ▪ UNECE Timber Committee ▪ UNECE/FAO Joint Working Party on Forest Statistics, Economics and Management ▪ ISIC Rev. 4, Section A, Division 02 ▪ FAOSTAT database
	d. Fuelwood consumption	Volume	▪ National	▪ FAO/ITTO/UNECE/Eurostat Inter-secretariat Working Group on Forest Sector Statistics ▪ State of Europe's Forests (Forest Europe/UNECE-FAO Forestry and Timber Section) ▪ ISIC Rev. 4, Section A, Division 02 ▪ Harmonized System (HS) ▪ FAOSTAT database
	e. Imports of forest products	Currency, Mass, Volume	▪ By type of product	
	f. Exports of forest products	Currency, Mass, Volume		

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Component 2: Environmental Resources and their Use				
Sub-component 2.5: Biological Resources				
Topic	**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 2.5.2: Aquatic resources and their use	a. **Fish capture production**	Mass	▪ By relevant species ▪ National ▪ Sub-national	▪ FAO ISCAAP ▪ ISIC Rev. 4, Section A, Division 03 ▪ The United Nations Convention on the Law of the Sea (UNCLOS) ▪ UNSD: MDG Indicator 7.4 Metadata
	b. **Aquaculture production**	Mass		
	c. Imports of fish and fishery products	Currency, Mass, Volume	▪ By relevant species ▪ By type of product ▪ By species	
	d. Exports of fish and fishery products	Currency, Mass, Volume	▪ National ▪ Sub-national	
	e. Amount used of:		▪ National ▪ Sub-national	
	1. *Pellets*	Mass, Volume		
	2. *Hormones*	Mass, Volume		
	3. *Colourants*	Mass, Volume		
	4. *Antibiotics*	Mass, Volume		
	5. *Fungicides*	Mass, Volume		
	f. Fish resources (natural; cultivated)		▪ By relevant species ▪ By type (e.g., cultivated or natural) ▪ By species ▪ National	
	1. Stocks of fish resources	Mass		
	2. *Additions to fish resources*	Mass		
	3. *Reductions in fish resources*	Mass		
Topic 2.5.3: Crops	a. Main annual and perennial crops		▪ By crop ▪ National ▪ Sub-national	▪ FAO Indicative Crop Classification (for 2010 round of agricultural censuses) ▪ FAO/WHO Specifications for Pesticides (2010) ▪ FAO Specifications for Commonly Used Fertilizers (2009) ▪ ISIC Rev. 4, Section A, Division 1 ▪ FAOSTAT database
	1. **Area harvested**	Area		
	2. **Area planted**	Area		
	3. **Amount produced**	Mass		
	4. *Amount of organic production*	Mass		
	5. *Amount of genetically modified crops produced*	Mass		
	b. Amount used of:		▪ By type of fertilizer ▪ By type of pesticide ▪ By crop ▪ National ▪ Sub-national	
	1. **Natural fertilizers** (e.g., manure, compost, lime)	Area, Mass, Volume		
	2. **Chemical fertilizers**	Area, Mass, Volume		
	3. **Pesticides**	Area, Mass, Volume		
	c. Monoculture / resource-intensive crops		▪ By crop ▪ National ▪ Sub-national	
	1. Area being used for production	Area		
	2. Amount produced	Mass		
	3. *Amount of genetically modified crops produced*	Mass		
	d. Imports of crops	Currency, Mass		
	e. Exports of crops	Currency, Mass		

Topic	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
Component 2: Environmental Resources and their Use				
Sub-component 2.5: Biological Resources				
Topic 2.5.4: Livestock	a. Livestock		▪ By type of animal ▪ National ▪ Sub-national	▪ FAOSTAT database ▪ ISIC Rev. 4, Section A, Division 1
	1. **Number of live animals**	Number		
	2. Number of animals slaughtered	Number		
	b. Amount used of:			
	1. *Antibiotics*	Mass		
	2. *Hormones*	Mass		
	c. Imports of livestock	Currency, Number		
	d. Exports of livestock	Currency, Number		
Topic 2.5.5: Wild, uncultivated biological resources (other than fish and timber)	a. Permits for regulated hunting of wild animals			▪ ISIC Rev. 4, Section A, Division 1
	1. Number of permits issued per year	Number		
	2. Total number of animal kills allowed by permits	Number		
	b. Imports of endangered species	Currency, Number		▪ CITES
	c. Exports of endangered species	Currency, Number		
	d. *Reported wild animals killed or trapped for food or sale*	Number		▪ ISIC Rev. 4, Section A, Division 1
	e. *Non-wood forest products and other plants*	Mass, Volume	▪ By type of product ▪ National ▪ Sub-national	▪ ISIC Rev. 4, Section A, Group 0230

Component 2: Environmental Resources and their Use				
Sub-component 2.6: Water Resources				
Topic	**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 2.6.1: Water resources	a. Inflow of water to inland water resources		▪ Inflow secured through treaties/not secured through treaties	▪ UNSD: IRWS
	1. **Precipitation** (also in 1.1.1.b)	Volume		▪ UNECE Standard Statistical Classification of Water Use (1989)
	2. **Inflow from neighbouring territories**	Volume		▪ UNSD: MDG Indicator 7.5 Metadata
	3. *Inflow subject to treaties*	Volume	▪ National	▪ FAO AQUASTAT
	b. Outflow of water from inland water resources		▪ Sub-national	▪ SEEA Central Framework (2012) Asset accounts
	1. **Evapotranspiration**	Volume	▪ By territory of origin and destination	▪ SEEA Water
	2. Outflow to neighbouring territories	Volume		▪ UNSD: Environment Statistics Section - Water Questionnaire
	3. Outflow subject to treaties	Volume		
	4. Outflow to the sea	Volume		
	c. Inland water stocks		▪ National	
	1. Surface water stocks in artificial reservoirs	Volume	▪ Sub-national	
	2. *Surface water stocks in lakes*	Volume		
	3. *Surface water stocks in rivers and streams*	Volume		
	4. *Surface water stocks in wetlands*	Volume		
	5. *Surface water stocks in snow, ice and glaciers*	Volume		
	6. Groundwater stocks	Volume		
	7. *Water rights*	Volume		

Component 2: Environmental Resources and their Use				
Sub-component 2.6: Water Resources				
Topic	**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 2.6.2: Abstraction, use and returns of water	a. **Total water abstraction**	Volume	▪ By type of source ▪ National ▪ Sub-national	▪ UNSD: IRWS ▪ UNECE Standard Statistical Classification of Water Use (1989) ▪ FAO AQUASTAT ▪ SEEA Central Framework (2012) ▪ SEEA Water ▪ UNSD: Environment Statistics Section - Water Questionnaire
	b. **Water abstraction from surface water**	Volume		
	c. Water abstraction from groundwater			
	1. **From renewable groundwater resources**	Volume		
	2. **From non-renewable groundwater resources**	Volume		
	d. Water abstracted for own use	Volume	▪ By ISIC economic activity ▪ National ▪ Sub-national	
	e. Water abstracted for distribution	Volume	▪ By ISIC economic activity ▪ National ▪ Sub-national	
	f. Desalinated water	Volume	▪ National	
	g. Reused water	Volume	▪ Sub-national	
	h. Water use	Volume	▪ By ISIC economic activity ▪ National ▪ Sub-national	
	i. *Rainwater collection*	Volume	▪ National	
	j. *Water abstraction from the sea*	Volume	▪ Sub-national	
	k. Losses in distribution	Volume	▪ By ISIC economic activity ▪ National ▪ Sub-national	
	l. *Exports of water*	Volume	▪ National	
	m *Imports of water*	Volume	▪ Sub-national	
	n. *Returns of water*	Volume	▪ By ISIC economic activity ▪ National ▪ Sub-national	

3.3 Component 3: Residuals

3.138. Component 3 is closely related to the physical flow accounts (flows from the economy to the environment) of the SEEA Central Framework on which, where relevant, the terms and definitions are based[40]. This component contains statistics on the amount and characteristics of residuals generated by human production and consumption processes, their management, and their final release to the environment. Residuals are solid, liquid and gaseous materials that are discarded, discharged or emitted through processes of production, consumption and accumulation. Residuals may be discarded, discharged or emitted directly to the environment or be captured, collected, treated, recycled or reused. The main groups of residuals are emissions, wastewater and waste.

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

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

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

3.142. Emissions, wastewater and waste can have different impacts and effects on human and ecosystem health. They will be absorbed, or will persist and concentrate differently, depending on their nature, their scale and a combination of local environmental dynamics (e.g., wind, currents, as well as characteristics of land, air and water masses, etc.). Sometimes the substances are released or disposed of with little or no treatment, but increasingly, emissions are treated to reduce pollutants before they are released into the environment. These treatment and management processes, and their infrastructure are also contained in this component.

3.143. A special category of residuals (dissipative uses of products in the SEEA Central Framework) covers the residue of products that are deliberately released to the environment as part of production processes. Examples are the application of biochemicals such as fertilizers and

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[40] System of Environmental-Economic Accounting Central Framework

pesticides, part of which may be absorbed in the production process while the remaining proportion will stay in the environment and may cause pollution.

3.144. The subsequent concentrations of residuals in the different media are covered in Component 1, Sub-component 1.3: Environmental Quality.

3.145. 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: Application of Biochemicals.

Sub-component 3.1: Emissions to Air

3.146. Air pollution can be caused by natural as well as anthropogenic sources. In the FDES, the focus is on the emission of pollutants from socio-economic processes. Emissions to air are gaseous and particulate substances released to the atmosphere by establishments and households as a result of production, consumption and accumulation activities. The statistical description of such emissions covers their sources and the quantities emitted by substances.

3.147. 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.

3.148. Air emissions can be measured directly, or can be estimated on the basis of fuel and other material input data and process-specific emission factors. This information is usually produced in the form of emission inventories, available primarily from environmental ministries or environment protection authorities. Emissions to air can be distinguished by the type of source (e.g., stationary or mobile, point or diffuse), by process, and by economic activity.

3.149. 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 ECE

Standard Statistical Classification of Ambient Air Quality (1990) lists the substances, parameters and variables needed for statistics on air emissions.

Topic 3.1.1: Emissions of Greenhouse Gases (GHGs)

3.150. 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 GHG being carbon dioxide (CO_2) and methane (CH_4), and the most important indirect GHG being sulphur dioxide (SO_2) and nitrogen oxides (NO_x).

Topic 3.1.2: Consumption of Ozone Depleting Substances (ODS)

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

Topic 3.1.3: Emissions of other substances

3.152. There are a number of other environmentally important substances that are emitted to air beyond GHGs and ODS. The most important among these are the different fractions of particulate matter, heavy metals and others that are linked to environmental and health problems, but there are a variety of other emissions that countries may wish to measure or estimate based on national circumstances and priorities.

Sub-component 3.2: Generation and Management of Wastewater

3.153. Statistics about the generation, management and discharge of wastewater, as well as the pollutant content of wastewater (emissions 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.

3.154. 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

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

Topic 3.2.2: Collection and treatment of wastewater

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

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

Topic 3.2.3: Discharge of wastewater to the environment

3.158. 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.

3.159. 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.

3.160. In addition to the volume of wastewater returned to the environment, it is also important to measure or estimate the volumes of different pollutants that are emitted with the wastewater or otherwise released to water bodies. Emissions to water are the substances released to water resources by establishments and households as a result of production, consumption and accumulation processes. Emissions to water should be disaggregated according to the releasing economic activities and should cover the most important substances.

Sub-component 3.3: Generation and Management of Waste

3.161. This sub-component describes statistics about the generation and management of waste, including liquid and solid residual waste. Statistics include the amount of waste generated by waste type and by source, as well as the amount of waste collected, treated or disposed of.

3.162. Policy makers, particularly local governments, require statistics on waste in order to assess how its generation, treatment and disposal are changing over time. This in turn assists in planning for present and future waste management, in terms of transportation and facilities required. More importantly, waste can also be a resource when recycled or used as a fuel source. Statistics on waste can also be useful in developing strategies to encourage waste reduction, reuse and recycling.

Topic 3.3.1: Generation of waste

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

Topic 3.3.2: Management of waste

3.164. This topic includes statistics on: (i) the amount of waste collected and transported to treatment facilities or to their final disposal; (ii) the amount treated by type of treatment or disposal (e.g., recycling, composting, incineration, landfilling); (iii) the physical infrastructure for waste treatment, including the number and capacity of treatment plants; and (iv) other relevant information.

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

Sub-component 3.4: Application of Biochemicals

Topic 3.4.1: Application of biochemicals

3.166. Biochemical use statistics deal 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 biochemicals through cycling systems and build-up of contaminations in water, land and species (through the food chain). Statistics under this topic include the amount of natural and chemical fertilizers, pesticides and other biochemicals (hormones, pellets etc.) used by type of active ingredients (see also in 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 biochemicals that remain in the environment and affect environmental quality.

Table 3.3: Basic Set of Environment Statistics – Component 3: Residuals

Component 3: Residuals				
Sub-component 3.1: Emissions to Air				
Topic	**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 3.1.1: Emissions of greenhouse gases	a. Total emissions of direct greenhouse gases (GHGs), by gas:		▪ By ISIC economic activity ▪ National ▪ Sub-national ▪ By IPCC Reporting Guidelines	▪ IPCC Emission Factor Database ▪ UN Framework Convention on Climate Change (UNFCCC) Reporting Guidelines) ▪ UNECE Standard Statistical Classification of Ambient Air Quality (1990) ▪ UNSD: MDG Indicator 7.2 Metadata ▪ WHO
	1. **Carbon dioxide (CO_2)**	Mass		
	2. **Methane (CH_4)**	Mass		
	3. **Nitrous oxide (N_2O)**	Mass		
	4. Perfluorocarbons (PFCs)	Mass		
	5. Hydrofluorocarbons (HFCs)	Mass		
	6. Sulphur hexafluoride (SF_6)	Mass		
	b. Total emissions of indirect greenhouse gases (GHGs), by gas:			
	1. **Sulphur dioxide (SO_2)**	Mass		
	2. **Nitrogen oxides (NO_x)**	Mass		
	3. Non-methane volatile organic compounds (NM-VOCs)	Mass		
	4. Other	Mass		
Topic 3.1.2: Consumption of ozone depleting substances	a. Consumption of ozone depleting substances (ODS), by substance:			▪ UNEP Ozone Secretariat ▪ IPCC Emission Factor Database ▪ UNECE Standard Statistical Classification of Ambient Air Quality (1990) ▪ UNSD: MDG Indicator 7.3 Metadata ▪ WHO
	1. Chlorofluorocarbons (CFCs)	Mass		
	2. Hydrochlorofluorocarbons (HCFCs)	Mass		
	3. Bromofluorocarbons	Mass		
	4. Methyl chloroform	Mass		
	5. Carbon tetrachloride	Mass		
	6. Methyl bromide	Mass		
	7. Other	Mass		
Topic 3.1.3. Emissions of other substances	a. Emissions of other substances:			▪ UNECE Standard Statistical Classification of Ambient Air Quality (1990) ▪ European Monitoring and Evaluation Programme (EMEP) is under the Convention on Long-range Transboundary Air Pollution
	1. Particulate matter (PM)	Mass		
	2. Heavy metals	Mass		
	3. *Other*	Mass		

Component 3: Residuals				
Sub-component 3.2: Generation and Management of Wastewater				
Topic	**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 3.2.1: Generation and pollutant content of wastewater	a. **Volume of wastewater generated**	Volume	▪ By ISIC economic activity ▪ National ▪ Sub-national	▪ UNSD: IRWS ▪ ISIC Rev. 4, Section E, Division 35 and 36 ▪ SEEA Water ▪ UNSD: Environment Statistics Section - Water Questionnaire
	b. Emissions of pollutants to wastewater	Mass	▪ By pollutant or pollution parameter (e.g., BOD, COD, N, P, TSS) ▪ By ISIC economic activity ▪ National ▪ Sub-national	

Table 3.3: Basic Set of Environment Statistics – Component 3: Residuals (continued)

	Statistics and Related Information	Category of	Potential Aggregations	
Component 3: Residuals				
Sub-component 3.2: Generation and Management of Wastewater				
Topic	**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 3.2.2: Collection and treatment of wastewater	a. **Volume of wastewater collected**	Volume	▪ National ▪ Sub-national	▪ UNSD: IRWS ▪ ISIC Rev. 4, Section E, Division 35 and 36 ▪ UNSD: Environment Statistics Section - Water Questionnaire
	b. **Volume of wastewater treated**	Volume	▪ By treatment type (e.g., primary, secondary, tertiary) ▪ National ▪ Sub-national	
	c. Total urban wastewater treatment capacity			
	1. Number of plants	Number		
	2. Capacity of plants	Volume		
	d. Total industrial wastewater treatment capacity			
	1. Number of plants	Number		
	2. Capacity of plants	Volume		
Topic 3.2.3: Discharge of wastewater to the environment	a. Wastewater discharge		▪ By treatment type (e.g., primary, secondary, tertiary) ▪ By recipient (e.g., surface water, groundwater, wetland, sea, soil) ▪ By ISIC economic activity ▪ National ▪ Sub-national ▪ By source (point / non-point source)	
	1. **Total volume of wastewater discharged to the environment after treatment**	Volume		
	2. **Total volume of wastewater discharged to the environment without treatment**	Volume		
	b. Pollutant content of discharged wastewater	Mass	▪ By pollutant or pollution parameter (e.g., BOD, COD, N, P) ▪ National ▪ Sub-national ▪ Net emission by ISIC economic activity ▪ By source (point / non-point source)	

Component 3: Residuals				
Sub-component 3.3: Generation and Management of Waste				
Topic	**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 economic activity**	Mass	▪ By ISIC economic activity ▪ National ▪ Sub-national	▪ European Commission: European List of Waste, pursuant to European Waste Framework Directive ▪ Eurostat: Data Centre on Waste ▪ Eurostat: European Waste Classification for Statistics, version 4 (Waste categories) ▪ Basel Convention: Waste categories and hazardous characteristics ▪ Eurostat: Manual on Waste Statistics ▪ Eurostat: Guidance on classification of waste according to EWC-Stat categories ▪ SEEA Central Framework (2012) ▪ UNSD: Environment Statistics Section - Waste Questionnaire
	b. Amount of waste generated by waste category	Mass	▪ By waste category (e.g., chemical waste, municipal waste, combustion waste, etc.) ▪ National ▪ Sub-national	
	c. Generation of hazardous waste		▪ By ISIC economic activity ▪ National ▪ Sub-national	
	1. **Amount of hazardous waste generated**	Mass		

Component 3: Residuals

Sub-component 3.3: Generation and Management of Waste

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

	Component 3: Residuals			
Sub-component 3.4: Application of Biochemicals				
Topic	**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 3.4.1: Application of biochemicals	a. Total amount of fertilizers used (also in 2.5.1.b and 2.5.3.b)	Area, Mass, Volume	▪ National ▪ Sub-national ▪ By ISIC economic activity (forestry, agriculture)	▪ FAOSTAT database
	b. Total amount of pesticides used (also in 2.5.1.b and 2.5.3.b)	Area, Mass, Volume		▪ FAOSTAT database
	c. *Total amount of pellets used (also in 2.5.2.e)*	Mass, Volume	▪ National ▪ Sub-national ▪ By ISIC economic activity (aquaculture)	
	d. *Total amount of hormones used (also in 2.5.2.e and 2.5.4.b)*	Mass, Volume	▪ National ▪ Sub-national ▪ By ISIC economic activity (aquaculture, livestock production)	
	e. *Total amount of colourants used (also in 2.5.2.e)*	Mass, Volume	▪ National ▪ Sub-national ▪ By ISIC economic activity (aquaculture)	
	f. *Total amount of antibiotics used (also in 2.5.2.e and 2.5.4.b)*	Mass, Volume	▪ National ▪ Sub-national ▪ By ISIC economic activity (aquaculture, livestock production)	

3.4 Component 4: Extreme Events and Disasters

3.167. 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.

3.168. 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.

3.169. 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

3.170. 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.

3.171. 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 10th or 90th percentile. A disaster is often described as a result of exposure to an extreme event. 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." (CRED, 2009)[41] It often surpasses local capacities to respond to it and requires national and/or international, external assistance. For inclusion in this sub-component, a disaster should be categorized using the same criteria as the CRED Emergency Events Database (EM-DAT). 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

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[41] CRED EM-DAT, 2009. *Emergency Events Database*. http://www.emdat.be

iv. Call for international assistance has been made.

3.172. 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.

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

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

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

Topic 4.1.1: Occurrence of natural extreme events and disasters

3.176. 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. In addition, statistics on hazard prone areas and on the vulnerability to disasters (i.e. population living in hazard prone areas), are also relevant.

Topic 4.1.2: Impact of natural extreme events and disasters

3.177. 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.

3.178. The Economic Commission for Latin America and the Caribbean (UN ECLAC) has developed a handbook which may be useful to other countries and regions, "ECLAC: Handbook for Estimating the Socio-economic and Environmental Effects of Disasters".[42] It evaluates the overall impact of disasters associated with natural events and includes a methodology for evaluating this impact. This analysis of disaster impact in terms of damage and losses makes it possible to estimate the impact of disasters on economic growth, on the population's living conditions and on environmental conditions in the region.

Sub-component 4.2: Technological Disasters

3.179. 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.

3.180. 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.

3.181. There are three types of technological disasters recognized by CRED.[43] These are: industrial disasters which cover leakages of fluid toxic chemicals, oil spills and explosions; transport disasters which cover accidents associated with the mechanized transport of chemicals, volatile materials or other hazardous substances by road, rail, water or pipeline; and miscellaneous disasters such as arson fires and other disasters of varied origin. All these types of disasters can impact large areas and affect both human safety and the environment in both the short and long term.

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[42] ECLAC: Handbook for Estimating the Socio-economic and Environmental Effects of Disasters. LC/MEX/G.5 ECLAC Mexico Office, July, 2003. http://www.eclac.cl/cgi-bin/getProd.asp?xml=/publicaciones/xml/4/12774/P12774.xml&xsl=/mexico/tpl-i/p9f.xsl&base=/mexico/tpl/top-bottom.xsl
[43] Disaster profiles of EM-DAT, http://www.emdat.be/disaster-profiles

Topic 4.2.1: Occurrence of technological disasters

3.182. 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.

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

3.184. This topic should include information on the identification and characterization of the different types of events including information on type of disaster, location, magnitude 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.

3.185. 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.

3.186. For inclusion in this sub-component, a technological disaster should be categorized using the same criteria as the CRED EM-DAT (see paragraph 3.171 for criteria).

Topic 4.2.2: Impact of technological disasters

3.187. This topic includes the specific impacts on humans, damage to the economy and the 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, homeless, and 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.

3.188. 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.

3.189. 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.

Table 3.4: Basic Set of Environment Statistics – Component 4: Extreme Events and Disasters

Component 4: Extreme Events and Disasters				
Sub-component 4.1: Natural Extreme Events and Disasters				
Topic	**Statistics and Related Information** (**Bold Text - Core Set/Tier 1**; Regular Text - Tier 2; *Italicized Text - Tier 3*)	**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
Topic 4.1.1: Occurrence of natural extreme events and disasters	a. Occurrence of natural extreme events and disasters:		▪ By event ▪ National ▪ Sub-national	▪ Centre for Research on the Epidemiology of Disasters Emergency Events Database (CRED EM-DAT) ▪ Economic Commission for Latin America and the Caribbean (UNECLAC) Handbook for Estimating the Socio-economic and Environmental Effects of Disasters
	1. **Type of natural disaster** (geophysical, meteorological, hydrological, climatological, biological)	Descriptive		
	2. **Location**	Location		
	3. Magnitude (where applicable)	Intensity		
	4. Date of occurrence	Date		
	5. Duration	Time period		
	6. Hazard prone areas	Area		
	7. Population living in hazard prone areas	Number		
Topic 4.1.2: Impact of natural extreme events and disasters	a. People affected by natural extreme events and disasters			
	1. **Number of people killed**	Number		
	2. Number of people injured	Number		
	3. Number of people homeless	Number		
	4. Number of people affected	Number		
	b. **Economic loss due to natural extreme events and disasters** (e.g., damage to buildings, transportation networks, loss of revenue for businesses, utility disruption, etc.)	Currency	▪ By event ▪ By ISIC economic activity ▪ National ▪ Sub-national ▪ By direct and indirect damage	
	c. Physical loss/damage due to natural extreme events and disasters (e.g., area and amount of crops, livestock, aquaculture, biomass etc.)	Area, Descriptive, Number		
	d. Effect of natural extreme events and disasters on integrity of ecosystems		▪ By event ▪ By ecosystem ▪ National ▪ Sub-national	
	1. *Area affected by natural disasters*	Area		
	2. *Loss of vegetation cover*	Area		
	3. *Area of watershed affected*	Area		
	4. *Other*	Descriptive		
	e. *External assistance received*	Currency	▪ By event ▪ National	

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Component 4: Extreme Events and Disasters				
Sub-component 4.2: Technological Disasters				
Topic	**Statistics and Related Information**	**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
Topic 4.2.1: Occurrence of technological disasters	a. Occurrence of technological disasters		▪ By event	▪ CRED EM-DAT
	1. Type of disaster (industrial, transportation, miscellaneous)	Descriptive	▪ By ISIC economic activity	▪ UNECLAC: Handbook for Estimating the Socio-economic and Environmental Effects of Disasters
	2. *Location*	Location	▪ National	
	3. *Date of occurrence*	Date	▪ Sub-national	
	4. *Duration*	Time period		
Topic 4.2.2: Impact of technological disasters	a. People affected by technological disasters		▪ By event	
	1. Number of people killed	Number	▪ National	
	2. *Number of people injured*	Number	▪ Sub-national	
	3. *Number of people homeless*	Number		
	4. *Number of people affected*	Number		
	b. Economic loss due to technological events and disasters (e.g., damage to buildings, transportation networks, loss of revenue for businesses, utility disruption, etc.)	Currency	▪ By event ▪ By ISIC economic activity	
	c. Physical loss/damage due to technological disasters (e.g., area and amount of crops, livestock, aquaculture, biomass etc.)	Area, Descriptive, Number	▪ National ▪ Sub-national ▪ By direct and indirect	
	d. Effects of technological disasters on integrity of ecosystems		▪ By event	
	1. *Area affected by technological disasters*	Area	▪ National	
	2. *Loss of vegetation cover*	Area	▪ Sub-national	
	3. *Area of watershed affected*	Area		
	4. *Other (e.g., for oil spills: volume of oil released into the environment, impact on ecosystem)*	Descriptive		
	e. *External assistance received*	Currency	▪ By event ▪ National	

3.5 Component 5: Human Settlements and Environmental Health

3.190. 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.

3.191. 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.

3.192. 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 disasters.

3.193. 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

3.194. 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 refer to 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.

3.195. 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.

3.196. 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.

3.197. The first topic in this sub-component covers urban and rural population statistics, providing information on the location where humans construct 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

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

3.199. 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 geo-referenced 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.

3.200. 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.

Topic 5.1.2: Access to water, sanitation and energy

3.201. 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.

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

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

Topic 5.1.3: Housing conditions

3.204. 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 vulnerable zones. Housing access and

conditions exert a direct effect on human wellbeing and health, and these data therefore serve as critical measures of those attributes.

3.205. 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.

3.206. With regard to housing sufficiency, statistics can include, but are not restricted to, the number and proportion of individuals or families that do not have access to an adequate dwelling, or live in a precarious dwelling.

3.207. Depending on the country, common statistics describing the quality and the location of houses in either safe or vulnerable zones include: urban population living in slums or informal settlements, as well as the number of dwellings with adequate building materials as defined by national or local standards. Additionally, when available, statistics on the density of the built environment and the placement of houses in vulnerable zones are commonly used.

3.208. Poor or inadequate housing conditions, in urban areas, can be approached using the concept of "slums" and statistics on the magnitude and proportion of urban population living in them. MDG indicator 7.10 states that the urban population living in slum households is defined as a group of individuals living under the same roof lacking one or more of the following conditions: access to improved water, access to improved sanitation, sufficient living area, durability of housing, or security of tenure. Information on secure tenure is not available for most countries however, so typically only the first four indicators are used to define slum households.[44]

3.209. Data sources for this topic include censuses and household surveys. The common partners of the NSO include the urban planning and housing authorities responsible for zoning, construction methods and materials of local houses and buildings.

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

3.210. This topic includes spatially described statistics on human populations exposed to different levels of air and noise pollution. This topic is unique in that it overlays pollutant emission and exposure data onto geographic and demographic data to create a more detailed understanding of the location of populations currently being exposed to pollutants and those

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[44] Millennium Development Goals Indicators, Indicator 7.10. http://mdgs.un.org/unsd/mdg/Metadata.aspx

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.

Topic 5.1.5: Environmental concerns specific to urban settlements

3.211. 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.

3.212. 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.

3.213. 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.

Sub-component 5.2: Environmental Health

3.214. Environmental health is defined by the WHO as "those aspects of the human health and disease that are determined by factors in the environment. It also refers to the theory and practice of assessing and controlling factors in the environment that can potentially affect health." (WHO, 2012)[45] The full scope of environmental health as defined by the WHO goes beyond the scope of the FDES. The FDES excludes indoor air pollution and the associated impacts on human health.

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

3.215. The impacts of changes in environmental conditions on human health are many and vary from country to country. The WHO is the leading global institution documenting the relationship between health and the environment. Notably, critical global statistics are set out through WHO's presentation, "10 facts on preventing disease through healthy environments". (WHO, 2010)[46]

3.216. Common measures of the health of human populations include statistics on mortality, morbidity and incidence associated with specific types of diseases and conditions that are heavily influenced by environmental conditions. Also, when available, estimations of the loss of work days and estimation of the economic cost in monetary terms (e.g., loss of wages or costs of treatment) can be included here. Associated statistics such as the emissions of pollutants to the environment can be found in Component 3: Residuals, while statistics on pollution concentration in air, water and soil can be found in Sub-component 1.3: Environmental Quality.

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

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

Topic 5.2.1: Airborne diseases and conditions

3.219. This topic includes all airborne diseases and conditions that are caused or worsened by exposure to unhealthy levels of pollutants (such as respirable PM, SO_2 or O_3), usually found in urban 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 and allergic rhinitis. This topic includes health statistics such as incidence and prevalence of this disease or condition, as well as measures of the associated impact on the labour force and on the economic costs.

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

Topic 5.2.2: Water-related diseases and conditions

3.220. This topic includes all water-related diseases and conditions that result from micro-organisms in the water humans drink as defined by the WHO. Water-related diseases and conditions are still a considerable public health problem in developing countries. They include, but are not limited to, diarrhoeal disease, gastroenteritis and water borne parasite infections. This topic includes health statistics such as incidence, prevalence and mortality of this disease or condition, as well as measures of the associated impact on the labour force and on the economic costs.

Topic 5.2.3: Vector borne diseases

3.221. This topic includes vector borne diseases that are transmitted by vectors (e.g., insects and arachnids) that carry viruses, bacteria, protozoa and other pathogens, as defined by the WHO. Common vector borne diseases include, but are not limited to, malaria, dengue fever, yellow fever and Lyme disease. Some vector borne diseases are being directly affected by climate change, notably by the change in rain patterns and floods. This topic includes health statistics such as incidence, prevalence and mortality of this disease or condition, as well as measures of the associated impact on the labour force and on the economic costs.

Topic 5.2.4: Health problems associated with excessive UV radiation exposure

3.222. This topic includes statistics on the incidence and prevalence of skin cancer and also the incidence, prevalence and treatment of cataracts associated with excessive UV radiation exposure. It is very relevant, particularly in countries and zones where the atmospheric ozone layer is thinner or severely reduced. In addition, this topic includes statistics on work days lost and economic costs in monetary terms.

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

3.223. This topic includes diseases and conditions associated with exposure to toxic substances, residuals and/or waste that result from localized emissions. Toxic substances include toxic pesticides (e.g., pesticides that have teratogenic, carcinogenic, tumorigenic and/or mutagenic effects), and toxic industrial chemicals (e.g., lead, arsenic, mercury and nickel, among others). Toxic substance-related diseases and health problems include, but are not limited to, chronic illnesses of the respiratory system (such as pneumonia, upper respiratory diseases, asthma and chronic obstructive pulmonary diseases), infertility, and congenital anomalies or malformations.

3.224. The exposure to toxic substances is usually the result of poor environmental management in energy production practices and waste management, and lack of information by stakeholders.

The resulting diseases and conditions included under this topic can be caused by exposure to the toxins through different or undetermined media such as air, water, food, soil or a combination of these elements. In this respect, the resulting health problems in this topic cannot be categorized as primarily or solely attributable to air or water borne diseases.

3.225. This topic also includes diseases and conditions associated with exposure to nuclear radiation. The related diseases and health conditions may be both short and long term and could include, but are not limited to, thermal burns from infrared heat radiation, beta and gamma burns from beta and gamma radiation, radiation sickness or "atomic disease", leukaemia, lung cancer, thyroid cancer and cancer of other organs, sterility and congenital anomalies or malformations, premature aging, cataracts and also increased vulnerability to disease as well as emotional disorders.

3.226. Nuclear radiation could occur from exposure to a nuclear explosion, meltdown or from fallout. Radioactive material is known to be emitted to surrounding air, water and soil of human settlements and ecosystems, in addition to causing obvious direct effects on humans. The conditions arising from exposure to humans can range from immediate thermal and mechanical injuries, through long term and delayed effects on organs and tissues, as well as effects on emotional wellbeing. Nevertheless, caution must be exerted since the resulting health problems in this area cannot always be categorized as primarily or solely attributable to nuclear radiation.

3.227. This topic includes statistics such as incidence and prevalence of these toxic substance-related diseases or conditions, as well as measures of the associated impact on the labour force and on the economic costs. These statistics are also relevant in Topic 4.2.2: Impact of technological disasters.

3.228. 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.

Table 3.5: Basic Set of Environment Statistics – Component 5: Human Settlements and Environmental Health

Component 5: Human Settlements and Environmental Health				
Sub-component 5.1: Human Settlements				
Topic	**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 5.1.1: Urban and rural population	a. Total population living in urban areas	Number	▪ Urban ▪ Rural	▪ UN Population Division ▪ UN Population Fund (UNFPA)
	b. Total population living in rural areas	Number		
	c. Total urban area	Number		
	d. Total rural area	Number		
Topic 5.1.2: Access to water, sanitation and energy	a. **Population using an improved drinking water source**	Number	▪ Urban ▪ Rural ▪ National ▪ Sub-national	▪ UNSD: MDG Indicator 7.8 and 7.9 Metadata ▪ UN-Water ▪ UNSD: Environment Statistics Section - Water Questionnaire ▪ WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation
	b. **Population using an improved sanitation facility**	Number		
	c. Population served by municipal waste collection	Number		
	d. **Population connected to wastewater collection**	Number	▪ By treatment type (e.g., primary, secondary, tertiary) ▪ National ▪ Sub-national	▪ UNSD: IRWS ▪ ISIC Rev. 4, Section E, Division 35 and 36 ▪ UNSD: Environment Statistics Section -Water Questionnaire
	e. **Population connected to wastewater treatment**	Number		
	f. Population served by water supply industry	Number		
	g. Population with access to electricity	Number		
Topic 5.1.3: Housing conditions	a. Urban population living in slums	Number		▪ UN Habitat ▪ UNSD: MDG Indicator 7.10 Metadata
	b. *Houses in zones vulnerable to particular environmental health issues, natural extreme events and disasters*	Number	▪ Urban ▪ Rural ▪ National ▪ Sub-national	
	c. *Population living in a precarious dwelling*	Number		
	d. *Population living in informal settlements*	Number		
	e. *Homeless population*	Number		
	f. *Number of dwellings with adequacy of building materials defined by national or local standards*	Number		

Table 3.5: Basic Set of Environment Statistics – Component 5: Human Settlements and Environmental Health (continued)

Component 5: Human Settlements and Environmental Health				
Sub-component 5.1: Human Settlements				
Topic	**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 5.1.4: Exposure to ambient pollution related to spatial location of population	a. Population exposed to air pollution (e.g., SO$_2$, NO$_X$, O$_3$) in main cities	Number	▪ By pollutant (e.g., SO$_2$, NOx, O$_3$)	▪ WHO
	b. *Population exposed to noise pollution in main cities*	Number		
Topic 5.1.5: Environmental concerns specific to urban settlements	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. *Existence of urban planning and zoning regulations and instruments in main cities*	Descriptive		
	h. *Effectiveness of urban planning and zoning regulations and instruments in main cities*	Descriptive		

Table 3.5: Basic Set of Environment Statistics – Component 5: Human Settlements and Environmental Health (continued)

Topic	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
Component 5: Human Settlements and Environmental Health				
Sub-component 5.2: Environmental Health				
Topic 5.2.1: Airborne diseases and conditions	a. Airborne diseases and conditions (e.g., upper and lower respiratory disease, obstructive pulmonary disease, asthma and allergic rhinitis):		▪ By disease or condition ▪ National ▪ Sub-national ▪ Urban ▪ Rural ▪ By gender ▪ By age group ▪ By time period	▪ WHO
	1. Incidence	Number		
	2. Prevalence	Number		
	3. *Loss of work days*	Number		
	4. *Estimates of economic cost in monetary terms*	Currency		
Topic 5.2.2: Water-related diseases and conditions	a. Water-related diseases and conditions (e.g., diarrhoeal disease, gastroenteritis and water borne parasite infections):			
	1. **Incidence**	Number		
	2. **Prevalence**	Number		
	3. **Mortality**	Number		
	4. *Loss of work days*	Number		
	5. *Estimates of economic cost in monetary terms*	Currency		
Topic 5.2.3: Vector borne diseases	a. Vector borne diseases (e.g., malaria, dengue fever, yellow fever and Lyme disease):			
	1. **Incidence**	Number		
	2. **Prevalence**	Number		
	3. **Mortality**	Number		
	4. *Loss of work days*	Number		
	5. *Estimates of economic cost in monetary terms*	Currency		
Topic 5.2.4: Health problems associated with excessive UV radiation exposure	a. Problems associated with excessive UV radiation exposure (e.g., skin cancer, cataracts):			
	1. *Incidence*	Number		
	2. *Prevalence*	Number		
	3. *Loss of work days*	Number		
	4. *Estimates of economic cost in monetary terms*	Currency		

Component 5: Human Settlements and Environmental Health				
Sub-component 5.2: Environmental Health				
Topic	**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 5.2.5: Toxic substance- and nuclear radiation-related diseases and conditions	a. Toxic substance- and nuclear radiation-related diseases and conditions		▪ By category of toxic substance ▪ By disease or condition ▪ National ▪ Sub-national ▪ Urban ▪ Rural ▪ By gender ▪ By age group	▪ WHO
	1. Incidence	Number		
	2. Prevalence	Number		
	3. *Loss of work days*	Number		
	4. *Estimates of economic cost in monetary terms*	Currency		

3.6 Component 6: Environment Protection, Management and Engagement

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

3.230. 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 programmmes 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.

3.231. 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

3.232. This sub-component is closely related to the environmental activity accounts of the SEEA Central Framework and it is based on the Classification of Environmental Activities (CEA)[47]. 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 determine the current and desired levels of engagement and commitment from both government and the private sector.

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[47] Classification of Environmental Activities (CEA), contained in the SEEA Central Framework, https://unstats.un.org/unsd/envaccounting/White_cover.pdf

3.233. 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 environment protection and other environment protection activities.

3.234. 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.

3.235. 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 Central Framework (for further information see Annex D: Classifications and environment statistics).

3.236. 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.

3.237. Closely linked to the Classification of Environmental Activities are the economic statistics of the Environmental Goods and Services Sector (EGSS).[48] EGSS consist of a heterogeneous set of producers of technologies, goods and services that measure, control, restore, prevent, treat, minimise, research and sensitize to: (i) environmental damages to air, water and soil as well as problems related to waste, noise, biodiversity and landscapes; and (ii) resources depletion. EGSS under (i) include cleaner technologies, goods and services that prevent or minimize

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[48] Eurostat, "The environmental goods and services sector. A data collection handbook". 2009 edition. Eurostat Methodologies and Working Papers. Available from http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-RA-09-012/EN/KS-RA-09-012-EN.PDF (accessed 31 January 2013).

pollution; while those under (ii) comprise mainly resource efficient technologies, goods and services that minimise the use of natural resources. The technologies, goods and services produced in the EGSS can be classified into environmental specific services, connected products (goods and services), adapted goods, integrated technologies and end-of-pipe technologies.

Topic 6.1.1: Government environment protection and resource management expenditure

3.238. 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.

3.239. The main institutional partners are the official institutions in charge of reporting government expenditure (e.g., internal revenue services) and the national and sub-national level institutions (e.g., municipalities). The resulting statistics will usually be at the national level, and can sometimes be disaggregated by functional governmental entities or by governmental levels. National accounts and government finance statistics are typically the divisions in the NSOs which need to be involved when developing these figures. These statistics are expressed in monetary units, typically with annual periodicity, depending on the availability of resources.

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

3.240. 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.

Sub-component 6.2: Environmental Governance and Regulation

3.241. 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.

3.242. 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.

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

Topic 6.2.1: Institutional strength

3.244. 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 environmental authority (name, budget and staff), and other relevant environmental bodies (names, budget and staff).

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

Topic 6.2.2: Environmental regulation and instruments

3.246. This topic includes statistics on the characterization of: (i) direct regulation (e.g., regulated pollutants, description of licensing system, application for licences, quotas for biological resource extraction, as well as budget and number of staff dedicated to enforcement of environmental regulations; and (ii) economic instruments (e.g., green taxes, green subsidies, eco-labelling and certification, as well as emission permits.).

3.247. 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.

Topic 6.2.3: Participation in MEAs and environmental conventions

3.248. This topic includes information on a country's participation[49] 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.

Sub-component 6.3: Extreme Event Preparedness and Disaster Management

3.249. Statistics describing extreme event and disaster preparedness will be different in each country depending on which type of extreme events and disasters usually occur or can potentially occur. In general, these statistics include the existence and strength of the disaster authority's facilities and infrastructure.

3.250. Extreme event and disaster preparedness expenditure should also be captured under this sub-component. It refers to any public or private expenditure whose primary purpose is to help inform, educate and protect the population from extreme events and disasters, including but not restricted to, the set up and maintenance of warning systems, monitoring stations and systems, signals, communication systems, emergency centres and shelters, etc.

Topic 6.3.1: Preparedness for natural extreme events and disasters

3.251. Measures of disaster preparedness will vary according to the community and location's 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,

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[49] 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.

as well as the expenditure on disaster prevention, preparedness, clean-up and rehabilitation are also important data requirements.

3.252. Lead responsibility for plans for disaster preparedness is often delegated to infrastructure authorities or ministries of public works, construction and housing. Common data sources are national and sub-national authorities responsible for disaster management and assistance as well as emergency management agencies and municipalities. Global and regional meteorological forecasting agencies can also provide useful data on the spatial scale and likelihood of a crisis. Relevant population data can be obtained from NSOs and pertinent flood and drainage control information can be had from authorities responsible for flood and drainage control. Close agro-meteorological collaboration can also provide effective and actionable joint forecast information from the agriculture ministries and counterparts in meteorological agencies. This can complement data from each of their domains.

Topic 6.3.2: Preparedness for technological disasters

3.253. 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 in contributing to preparedness and clean-up. In the case of natural extreme events and disasters, these usually occur on a larger scale and it is normally the government who is involved in preparedness and clean-up.

3.254. 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 preparedness, clean-up and rehabilitation.

Sub-component 6.4: Environmental Information and Awareness

3.255. This component covers information about diverse processes that contribute to increase social awareness of environmental issues, thus promoting pro-environmental engagement and actions by the public and decision-makers at both local and national levels.

3.256. The statistics in this sub-component are relevant for policy makers, analysts and civil society in order to understand what information and education programmes are in place in their

country, whether these activities are increasing or decreasing over time, and potentially what the impact of information and education is on the public perception, awareness of environmental issues and social engagement in pro-environmental actions. An understanding of environmental perceptions of the general public and key local constituencies can also be useful for policy makers when shaping local and national environmental policies and programmes

3.257. 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.

3.258. 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

3.259. 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).

3.260. The production and dissemination of environment statistics within national statistical systems enables the production of robust environmental and sustainable development indicators 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.

3.261. 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.

Topic 6.4.2: Environmental education

3.262. 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.

3.263. 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.

3.264. 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.

Topic 6.4.3: Environmental engagement

3.265. This topic is intended to capture any available statistics on participation in pro-environment activities in a country. Pro-environment activities are those activities undertaken by civil societies or community groups to protect, improve and manage the environment. It can include 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), among many other activities.

3.266. 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 people participating in pro-environmental activities, and the number of pro-environmental programmes.

3.267. 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.

Topic 6.4.4: Environmental perception and awareness

3.268. This topic includes both the general public or a specific group's perceptions and awareness towards and about the environment through the measurement of knowledge, attitudes, values and actions. It also encompasses people's perceptions about governments' environmental policies toward addressing pressing environmental concerns. Increasingly, countries and international polling companies have been surveying the public to measure such information across society

3.269. 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.

3.270. 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., local governments). These statistics are produced through surveys designed for data collection on this topic. Statistics belonging to this topic are mainly qualitative, and are compiled at both the sub-national and national level.

Table 3.6: Basic Set of Environment Statistics – Component 6: Environment Protection, Management and Engagement

Topic	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
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		▪ By environmental activity ▪ By ministry ▪ National ▪ Sub-national ▪ By funding	▪ Classification of Environmental Activities (CEA) ▪ SEEA Central Framework (2012) Annex 1 ▪ Eurostat - SERIEE Environmental Protection Expenditure Accounts Compilation Guide
	1. **Annual government environment protection expenditure**	Currency		
	2. Annual government resource management expenditure	Currency		
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		▪ By environmental activity ▪ By ISIC economic activity ▪ National ▪ Sub-national	
	1. Annual corporate environment protection expenditure	Currency		
	2. *Annual corporate resource management expenditure*	Currency		
	3. *Annual non-profit institution environment protection expenditure*	Currency		
	4. *Annual non-profit institution resource management expenditure*	Currency		
	5. *Annual household environment protection expenditure*	Currency		
	6. *Annual household resource management expenditure*	Currency		

Component 6: Environment Protection, Management and Engagement				
Sub-component 6.2: Environmental Governance and Regulation				
Topic	**Statistics and Related Information** (Bold Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
Topic 6.2.1: Institutional strength	a. Environmental institutions and their resources		▪ National ▪ Sub-national	
	1. Name of the main environmental authority/agency and year of establishment	Descriptive		
	2. Annual budget of main environmental authority/agency	Currency		
	3. Number of staff of main environmental authority/agency	Number		
	4. List of environmental departments in other ministries/agencies and year of establishment	Descriptive		
	5. Annual budget of environmental departments in other ministries/agencies	Currency		
	6. Number of staff of environmental departments in other ministries/agencies	Number		
Topic 6.2.2: Environmental regulation and instruments	a. Direct regulation		▪ Per media (e.g., water, air, land, soil, oceans) ▪ By ISIC economic activity ▪ National ▪ Sub-national	
	1. **List of regulated pollutants and description** (e.g., by year of adoption and maximum allowable levels)	Descriptive, Number		
	2. Description (e.g., name, year established) of licensing system to ensure compliance with environmental standards for businesses or other new facilities	Descriptive		
	3. Number of applications for licenses 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*	Descriptive, Value		
	2. *List and description (e.g., year of establishment) of environmentally relevant subsidies*	Descriptive, Value		
	3. *List of eco-labelling and environmental certification programmes*	Descriptive		
	4. Emission permits traded	Number, Value		
Topic 6.2.3: Participation in MEAs and environmental conventions	a. Participation in MEAs and other global environmental conventions			▪ Secretariats of MEAs
	1. **List and description (e.g., year of participation[d] of country) of MEAs and other global environmental conventions**	Descriptive, 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: 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.				

Table 3.6: Basic Set of Environment Statistics – Component 6: Environment Protection, Management and Engagement (continued)

Topic	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
Component 6: Environment Protection, Management and Engagement				
Sub-component 6.3: Extreme Event Preparedness and Disaster Management				
Topic 6.3.1: Preparedness for natural extreme events and disasters	a. National natural extreme event and disaster preparedness and management systems		▪ National ▪ Sub-national	▪ International Emergency Management Organization (IMEO) ▪ The United Nations Office for Disaster Risk Reduction (UNISDR) ▪ Hyogo Framework for Action
	1. Existence of national disaster plans/programmes	Descriptive		
	2. Description (e.g., number of staff) of national disaster plans/programmes	Descriptive		
	3. Number and type of shelters in place or able to be deployed	Descriptive, Number		
	4. *Number and type of internationally certified emergency and recovery management specialists*	Descriptive, Number		
	5. *Number of volunteers*	Number		
	6. *Quantity of first aid, emergency supplies and equipment stockpiles*	Number		
	7. *Existence of early warning systems for all major hazards*	Descriptive		
	8. *Expenditure on disaster prevention, preparedness, clean-up and rehabilitation*	Currency		
Topic 6.3.2: Preparedness for technological disasters	a. National technological disaster preparedness and management systems			
	1. *Existence and description (e.g., number of staff) of public disaster management plans/programmes (and private when available)*	Descriptive		
	2. *Expenditure on disaster preparedness, clean-up and rehabilitation*	Currency		

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

Chapter 4: The Core Set of Environment Statistics

4.1.   This chapter further elaborates the FDES by identifying the statistics that describe the statistical topics, grouped within the Basic Set of Environment Statistics and the Core Set of Environment Statistics. They have been selected according to their relevance to environmental issues and to corresponding FDES topics, as well as for calculating environmental indicators and for generating environmental-economic accounts.

4.2.   The statistics included in the Basic Set are comprehensive but neither exhaustive nor the only possible ones for assessment of the statistical topics. They should be considered a set of statistics which can assist in making decisions on priorities for statistical development. In order to do so, the Basic Set of Environment Statistics has been set up following a progression of three tiers (see Figure 4.1), where 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 Tier 2 and Tier 3 as national priorities require and as data availability and resources permit. (Description of Tiers 2 and 3 follow in paragraph 4.16.)

Figure 4.1: The Core Set embedded in the Basic Set of Environment Statistics
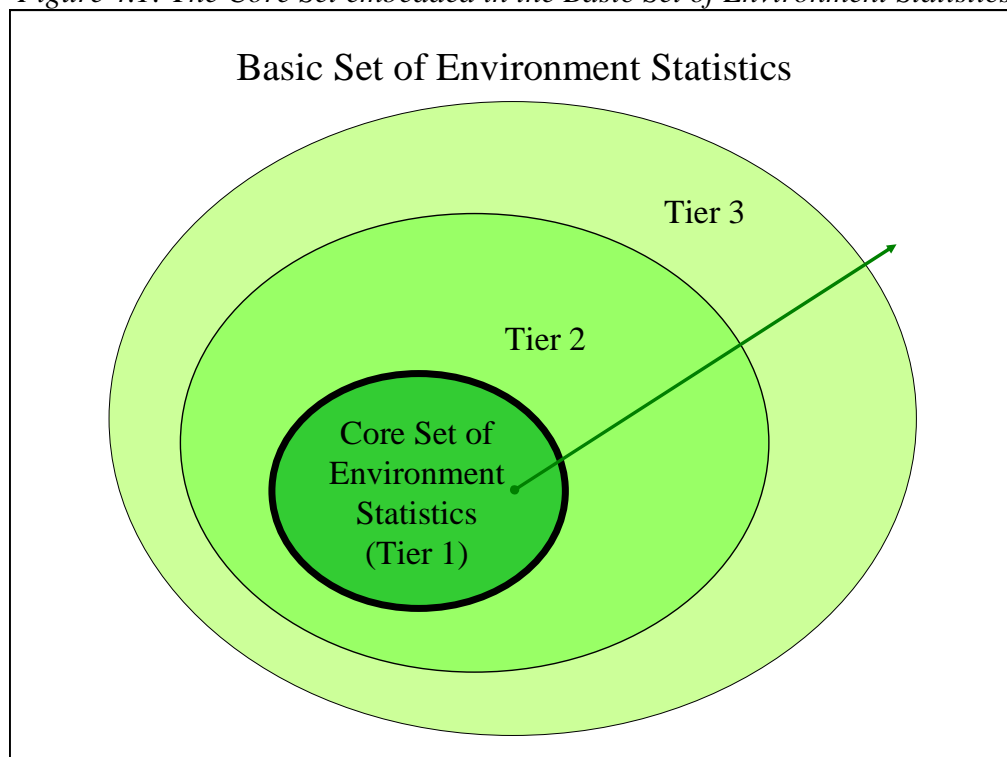
4.3.   This approach is useful in providing an overview of the entire field of environment statistics and can help statisticians to identify data sources and make the arrangements for regular data acquisition. It serves as a starting point for the identification of appropriate statistical series and will help to determine relevant classifications.

4.4.   The Core Set of Environment Statistics will be accompanied by detailed guidance elaborating on agreed concepts, definitions, classifications and data compilation methods. This methodological guidance will be used to train and assist countries that wish to incorporate the Core Set of Environment Statistics into their national statistical programmes. This would be invaluable in ensuring the availability of a defined set of relevant and internationally comparable environment statistics.

4.5.   The Core Set (Tier 1) of Environment Statistics is presented at the end of this chapter. The complete Basic Set of Environment Statistics which demonstrates how the Core Set is embedded in the Basic Set for each statistical topic of the FDES is contained in Annex A. The Basic Set includes columns illustrating, for each statistic, common disaggregation, temporal and spatial considerations, as well as available methodologies and classifications.

4.1 What is the Core Set of Environment Statistics?

4.6.   The Core Set of Environment Statistics consists of a limited number of statistics, as well as some non-statistical information on the environment (e.g., qualitative descriptions). The Core Set represents a broad consensus of opinion on the pertinence and feasibility of these statistics; as such, it is intended to foster collection, coordination and harmonization of environment statistics at the national, regional and international levels.

4.7.   When a country faces stringent resource constraints in developing a national environment statistics programme, or is at early stages in the development of environment statistics, the Core Set is well suited to provide guidance in determining priorities, scope, timing and periodicity in the production of such statistics, depending on national circumstances. It presents a comprehensive body of relevant environment statistics which can easily be tailored to suit specific national needs.

4.8.   The Core Set can also help in identifying data gaps in established national environment statistics programmes. Some countries may be in the position of having started environment statistics programmes in response to very specific event-driven imperatives. The use of the Core Set and the forthcoming methodological guidance for its compilation will allow them to build on such beginnings by adding or adjusting statistics based on an organized set of

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

4.9.   The Core Set provides guidance on statistics to include in a national environment statistics programme in order to be able to serve national and international policy-makers with the most necessary information on environmental issues of interest to countries, and those that go well beyond national boundaries. It incorporates the most pertinent statistics needed to report on global environmental conventions and MEAs and as such, its utilization in national statistical programmes will help improve reporting on these conventions and agreements.

4.10.   In conclusion, the Core Set together with the Basic Set of Environment Statistics can contribute to the gradual production and strengthening of environment statistics within countries, and thus enable and support the development, monitoring and assessment of evidence-based environmental policies. They can be instrumental when dealing with the growing demand for monitoring and reporting on the environment and sustainable development. The FDES as well as the Core and Basic Sets of Environment Statistics provide a flexible framework from which the necessary environment statistics to inform on a whole range of environmental issues can be identified and organized. While the Core Set and the Basic Set are not exhaustive, they are comprehensive enough given the state of current knowledge to respond both to existing, as well as to newly emerging issues.

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

4.11.   The development of the Core Set of Environment Statistics began in 2010 with a review of the UNSD List of Environmental Indicators, adopted by the UN Statistical Commission in 1995, and the list of environment statistics contained in the two technical reports which accompanied the 1984 FDES.[50,51] The process also involved an assessment of international data collection efforts, including major global or regional indicator initiatives. The selection of statistics also took into account pertinent data needed to respond to global environmental conventions and MEAs.

4.12.   A review of 2,575 environmental indicators and statistics was carried out during the process. Indicators and statistics from 37 sources and 65 lists/sets from international, regional and inter-governmental institutions, global environmental conventions, academia and NGOs were

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[50] Concepts and Methods of Environment Statistics: Human Settlement Statistics – A Technical Report, Studies in Methods, Series F, No. 51, United Nations publication, Sales No. E88.XVII.14. Available from http://unstats.un.org/unsd/publication/SeriesF/SeriesF_51E.pdf (accessed 21 December 2012).

[51] Concepts and Methods of Environment Statistics: Statistics of the Natural Environment – A Technical Report, Studies in Methods, Series F, No. 57, United Nations publication, Sales No. E91.XVII.18. Available from http://unstats.un.org/unsd/publication/SeriesF/SeriesF_57E.pdf (accessed 21 December 2012).

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

4.13. Based on the aforementioned analysis, statistics that focus on the most important environmental and associated economic and social activities, which can be used for analysis and reporting on the environment, were included in the Basic Set of Environment Statistics. The Basic Set does not constitute an exhaustive collection of environment statistics, but it does present a selection of about 500 statistics that are considered relevant, appropriate, adequate and important for describing and measuring the environment, and for responding to policy needs or public information requirements. All environment statistics which were identified for inclusion in the Basic Set were then grouped according to the FDES structure outlined in Chapter 3 consisting of components, sub-components and topics.

4.14. The contents of the Basic Set were then subjected to a pilot test that 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.

4.15. The main selection criteria of the Core Set of Environment Statistics (Tier 1) were relevance, measurability and methodological soundness, further elaborated as follows:
   i. Relevance: Core statistics should meet the needs of the broad variety 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.

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

- Tier 1 is the Core Set of Environment Statistics which 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.

4.3 Contents of the Core Set of Environment Statistics

4.17.   Table 4.1 below presents the Core Set which organizes the statistics by the components, sub-components and statistical topics of the FDES.

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.**

4.3.1 The Core Set of Environment Statistics

Table 4.1: The Core Set of Environment Statistics

Component	Sub-component	Topic		Core Set / Tier 1 Statistics	Category of Measurement
Component 1: Environmental Conditions and Quality	Sub-component 1.1: Physical Conditions	Topic 1.1.1: Atmosphere, climate and weather	a. Temperature	**1. Monthly averages**	Degrees
				2. Minimum monthly average	Degrees
				3. Maximum monthly average	Degrees
			b. Precipitation (also in 2.6.1.a)	**1. Annual averages**	Height
				2. Long-term annual averages	Height
		Topic 1.1.2: Hydrographical characteristics	d. Watersheds	**1. Description of main watersheds**	Area, Descriptive, Location
		Topic 1.1.3: Geological and geographical information	a. Geological, geographical and geomorphological conditions of terrestrial areas and islands	**2. Area of country or region**	Area
			b. Coastal area (includes area of coral reefs, mangroves, etc.) (also in 2.3.1.c)		Area, Descriptive
			c. Length of marine coastline		Length
		Topic 1.1.4: Soil characteristics	a. Soil characterization	**1. Area of soil types**	Area
			b. Degradation	**1. Area affected by soil erosion**	Area
				2. Area affected by desertification	Area
	Sub-component 1.2: Land Cover, Ecosystems and Biodiversity	Topic 1.2.1: Land cover	a. Extent and spatial distribution of main land cover categories	**1. Area of land cover**	Area
				2. Location of land cover	Location
		Topic 1.2.2: Ecosystems	a. General ecosystem characteristics, extent and pattern	**1. Area of ecosystems**	Area
			c. Biological components of ecosystems (also in 1.2.3.a-b)	**4. Threatened species**	Number
		Topic 1.2.3: Biodiversity	a. Flora - terrestrial, freshwater and marine (also in 1.2.2.c)	**1. Number of known species by status category**	Number
			b. Fauna - terrestrial, freshwater and marine (also in 1.2.2.c)	**1. Number of known species by status category**	Number
			c. Protected areas	**1. Protected terrestrial (including inland water) and marine area** (also in 1.2.4.a)	Area
		Topic 1.2.4: Forests	a. Forest area (also in 1.2.1.a and 1.2.2.a)	**1. Total**	Area
				5. Area deforested	Area
	Sub-component 1.3: Environmental Quality	Topic 1.3.1: Air quality	a. Breathable particles	**1. Concentration levels of particulate matter (PM$_{10}$)**	Concentration
				2. Concentration levels of particulate matter (PM$_{2.5}$)	Concentration
			b. Breathable gases	**1. Concentration levels of tropospheric ozone (O$_3$)**	Concentration
				2. Concentration levels of carbon monoxide (CO)	Concentration
			c. Ambient concentrations of other relevant pollutants	**1. Concentration levels of sulphur dioxide (SO$_2$)**	Concentration
				2. Concentration levels of nitrogen oxides (NO$_X$)	Concentration
		Topic 1.3.2: Freshwater quality	a. Nutrients and chlorophyll	**1. Concentration of nitrates in freshwater bodies**	Concentration
				2. Concentration of phosphates in freshwater bodies	Concentration
			b. Organic matter in freshwater bodies	**1. Biochemical oxygen demand (BOD) in freshwater bodies**	Concentration
			c. Pathogens	**1. Concentration of faecal coliforms in freshwater bodies**	Concentration
		Topic 1.3.3: Marine water quality	a. Nutrients and chlorophyll	**1. Concentration of nitrates in marine water bodies**	Concentration
				2. Concentration of phosphates in marine water bodies	Concentration
			b. Organic matter in marine water bodies	**1. Biochemical oxygen demand (BOD) in marine water bodies**	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: Environmental Resources and their Use	Sub-component 2.1: Non-energy Mineral Resources	Topic 2.1.1: Stocks and changes of non-energy mineral resources	a. Non-energy mineral resources	**1. Stocks of commercially recoverable resources**	Mass, Volume
				5. Extraction	Mass, Volume
	Sub-component 2.2: Energy Resources	Topic 2.2.1: Stocks and changes of mineral energy resources	a. Mineral energy resources	**1. Stocks of commercially recoverable resources**	Mass, Volume
				5. Extraction	Mass, Volume
				11. Imports of energy minerals	Currency, Mass, Volume
				12. Exports of energy minerals	Currency, Mass, Volume
		Topic 2.2.2: Production and use of energy from non-renewable and renewable sources	a. Production of energy from non-renewable and renewable sources	**1. Total**	Energy unit, Mass, Volume
				2. Non-renewable sources	Energy unit, Mass, Volume
				3. Renewable sources	Energy unit, Mass, Volume
			b. Production of energy	**1. Primary energy production**	Energy unit, Mass, Volume
				2. Secondary energy production	Energy unit, Mass, Volume
			c. Total consumption of energy		Energy unit, Mass, Volume
			d. Electric energy	**1. Electricity production**	Energy unit
				2. Installed capacities	Energy unit
	Sub-component 2.3: Land	Topic 2.3.1: Land use	**a. Land use area**		Area
			b. Area of inland water use		Area
			c. Coastal area (includes area of coral reefs, mangroves, etc.) (also in 1.1.3.b)		Area
			i. Land use change	**3. Change of land use category by origin and destination**	Area
	Sub-component 2.5: Biological Resources	Topic 2.5.1: Timber resources and their use	a. Timber resources	**1. Stocks of timber resources**	Volume
		Topic 2.5.2:Aquatic resources and their use	**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:	**1. Natural fertilizers (e.g., manure, compost, lime)**	Area, Mass, Volume
				2. Chemical fertilizers	Area, Mass, Volume
				3. Pesticides	Area, Mass, Volume
		Topic 2.5.4: Livestock	a. Livestock	**1. Number of live animals**	Number
	Sub-component 2.6: Water Resources	Topic 2.6.1: Water resources	a. Inflow of water to inland water resources	**1. Precipitation** (also in 1.1.1.b)	Volume
				2. Inflow from neighbouring territories	Volume
			b. Outflow of water from inland water resources	**1. Evapotranspiration**	Volume
		Topic 2.6.2: Abstraction, use and returns of water	**a. Total water abstraction**		Volume
			b. Water abstraction from surface water		Volume
			c. Water abstraction from groundwater	**1. From renewable groundwater resources**	Volume
				2. From non-renewable groundwater resources	Volume

Component	Sub-component	Topic		Core Set / Tier 1 Statistics	Category of Measurement
Component 3: Residuals	Sub-component 3.1: Emissions to Air	Topic 3.1.1: Emissions of greenhouse gases	a. Total emissions of direct greenhouse gases (GHGs), by gas:	**1. Carbon dioxide (CO$_2$)**	Mass
				2. Methane (CH$_4$)	Mass
				3. Nitrous oxide (N$_2$O)	Mass
			b. Total emissions of indirect greenhouse gases (GHGs), by gas:	**1. Sulphur dioxide (SO$_2$)**	Mass
				2. Nitrogen oxides (NO$_x$)	Mass
	Sub-component 3.2: Generation and Management of Wastewater	Topic 3.2.1: Generation and pollutant content of wastewater	**a. Volume of wastewater generated**		Volume
		Topic 3.2.2: Collection and treatment of wastewater	**a. Volume of wastewater collected**		Volume
			b. Volume of wastewater treated		Volume
		Topic 3.2.3: Discharge of wastewater to the environment	a. Wastewater discharge	**1. Total volume of wastewater discharged to the environment after treatment**	Volume
				2. Total volume of wastewater discharged to the environment without treatment	Volume
	Sub-component 3.3: Generation and Management of Waste	Topic 3.3.1: Generation of waste	**a. Amount of waste generated by economic activity**		Mass
			c. Generation of hazardous waste	**1. Amount of hazardous waste generated**	Mass
		Topic 3.3.2: Management of waste	a. Municipal waste	**1. Total municipal waste collected**	Mass
				2. Amount of municipal waste treated by type of treatment	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	Mass
				3. Number of hazardous waste treatment and disposal facilities	Number
			d. Amount of recycled waste		Mass
Component 4: Extreme Events and Disasters	Sub-component 4.1: Natural Extreme Events and Disasters	Topic 4.1.1: Occurrence of natural extreme events and disasters	a. Occurrence of natural extreme events and disasters:	**1. Type of natural disaster** (geophysical, meteorological, hydrological, climatological, biological)	Descriptive
				2. Location	Location
		Topic 4.1.2: Impact of natural extreme events and disasters	a. People affected by natural extreme events and disasters	**1. Number of people killed**	Number
			b. Economic loss due to natural extreme events and disasters (e.g., damage to buildings, transportation networks, loss of revenue for businesses, utility disruption, etc.)		Currency

Component	Sub-component	Topic	Core Set / Tier 1 Statistics		Category of Measurement
Component 5: Human Settlements and Environmental Health	Sub-component 5.1: Human Settlements	Topic 5.1.2: Access to water, sanitation and energy	**a. Population using an improved drinking water source**		Number
			b. Population using an improved sanitation facility		Number
			d. Population connected to wastewater collection		Number
			e. Population connected to wastewater treatment		Number
		Topic 5.1.5: Environmental concerns specific to urban settlements	**c. Number of private and public vehicles**		Number
	Sub-component 5.2: Environmental Health	Topic 5.2.2: Water-related diseases and conditions	a. Water-related diseases and conditions (e.g., diarrhoeal disease, gastroenteritis and water borne parasite infections):	**1. Incidence**	Number
				2. Prevalence	Number
				3. Mortality	Number
		Topic 5.2.3: Vector borne diseases	a. Vector borne diseases (e.g., malaria, dengue fever, yellow fever and Lyme disease):	**1. Incidence**	Number
				2. Prevalence	Number
				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	**1. List of regulated pollutants and description** (e.g., by year of adoption and maximum allowable levels)	Descriptive, Number
		Topic 6.2.3: Participation in MEAs and environmental conventions	a. Participation in MEAs and other global environmental conventions	**1. List and description (e.g., year of participation[a] of country) of MEAs and other global environmental conventions**	Descriptive, Number

(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.

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

5.1   The FDES is a framework which organizes the domain of environment statistics into six components which are further broken down into sub-components and statistical topics. The statistical topics in the FDES, and the underlying environment statistics in the Core Set of Environment Statistics and the Basic Set of Environment Statistics, can be combined and reorganized in different ways according to specific analytical needs and policy requirements. This is an inherent aspect of the design of the FDES as a flexible multi-purpose framework.

5.2   This chapter describes how to identify and organize FDES topics, and statistics from the Core Set of Environment Statistics and the Basic Set of Environment Statistics, necessary to inform on four selected cross-cutting issues: water, energy, climate change and agriculture. The chapter discusses these environmental issues and provides a detailed listing of the relevant corresponding individual environment statistics for each issue. Statistics related to these cross-cutting issues are certainly relevant from the regional and global perspectives, but the emphasis in this chapter is on the national level, as this is where most data collection will take place.

5.3   When compiling environment statistics on a particular cross-cutting issue, it is important to start by first understanding the scientific background, underlying processes and cause-effect relationships. It is also necessary to analyze and understand its relevance to the country and to particular sub-national areas, productive sectors and social groups, its national policy implications and commitments, as well as the institutional aspects and the international context. This comprehensive view will help the environmental statistician better adapt the FDES, the Core Set of Environment Statistics and the Basic Set of Environment Statistics to provide environment statistics that fit the needs of users.

5.4   The cross-cutting issues of water, energy, climate change and agriculture discussed in this chapter are examples and should be considered illustrative applications of selected cross-cutting issues. The FDES users might wish to develop other analyses of cross-cutting issues for specific purposes, according to national relevance and needs (e.g., sustainable management of natural resources,

or environmental impacts of specific activities such as tourism, transport, poverty, mining, manufacturing, etc.).

5.5   The statistics for describing the selected cross-cutting issues are organized based on a logical sequence of events that illustrate the relevant related processes. These sequences resemble the occurrence of events, according to the nature of the issue itself. In each case, the correspondence of these sequences with the FDES structure is described. Each application is presented both at the level of the statistical topics and at the level of individual statistics from the Core Set of Environment Statistics and the Basic Set of Environment Statistics.

5.1 Water

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

5.7   The quality of and access to potable water remains a critical public health issue, particularly in developing countries, though the issue is generally improving over recent decades. There are also increasing pressures on water supply from human consumption and agricultural practices. Efforts to restructure natural hydrological systems have provided benefits to the human sub-system but have also created new environmental issues. These issues are wide-ranging and include water-borne diseases, stress on ecosystems, loss of natural and human habitats, reduction of fish and aquatic plant productivity, waterlogging and salinization of soils, and conflicts between up- and downstream water users. In addition,

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[52] WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (JMP). Available from http://www.wssinfo.org/ (accessed 22 December 2012).

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 sustainable management of water resources, and the demand for related environment statistics, is increasing worldwide.

5.8   Water use and returns affect the environment in different ways. If water is abstracted faster than its natural replenishment, the resource can be depleted and even exhausted. Water abstraction itself affects the environment by decreasing, at least momentarily, the available water for other purposes including key ecological functions. Distribution losses also can cause inefficiency and require higher amounts to be extracted. When the water is used and then returned to the environment, quality and pollution become the major problems. Returns of water can either be treated or not, and to different extents, so when it is returned it has the potential to adversely affect the environment. Water temperature is also an important factor in returns to the environment for key ecological functions. There is also the problem of distribution and access to adequate drinking water and water for other uses such as small scale agriculture, particularly in rural areas of developing countries. Similar problems of access also occur with regard to sanitation facilities in developing countries.

5.9   Protecting the quality of freshwater is important for ecosystems, drinking water supply, food production and recreational water use. The main causes of water quality degradation include: elevated levels of salinity; suspended matter; nutrients (which can be positive for food production of aquatic resources in certain circumstances); toxins and odour compounds; pesticides and other contaminants; water temperature; dissolved oxygen and pH outside natural ranges; as well as radiological hazards.

5.10   In addition to quantity and quality of water supply, the distribution of this supply within countries is of key importance. When assessing distribution of total available water, it is necessary to take into account spatial and temporal considerations. Sub-national statistics must be used, as aggregated national statistics can be misleading, and sub-national statistics must be assessed in the context of the specific geographic location as challenges of equitable water distribution will vary dependent on location (e.g., rainforest versus desert).

Seasonality must also be taken into account as precipitation levels change over time and seasonal flooding occurs in certain areas.

5.11   International partners in water assessment and management include UN-Water, the UN inter-agency coordination mechanism for all freshwater-related issues, which has drinking water and sanitation among its key focus areas.[53] The UN has also issued water quantity, quality and sanitation MDGs, specifically target 7.a, indicator 7.5 (proportion of total water resources used) and target 7.c, indicators 7.8 (proportion of population using an improved drinking water source) and 7.9 (proportion of population using an improved sanitation facility). In addition, the UN has developed the IRWS in an effort to assist countries to establish and strengthen information systems for water as part of their integrated water resources management.[54] This publication was adopted by the UN Statistical Commission in 2010. With regard to environmental-economic water accounts, the SEEA-Water is also available.[55]

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

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[53]UN-Water. Available from http://www.unwater.org/ (accessed 25 November 2012).
[54] International Recommendations for Water Statistics. Available from
http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf (accessed 25 November 2012).
[55] System of Environmental-Economic Accounts for Water (SEEA-Water). Part I of SEEA-Water was adopted as an interim international statistical standard by the United Nations Statistical Commission (UNSC) in 2007. Available from
http://unstats.un.org/unsd/envaccounting/seeaw/seeawaterwebversion.pdf (accessed 25 November 2012).
[56] "The future we want." Paragraph 119, 2012. Available from
http://www.uncsd2012.org/content/documents/727The%20Future%20We%20Want%2019%20June%201230pm.pdf (accessed 26 November 2012).

Application of the FDES to water statistics

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

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

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

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

Component 1: Environmental Conditions and Quality
Sub-component 1.1: Physical Conditions
Topic 1.1.1 Atmosphere, climate and weather Topic 1.1.2 Hydrographical characteristics Topic 1.1.3 Geological and geographical information
Sub-component 1.2: Land Cover, Ecosystems and Biodiversity
Topic 1.2.1 Land cover Topic 1.2.2 Ecosystems (freshwater and marine) Topic 1.2.3 Biodiversity (freshwater and marine)
Sub-component 1.3: Environmental Quality
Topic 1.3.2 Freshwater quality Topic 1.3.3 Marine water quality

Component 2: Environmental Resources and their Use
Sub-component 2.3: Land
Topic 2.3.1 Land use (inland water, coastal area and EEZ)
Sub-component 2.5: Biological Resources
Topic 2.5.2 Aquatic resources and their use
Sub-component 2.6: Water Resources
Topic 2.6.1 Water resources Topic 2.6.2 Abstraction, use and returns of water

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

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

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

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

*Figure 5.2: Water and the environment in the Core Set and Basic Set of Environment
Statistics - environment statistics level*
(Bold Text – Core Set/Tier 1; Regular Text – Tier 2; *Italicized Text – Tier 3*)

Component 1: Environmental Conditions and Quality	
Sub-component 1.1: Physical Conditions	

Topic 1.1.1: Atmosphere climate and weather	1.1.1.b: Precipitation
	    1.1.1.b.1: Annual averages
	    1.1.1.b.2: Long-term annual averages
	    1.1.1.b.3: Monthly averages
	    1.1.1.b.4: 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 and La Niña events, when relevant
	    1.1.1.h.1: Occurrence
	    1.1.1.h.2: Location
	    1.1.1.h.3: Time period

Topic 1.1.2: Hydrographical characteristics	1.1.2.a: Lakes
	    1.1.2.a.1: Surface area
	    1.1.2.a.2: Location
	1.1.2.b: Rivers
	    1.1.2.b.1: Length
	    1.1.2.b.2: Location
	1.1.2.c: Reservoirs
	    1.1.2.c.1: Surface area
	    1.1.2.c.2: Location
	1.1.2.d: Watersheds
	    1.1.2.d.1: Description of main watersheds
	1.1.2.f: Groundwater
	    1.1.2.f.1: Aquifers
	1.1.2.g: Glaciers

Topic 1.1.3: Geological and geographical information	**1.1.3.b: Coastal area** (includes area of coral reefs, mangroves, etc.) (also in 2.3.1.c) **1.1.3.c: Length of marine coastline**
Sub-component 1.2: Land Cover, Ecosystems and Biodiversity	

Topic 1.2.1: Land cover	1.2.1.a: Extent and spatial distribution of main land cover categories
	    1.2.1.a.1: Area of land cover (e.g., mangrove, aquatic or regularly flooded; permanent snow and glaciers; inland water bodies; and coastal water bodies and inter-tidal areas)
	    1.2.1.a.2: Location of land cover

Topic 1.2.2: Ecosystems (freshwater and marine)	1.2.2.a: General ecosystem characteristics, extent and pattern
	    1.2.2.a.1: Area of ecosystems
	    1.2.2.a.2: Location within country
	    1.2.2.a.3: Proximity of relevant ecosystem to urban areas and cropland
	1.2.2.b: Ecosystems' chemical and physical characteristics
	    1.2.2.b.1: Nutrients
	    1.2.2.b.2: Carbon
	    1.2.2.b.3: Pollutants
	1.2.2.c: Biological components of ecosystems (also in 1.2.3.a-b)
	    1.2.2.c.1: Biota (flora and fauna)
	    1.2.2.c.2: Endemic species
	    1.2.2.c.3: Biodiversity (aggregated measure of diversity of flora and fauna)
	1.2.2.c.4: Threatened species

Topic 1.2.3: Biodiversity (freshwater and marine)	1.2.3.a: Flora - freshwater and marine (also in 1.2.2.c)
	    1.2.3.a.1: Number of known species by status category
	    1.2.3.a.2: Species population
	    1.2.3.a.3: Number of endemic species
	    1.2.3.a.4: Number of invasive alien species
	    1.2.3.a.5: Habitat fragmentation

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	1. 2.3.b: Fauna - freshwater and marine (also in 1.2.2.c) **1.2.3.b.1: Number of known species by status category** 1.2.3.b.2: Species population 1.2.3.b.3: Number of endemic species 1.2.3.b.4: Number of invasive alien species *1.2.3.b.5: Habitat fragmentation* 1.2.3.c: Protected areas **1.2.3.c.1: Protected terrestrial (including inland water) and marine area** (also in 1.2.4.a) 1.2.3.d: Protected species 1.2.3.d.1: Number of freshwater and marine protected flora species 1.2.3.d.2: Number of freshwater and marine protected fauna species 1.2.3.e: Other *1.2.3.e.1: Trade in wildlife and captive-bred species* (freshwater and marine)
Sub-component 1.3: Environmental Quality	
Topic 1.3.2: Freshwater quality	1.3.2.a: Nutrients and chlorophyll **1.3.2.a.1: Concentration of nitrates in freshwater bodies** **1.3.2.a.2: Concentration of phosphates in freshwater bodies** 1.3.2.a.3: Concentration of chlorophyll A in freshwater bodies 1.3.2.a.4: Maximum allowable levels 1.3.2.b: Organic matter in freshwater bodies **1.3.2.b.1: Biochemical oxygen demand (BOD) in freshwater bodies** 1.3.2.b.2: Chemical oxygen demand (COD) in freshwater bodies 1.3.2.b.3: Maximum allowable levels 1.3.2.c: Pathogens **1.3.2.c.1: Concentration of faecal coliforms in freshwater bodies** 1.3.2.c.2: Maximum allowable levels 1.3.2.d: Metals (e.g., mercury, lead, nickel, arsenic, cadmium) 1.3.2.d.1: Concentrations in the sediment and water 1.3.2.d.2: Concentrations in freshwater organisms 1.3.2.d.3: Maximum allowable levels 1.3.2.e: Organic contaminants (e.g., PCBs, DDT, pesticides, furans, dioxins, phenols and radioactive waste) 1.3.2.e.1: Concentrations in the sediment and water 1.3.2.e.2: Concentrations in freshwater organisms 1.3.2.e.3: Maximum allowable levels 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) in freshwater bodies 1.3.2.g: Plastic waste and other freshwater debris 1.3.2.g.1: Amount of plastic waste and other debris in freshwater
Topic 1.3.3: Marine water quality	1.3.3.a: Nutrients and chlorophyll **1.3.3.a.1: Concentration of nitrates in marine water bodies** **1.3.3.a.2: Concentration of phosphates in marine water bodies** 1.3.3.a.3: Concentration of chlorophyll A in marine water bodies 1.3.3.a.4: Maximum allowable levels 1.3.3.b: Organic matter in marine water bodies **1.3.3.b.1: Biochemical oxygen demand (BOD) in marine water bodies** 1.3.3.b.2: Chemical oxygen demand (COD) in marine water bodies 1.3.3.b.3: Maximum allowable levels 1.3.3.c: Pathogens 1.3.3.c.1: Concentration of faecal coliforms in marine water bodies 1.3.3.c.2: Maximum allowable levels 1.3.3.d: Metals (e.g., mercury, lead, nickel, arsenic, cadmium) 1.3.3.d.1: Concentrations in the sediment and water 1.3.3.d.2: Concentrations in marine organisms 1.3.3.d.3: Maximum allowable levels 1.3.3.e: Organic contaminants (e.g., PCBs, DDT, pesticides, furans, dioxins, phenols and radioactive waste) *1.3.3.e.1: Concentrations in the sediment and water* *1.3.3.e.2: Concentrations in marine organisms* *1.3.3.e.3: Maximum allowable levels*

	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) in marine water bodies
	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
	1.4.3.i: Red tide
	1.4.3.i.1: Occurrence
	1.4.3.i.2: Impacted Area
	1.4.3.i.3: Location
	1.4.3.i.4: Duration
	1.4.3.j: Oil pollution
	1.4.3.j.1: Area of oil slicks
	1.4.3.j.2: Amount of tar balls

Component 2: Environmental Resources and their Use

Sub-component 2.3: Land

Topic 2.3.1: Land use	**2.3.1.b: Area of inland water use**

Sub-component 2.5: Biological Resources

Topic 2.5.2: Aquatic resources and their use	**2.5.2.a: Fish capture production**
	2.5.2.b: Aquaculture production
	2.5.2.c: Imports of fish and fishery products
	2.5.2.d: Exports of fish and fishery products
	2.5.2.e: Amount used of**:**
	2.5.2.e.1: Pellets
	2.5.2.e.2: Hormones
	2.5.2.e.3: Colourants
	2.5.2.e.4: Antibiotics
	2.5.2.e.5: Fungicides
	2.5.2.f: Fish resources (natural; cultivated**)**
	2.5.2.f.1: Stocks of fish resources
	2.5.2.f.2: Additions to fish resources
	2.5.2.f.3: Reductions in fish resources

Sub-component 2.6: Water Resources

Topic 2.6.1: Water resources	2.6.1.a: Inflow of water to inland water resources
	2.6.1.a.1: Precipitation (also in 1.1.1.b)
	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
	2.6.1.c.7: Water rights
Topic 2.6.2: Abstraction, use and returns of water	**2.6.2.a: Total water abstraction**
	2.6.2.b: Water abstraction from surface water
	2.6.2.c: Water abstraction from groundwater
	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 in distribution
	2.6.2.l: 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: Generation and pollutant content of wastewater	**3.2.1.a: Volume of wastewater generated** 3.2.1.b: Emissions of pollutants to wastewater

Topic 3.2.2: Collection and treatment of wastewater	**3.2.2.a: Volume of wastewater collected**
	3.2.2.b: Volume of wastewater treated
	3.2.2.c: Total urban wastewater treatment capacity
	        3.2.2.c.1: Number of plants
	        3.2.2.c.2: Capacity of plants
	3.2.2.d: Total industrial wastewater treatment capacity
	        3.2.2.d.1: Number of plants
	        3.2.2.d.2: Capacity of plants

Topic 3.2.3: Discharge of wastewater to the environment	3.2.3.a: Wastewater discharge
	    3.2.3.a.1: Total volume of wastewater discharged to the environment after treatment
	    3.2.3.a.2: Total volume of wastewater discharged to the environment without treatment
	3.2.3.b: Pollutant content of discharged wastewater

Component 4: Extreme Events and Disasters

Sub-component 4.1: Natural Extreme Events and Disasters

Topic 4.1.1: Occurrence of natural extreme events and disasters (droughts and floods)	4.1.1.a: Occurrence of natural extreme events and disasters (droughts and floods):
	    4.1.1.a.1: Type of natural disaster
	    4.1.1.a.2: Location
	    4.1.1.a.3: Magnitude (where applicable)
	    4.1.1.a.4: Date of occurrence
	    4.1.1.a.5: Duration (in days)
	    4.1.1.a.6: Hazard prone areas
	    4.1.1.a.7: Population living in hazard prone areas

Topic 4.1.2: Impact of natural extreme events and disasters (droughts and floods)	4.1.2.a: People affected by natural extreme events and disasters (droughts and floods)
	    4.1.2.a.1: Number of people killed
	    4.1.2.a.2: Number of people injured
	    4.1.2.a.3: Number of people homeless
	    4.1.2.a.4: Number of people affected
	4.1.2.b: Economic loss due to natural extreme events and disasters (droughts and floods)
	4.1.2.c: Physical loss/damage 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: Effect on watershed area
	    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: Occurrence of technological	4.2.1.a: Occurrence of technological disaster (only affecting marine and freshwater bodies)
	    4.2.1.a.1: Type of disaster
	    4.2.1.a.2: Location

disasters (only affecting marine and freshwater bodies)	*4.2.1.a.3: Date of occurrence* *4.2.1.a.4: Duration* (in days)

Topic 4.2.2: Impact of technological disasters (only affecting marine and freshwater bodies)	4.2.2.a: People affected by technological disasters (only affecting marine and freshwater bodies)
	    4.2.2.a.1: Number of people killed
	    4.2.2.a.2: Number of people injured
	    4.2.2.a.3: Number of people homeless
	    4.2.2.a.4: Number of people affected
	4.2.2.b: Economic loss due to technological disasters (only affecting marine and freshwater bodies)
	4.2.2.c: Physical loss/damage due to technological disasters (only affecting marine and freshwater bodies) (droughts and floods)
	4.2.2.d: Effects of technological disasters on integrity of ecosystems (only affecting marine and freshwater 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

Component 5: Human Settlements and Environmental Health

Sub-component 5.1: Human Settlements	
Topic 5.1.2: Access to water, sanitation and energy	**5.1.2.a: Population using an improved drinking water source** **5.1.2.b: Population using an improved sanitation facility** **5.1.2.d: Population connected to wastewater collection** **5.1.2.e: Population connected to wastewater treatment** 5.1.2.f: Population served by water supply industry
Sub-component 5.2: Environmental Health	

Topic 5.2.2: Water-related diseases and conditions	5.2.2.a: Water-related diseases and conditions (e.g., diarrhoeal disease, gastroenteritis and water borne parasite infections)
	    5.2.2.a.1: Incidence
	    5.2.2.a.2: Prevalence
	    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

Component 6: Environment Protection, Management and Engagement

Sub-component 6.1: Environment Protection and Resource Management Expenditure	

Topic 6.1.1: Government environment protection and resource management expenditure (see Note)	6.1.1.a: Government environment protection and resource management expenditure
	    6.1.1.a.1: Annual government environment protection expenditure (on water)
	    6.1.1.a.2: Annual government resource management expenditure (on water)
	
	Note –
	
	    For environment protection expenditure include:
	      ▪ Wastewater management
	      ▪ Waste management (disposal at sea)
	      ▪ Protection and remediation of soil, groundwater and surface water
	      ▪ Protection of biodiversity and landscape
	      ▪ Research and development – water protection related.
	    For resource management expenditure include:
	      ▪ Management of aquatic resources
	      ▪ Management of water resources
	      ▪ Research and development – water resources

Sub-component 6.2: Environmental Governance and Regulation	

Topic 6.2.1: Institutional strength (only	6.2.1.a: Environmental institutions and their resources
	    6.2.1.a.1: Name of the main environmental (water) authority/agency and year of establishment
	    6.2.1.a.2: Annual budget of main environmental (water) authority/agency

institutions directly regulating and managing water)	6.2.1.a.3: Number of staff of main environmental (water) authority/agency 6.2.1.a.4: List of environmental (water) departments in other ministries/agencies and year of establishment 6.2.1.a.5: Annual budget of environmental (water) departments in other ministries/agencies 6.2.1.a.6: Number of staff of environmental (water) departments in other ministries/agencies

Topic 6.2.2: Environmental regulation and instruments (regulating, managing and affecting water only)	6.2.2.a: Direct regulation
	    6.2.2.a.1: List of regulated water pollutants and description (e.g., by year of adoption and maximum allowable levels)
	    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 (water-related) taxes
	    6.2.2.b.2: List and description (e.g., year of establishment) of environmentally relevant subsidies (relevant to water)
	    6.2.2.b.3: List of (water) eco-labelling and environmental certification programmes
	    6.2.2.b.4: Emission permits traded

Topic 6.2.3: Participation in MEAs and environmental conventions (regulating, managing and affecting water only)	6.2.3.a: Participation in MEAs and other global environmental conventions **6.2.3.a.1: List and description (e.g., year of participation[a] of country) of MEAs and other global environmental conventions regulating, managing and affecting water**
Sub-component 6.3: Extreme Event Preparedness and Disaster Management	

Topic 6.3.1: Preparedness for extreme events and natural disasters	6.3.1.a: National natural extreme events and disaster preparedness and management systems
	    6.3.1.a.1: Existence of national disaster plans/programmes (related to flooding)
	    6.3.1.a.2: Description of national disaster plans/programmes (related to flooding)

(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.	

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

Water Resources	
Sub-component 1.1: Physical Conditions	**Sub-component 2.6: Water Resources**
1.1.2.a-d & f-g Hydrographical characteristics of lakes, rivers, reservoirs, watersheds, groundwater and glaciers	2.6.1.a-c Inflow, outflow and stocks of inland water resources

Water Use and Management		
Sub-component 2.6: Water Resources	**Sub-component 3.2: Generation and Management of Wastewater**	**Sub-component 5.1: Human Settlements**
2.6.2.a-n Abstraction, use and returns of water	3.2.1.a Volume of wastewater generated 3.2.2.a-d Collection and treatment of wastewater	5.1.2.a Population using an improved drinking water source 5.1.2.b Population using an improved sanitation facility 5.1.2.f Population served by water supply industry

Environmental Effects		
Sub-comp. 1.3: Environmental Quality	**Sub-comp. 2.6: Water Resources**	**Sub-comp. 3.2: Generation and Management of Wastewater**
1.3.2.a-g Freshwater quality	2.6.1.c Inland water stocks	3.2.1.b Emissions of pollutants to wastewater 3.2.3.a-b Wastewater discharge and pollutant content of discharged wastewater

Protection and Mitigation Activities	
Sub-component 6.1: Environment Protection and Resource Management Expenditure	**Sub-component 6.2: Environmental Governance and Regulation**
6.1.1.a Government environment protection and resource management expenditure (water related) 6.1.2.a Private sector environment protection and resource management expenditure (water related)	6.2.2.a Direct regulation (water related)

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

Water Resources
Sub-component 1.1: Physical Conditions
1.1.2.a: Lakes
1.1.2.a.1: Surface area
1.1.2.a.2: Location
1.1.2.b: Rivers
1.1.2.b.1: Length
1.1.2.b.2: Location
1.1.2.c: Reservoirs
1.1.2.c.1: Surface area
1.1.2.c.2: Location
1.1.2.d: Watersheds
1.1.2.d.1: Description of main watersheds
1.1.2.f: Groundwater
1.1.2.f.1: Aquifers
1.1.2.g: Glaciers
Sub-component 2.6: Water Resources
2.6.1.a: Inflow of water to inland water resources
2.6.1.a.1: Precipitation
2.6.1.a.2: Inflow from neighbouring territories
2.6.1.a.3: Inflow subject to treaties
2.6.1.b: Outflow 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
2.5.1.c.2: Surface water stocks in lakes
2.5.1.c.3: Surface water stocks in rivers and streams
2.5.1.c.4: Surface water stocks in wetlands
2.5.1.c.5: Surface water stocks in snow, ice and glaciers
2.5.1.c.6: Groundwater stocks
2.5.1.c.7: Water rights

Water Use and Management
Sub-component 2.6: Water Resources
2.6.2.a: Total water abstraction
2.6.2.b: Water abstraction from surface water
2.6.2.c: Water abstraction from groundwater
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 in distribution
2.6.2.l: 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
3.2.1.a: Volume of wastewater generated
3.2.1.b: Emissions of pollutants to wastewater
3.2.2.b: Volume of wastewater treated

3.2.2.c: Total urban wastewater treatment capacity
3.2.2.c.1: Number of plants
3.2.2.c.2: Capacity of plants

Sub-component 5.1: Human Settlements
5.1.2.a: Population using an improved drinking water source
5.1.2.b: Population using an improved sanitation facility
5.1.2.d: Population connected to wastewater collection
5.1.2.e: Population connected to wastewater treatment
5.1.2.f: Population served by water supply industry

Environmental Effects

Sub-component 1.3: Environmental Quality
1.3.2.a: Nutrients and chlorophyll
1.3.2.a.1: Concentration of nitrates in freshwater bodies
1.3.2.a.2: Concentration of phosphates in freshwater bodies
1.3.2.a.3: Concentration of chlorophyll A in freshwater bodies
1.3.2.a.4: Maximum allowable levels
1.3.2.b: Organic matter in freshwater bodies
1.3.2.b.1: Biochemical oxygen demand (BOD) in freshwater bodies
1.3.2.b.2: Chemical oxygen demand (COD) in freshwater bodies
1.3.2.b.3: Maximum allowable levels
1.3.2.c: Pathogens
1.3.2.c.1: Concentration of faecal coliforms in freshwater bodies
1.3.2.c.2: Maximum allowable levels
1.3.2.d: Metals (e.g., mercury, lead, nickel, arsenic, cadmium)
1.3.2.d.1: Concentrations in the sediment and water
1.3.2.d.2: Concentrations in freshwater organisms
1.3.2.d.3: Maximum allowable levels
1.3.2.e: Organic contaminants (e.g., PCBs, DDT, pesticides, furans, dioxins, phenols and radioactive waste)
1.3.2.e.1: Concentrations in the sediment and water
1.3.2.e.2: Concentrations in freshwater organisms
1.3.2.e.3: Maximum allowable levels
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) in freshwater bodies
1.3.2.g: Plastic waste and other freshwater debris
1.3.2.g.1: Amount of plastic waste and other debris in freshwater

Sub-component 2.6: Water Resources
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
2.6.1.c.7: Water rights

Sub-component 3.2: Generation and Management of Wastewater
3.2.1.b: Emission of pollutants to wastewater
3.2.3.a: Wastewater discharge
3.2.3.a.1: Total volume of wastewater discharged to the environment after treatment
3.2.3.a.2: Total volume of wastewater discharged to the environment without treatment
3.2.3.b: Pollutant content of discharged wastewater

Protection and Mitigation Activities
Sub-component 6.1: Environment Protection and Resource Management Expenditure
6.1.1.a: Government environment protection and resource management expenditure
6.1.1.a.1: Annual government environment protection expenditure (on water)
6.1.1.a.2: Annual government resource management expenditure (on water)
6.1.2.a: Private sector environment protection and resource management expenditure
6.1.2.a.1: Annual corporate environment protection expenditure (on water)
6.1.2.a.2: Annual corporate resource management expenditure (on water)
6.1.2.a.3: Annual non-profit institution environment protection expenditure (on water)
6.1.2.a.4: Annual non-profit institution resource management expenditure (on water)
6.1.2.a.5: Annual household environment protection expenditure (on water)
6.1.2.a.6: Annual household resource management expenditure (on water)
Sub-component 6.2: Environmental Governance and Regulation
6.2.2.a: Direct regulation
6.2.2.a.1: List of regulated pollutants and description (related to water)
6.2.2.a.2: Description of licensing system to ensure compliance with environmental standards for businesses or other new facilities (water related)
6.2.2.a.3: Number of applications for licenses (compliance with water standards) received and approved per year
6.2.2.a.5: Budget and number of staff dedicated to enforcement of environmental regulations (water related)

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

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

5.2 Energy

5.17   Energy 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   Energy production and consumption affects the environment in different ways. The first issue relates to depletion of non-renewable energy resources, for as mineral energy resources are extracted, depletion occurs. In addition, extraction of mineral energy resources involves mining operations which disturb ecosystems, restructure the land, remove soil and water, and produce wastes. Extraction techniques also result in the removal of large areas of surface vegetation, deep-well drilling and the use of heavy equipment for exploratory wells on land and off-shore oil rigs for exploration of ocean geology. The sheer quantity in the output of coal and the complex infrastructure required in oil and gas development have created large-scale environmental disturbances through the construction of pipelines, railways and large-scale terminal shipping facilities. This situation is further exacerbated by hazards of oil spills, well-head and pipeline explosion and fires, as well as the chemical pollution of the associated petrochemical industry.

5.19   The consumption of mineral energy resources also affects the environment. It is estimated that fossil fuels represented 81 percent of the total primary energy demand in 2010.[57] Combustion of fossil fuels pollutes the air, affects human health, and results in significant GHG emissions. Renewable energy does not face the depletion problem of mineral energy resources, but the harvesting of renewable energy can also affect the natural environment, particularly in large hydro energy facilities. Regardless of how energy is produced, its distribution requires facilities which can also change the land and affect natural areas. Each country must construct public policies to lead the required changes in their energy

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[57] International Energy Agency, *World Energy Outlook 2012*. Available from http://www.oecd-ilibrary.org/energy/world-energy-outlook-2012_weo-2012-en (accessed 24 January 2013).

production and consumption in order to meet the demands of development in a sustainable and clean manner.

5.20   Energy plays a critical role in socio-economic development. The outcome document of the Rio+20 United Nations Conference on Sustainable Development, "The future we want", addressed energy within the context of sustainable development.[58] Among other things, it called for action to ensure "access to sustainable modern energy services for all". It also reaffirmed support for cleaner energy technologies, citing "increased use of renewable energy sources and other low-emission technologies", "more efficient use of energy" and "greater reliance on advanced energy technologies" as parts of an appropriate energy mix for meeting developmental needs. This document urged governments to create enabling environments for investment in cleaner energy technologies. The core challenge facing policy makers in regards to energy production and consumption remains in balancing the demand and need for energy with the impacts from its production and consumption. There is therefore great need for coordination and harmonization over all levels, as data are needed for policy, regulation, science and to complement the economic and social aspects when doing analysis.

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

Application of the FDES to energy statistics

5.22   In the figures below, those aspects of energy statistics which are related to environment statistics using the FDES are described. The figures have been constructed to reflect the process from energy resources through their extraction,

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[58] "The future we want." Paragraph 125-129, 2012. Available from http://www.uncsd2012.org/content/documents/727The%20Future%20We%20Want%2019%20June%201230pm.pdf (accessed 22 October 2012).
[59] UNSD, *International Recommendations for Energy Statistics*. Available from http://unstats.un.org/unsd/energy/ires/default.htm (accessed 10 November 2012).

the production and consumption of energy and their environmental effects, to protection and mitigation activities.

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

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

Energy Resources

Sub-component 2.2: Energy Resources

2.2.1.a
Stocks and changes of mineral energy resources

Energy Production and Consumption

Sub-component 2.2: Energy Resources

2.2.2.a-d
Production and consumption of energy from non-renewable and renewable sources

Environmental Effects

Sub-comp. 1.3: Environmental Quality	Sub-comp. 2.3: Land	Sub-comp. 3.1: Emissions to Air	Sub-comp. 3.2: Generation and Management of Wastewater	Sub-comp. 3.3: Generation and Management of Waste	Sub-comp. 4.2: Technological Disasters	Sub-comp. 5.1: Human Settlements	Sub-comp. 5.2: Environmental Health
1.3.1.a-b Breathable particles and gases 1.3.1.c Ambient concentrations of other relevant pollutants 1.3.1.d Global atmospheric concentrations of climate process drivers	2.3.1.i Land use change	3.1.1.a-b Total emissions of direct and indirect greenhouse gases 3.1.3.a. Emissions of other substances	3.2.1.a Volume of wastewater generated 3.2.1.b Emissions of pollutants to wastewater	3.3.1a-c Generation of waste (related to energy production and consumption)	4.2.1 Occurrence of technological disasters 4.2.2 Impact of technological disasters	5.1.4 Exposure to ambient pollution related to spatial location of population	5.2.1 Airborne diseases and conditions 5.2.5 Toxic substance- and radiation-related diseases and conditions

Protection and Mitigation Activities

Sub-component 6.1: Environment Protection and Resource Management Expenditure	Sub-component 6.2: Environmental Governance and Regulation	Sub-component 6.3: Extreme Event Preparedness and Disaster Management
6.1.1.a Government environment protection and resource management expenditure 6.1.2.a Private sector environment protection and resource management expenditure	6.2.2.a Direct regulation 6.2.2.b Economic instruments	6.3.2 Preparedness for technological disasters

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
2.2.1.a: Mineral energy resources
2.2.1.a.1: Stocks of commercially recoverable resources
2.2.1.a.2: New discoveries
2.2.1.a.3: Upward reappraisals
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
2.2.1.a.11: Imports of energy minerals
2.2.1.a.12: Exports of energy minerals

Energy Production and Consumption
Sub-component 2.2: Energy Resources
2.2.2.a: Production of energy from non-renewable and renewable sources
2.2.2.a.1: Total
2.2.2.a.2: Non-renewable sources
2.2.2.a.3: Renewable sources
2.2.2.b: Production of energy
2.2.2.b.1: Primary energy production
2.2.2.b.2: Secondary energy production
2.2.2.c: Total consumption of energy
2.2.2.d.: Electric energy
2.2.2.d.1: Electricity production
2.2.2.d.2: Installed capacities

Environmental Effects
Sub-component 1.3: Environmental Quality
1.3.1.a: Breathable particles
1.3.1.a.1: Concentration levels of particulate matter (PM$_{10}$)
1.3.1.a.2: Concentration levels of particulate matter (PM$_{2.5}$)
1.3.1.a.3: Maximum allowable levels
1.3.1.a.4: Number of days where maximum allowable levels were surpassed per year
1.3.1.b: Breathable gases
1.3.1.b.1: Concentration levels of tropospheric ozone (O$_3$)
1.3.1.b.2: Concentration levels of carbon monoxide (CO)
1.3.1.b.3: Maximum allowable levels
1.3.1.b.4: Number of days where maximum allowable levels were surpassed per year
1.3.1.c: Ambient concentrations of other relevant pollutants
1.3.1.c.1: Concentration levels of sulphur dioxide (SO$_2$)
1.3.1.c.2: Concentration levels of nitrogen oxides (NO$_X$)
1.3.1.c.3: Concentration levels of heavy metals
1.3.1.c.4: Concentration levels of non-methane volatile organic compounds (NMVOCs)
1.3.1.c.5: Concentration levels of dioxins
1.3.1.c.6: Concentration levels of furans
1.3.1.c.7: Other pollutants (related to energy production and consumption)
1.3.1.c.8: Maximum allowable levels
1.3.1.c.9: Number of days where maximum allowable levels were surpassed per year
1.3.1.d: Global atmospheric concentrations of climate process drivers
1.3.1.d.1: Global atmospheric concentration levels of carbon dioxide (CO$_2$)

1.3.1.d.2: Global atmospheric concentration levels of methane (CH_4)	

Sub-component 2.3: Land
2.3.1.a: Land use (related to energy production and consumption)
2.3.1.i.1: Increase of area within category
2.3.1.i.2: Decrease of area within category
2.3.1.i.3: Change of land use category by origin and destination
Sub-component 3.1: Emissions to Air
3.1.1.a: Total emissions of direct greenhouse gases (GHGs), by gas:
3.1.1.a.1: Carbon dioxide (CO_2)
3.1.1.a.2: Methane (CH_4)
3.1.1.a.3: Nitrous oxides (N_2O)
3.1.1.a.4: Perfluorocarbons (PFCs)
3.1.1.a.5: Hydrofluorocarbons (HFCs)
3.1.1.a.6: Sulphur hexafluoride (SF_6)
3.1.1.b: Total emissions of indirect greenhouse gases (GHGs), by gas:
3.1.1.b.1: Sulphur dioxide (SO_2)
3.1.1.b.2: Nitrogen oxides (NO_x)
3.1.1.b.3: Non-methane volatile organic compounds (NM-VOCs)
3.1.1.b.4: Other
3.1.3.a: Emissions of other substances
3.1.3.a.1: Particulate matter (PM)
3.1.3.a.2: Heavy metals
3.1.3.a.3: Other
Sub-component 3.2: Generation and Management of Wastewater
3.2.1.a: Volume of wastewater generated (related to energy production and consumption)
3.2.1.b: Emissions of pollutants to wastewater (related to energy production and consumption)
Sub-component 3.3: Generation and Management of Waste
3.3.1.a: Amount of waste generated by economic activity (related to energy production and consumption)
3.3.1.c: Generation of hazardous waste (related to energy production and consumption)
3.3.1.c.1: Amount of hazardous waste generated
Sub-component 4.2: Technological Disasters
4.2.1.a: Occurrence of technological disasters (related to energy production and consumption)
4.2.1.a.1: Type of technological disaster
4.2.1.a.2: Location
4.2.1.a.3: Date of occurrence
4.2.1.a.4: Duration
4.2.2.a: People affected by technological disasters (related to energy production and consumption)
4.2.2.a.1: Number of people killed
4.2.2.a.2: Number of people injured
4.2.2.a.3: Number of people homeless
4.2.2.a.4: Number of people affected
4.2.2.b: Economic loss due to technological disasters (related to energy production and consumption)
4.2.2.c: Physical loss/damage 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
5.1.4.a: Population exposed to air pollution in main cities
Sub-component 5.2: Environmental Health
5.2.1.a: Airborne diseases and conditions (related to energy production and consumption)
5.2.1.a.1: Incidence
5.2.1.a.2: Prevalence
5.2.1.a.3: Loss of work days
5.2.1.a.4: Estimates of economic cost in monetary terms
5.2.5.a: Toxic substance- and nuclear radiation-related diseases and conditions (related to energy production and consumption)
5.2.5.a.1: Incidence

5.2.5.a.2: Prevalence
5.2.5.a.3: Loss of work days
5.2.5.a.4: Estimates of economic cost in monetary terms

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

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

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

5.3 Climate Change

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

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

5.27   The Rio+20 United Nations Conference on Sustainable Development reaffirmed the pre-eminence of climate change, expressing alarm about the rise of GHG globally. In its outcome document, it called for cooperative action to coordinate effective international response to this challenge to ensure reduction of the emission of GHG. It noted that countries already experience adverse impacts of climate change such as persistent drought, extreme weather events, sea-level rise and threats to food security. In this regard, the Conference indicated adaptation to climate change to be an "urgent global priority"[62].

5.28   Climate change occurs through a chain of events and can be observable at all levels, from local to global. The first step is increasing emissions of CO_2 that are produced by current production patterns and a heavy dependence on fossil fuels for energy and transportation. These persistently high emissions lead to high

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[60] United Nations Framework Convention on Climate Change, Essential Background. Available from
http://unfccc.int/essential_background/items/6031.php (accessed 15 September 2012).
[61] The global energy balance is defined by the Oxford Dictionary of Geography as the difference between the total influx of solar radiation to the earth's surface and the loss of this energy via terrestrial radiation, evaporation, and the dissipation of sensible heat into the ground
[62] "The future we want." Paragraph 190, 2012. Available from
http://www.uncsd2012.org/content/documents/727The%20Future%20We%20Want%2019%20June%201230pm.pdf (accessed 22 October 2012).

atmospheric CO_2 concentrations, which in turn prevent heat from escaping the Earth and change the climate. The evidence of global warming and climate change include increased global temperatures, changing weather patterns, and rising sea levels, to name just a few. Impacts from climate change include, among many others, more intense storms, changes in agricultural productivity, water scarcity and coral bleaching. Mitigation and adaptation processes are another important part of the sequence of climate change, because ecosystems and humans continue to adapt to changes in the climate. This sequence of events is currently occurring and is expected to continue unless the global concentrations of CO_2 diminish considerably to pre-climate change levels.

5.29   To cite a few recent observations, 2008 CO_2 emissions were 38 percent above the 1990 level. Per capita emissions remain highest in the developed regions, 11.2 metric tons of CO_2 per person per year in 2008, compared to about 2.9 metric tons in the developing regions and 0.8 metric tons in sub-Saharan Africa, the lowest regional value.[63] Since the beginning of civilization up until about 200 years ago, our atmosphere contained around 275 parts per million of CO_2. As of May 2012, there were 396 parts per million of CO_2 in the atmosphere.[64] Many scientists, climate change experts and national governments agree that the safe upper limit for humanity is 350 parts per million.

5.30   The impacts and risks associated with climate change are real and are already evident in many systems and sectors essential for human livelihood, including water resources, food security, coastal zones and health. In addition, climate change is increasing the frequency and intensity of extreme events and disasters. Adaptation to the adverse effects of climate change is vital in order to reduce future impacts. In this context, there is an urgent need for an integrated policy response to the climate change and development challenge.

5.31   Climate adaptation has been identified by the UNFCCC as one of the key building blocks for a coordinated response to climate change. The IPCC describes adaptation as an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits

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[63] United Nations, *The Millennium Development Goals Report 2012*. Available from http://www.un.org/millenniumgoals/pdf/MDG%20Report%202012.pdf (accessed 12 October 2012).
[64] Mauna Loa Observatory, US National Oceanic and Atmospheric Administration, *Monthly Mean Concentrations at the Mauna Loa Observatory (PPM)*, 5 June 2012 release date. Available at http://co2now.org/images/stories/data/co2-mlo-monthly-noaa-esrl.xls (accessed 7 October 2012).

beneficial opportunities.[65] 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

5.32   Necessarily, a scientific approach to climate change must be supported with the provision of well structured, relevant, reliable and timely statistics. At the same time, the need for underlying data to inform the policy aspects of climate change also remains a pressing requirement. As a cross-cutting issue, climate change statistics are spread over a large proportion of the domain of environment statistics.

5.33   The information required to analyze climate change includes economic, social and environmental aspects. The FDES provides a set of environmental topics and individual environment statistics that are of the most importance when informing on climate change in any given country. These statistics should be complemented with both social and economic statistics to provide a comprehensive set of information.

5.34   With regard to determining and apportioning the appropriate statistics for measurement of climate change, consideration of a sequence of changes is important. The IPCC has elaborated on the sequence of events described in the preceding paragraphs and usually denotes these stages by Climate Process Drivers, Climate Change Evidence, Impacts and Vulnerability, Mitigation and Adaptation (see *Figure 5.7*). Statistics pertaining to the different steps of the

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[65] IPCC Fourth Assessment Report: Climate Change 2007. Available from
http://www.ipcc.ch/publications_and_data/ar4/wg2/en/tssts-5.html#ts-5-1 (accessed 10 October 2012).

sequence are necessary to monitor climate change and how it is affecting different countries and regions.

Figure 5.7: Schematic framework representing anthropogenic drivers, impacts of and responses to climate change, and their linkages[66]
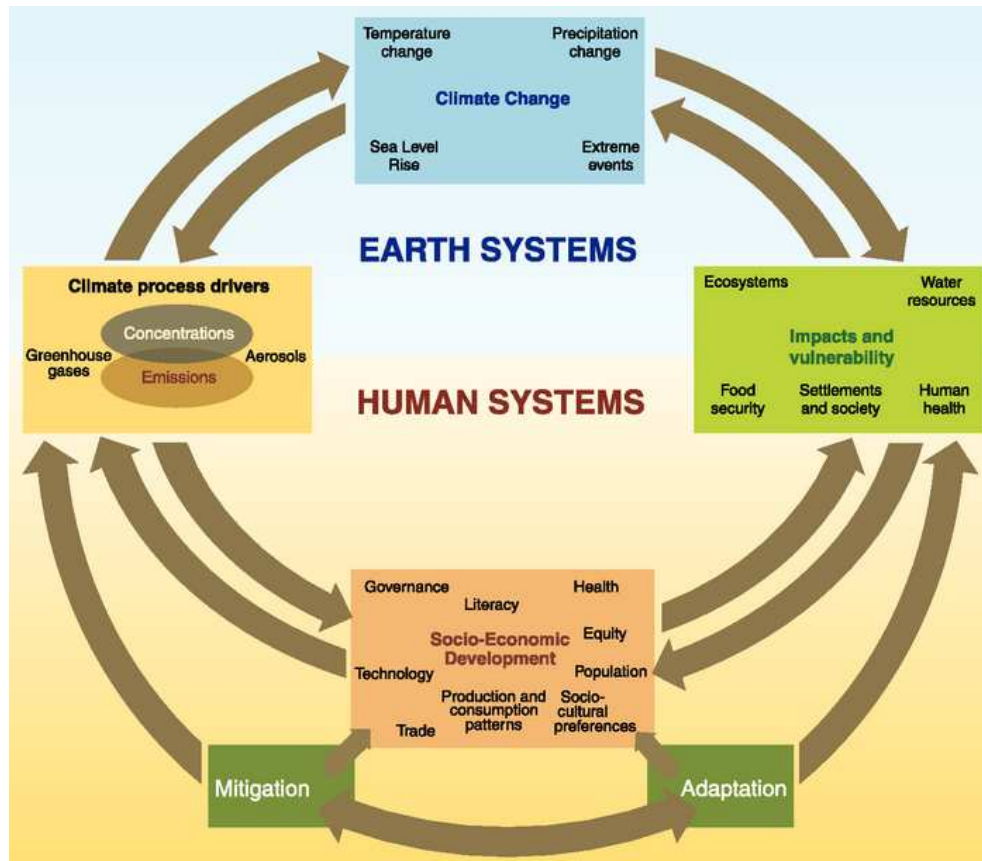
5.35 The structure of the figures in this cross-cutting issue aligns with the IPCC described sequence with one modification - under "Socio-Economic Development" the focus has been put on only those elements that belong to the realm of environment statistics.

5.36 At present, the availability of statistics varies among the stages in the sequence. Data on drivers of climate change, climate change evidence, as well as impacts and mitigation activities are all fairly developed, though impacts from climate change are more difficult to measure because changes in the climate are not the

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

only possible force to which the effects can be attributed. Despite their importance, vulnerability and adaptation statistics are still in a developmental stage. Considerable statistical progress is expected and needed in these two areas in the upcoming years.

5.37   When compiling statistics on climate change at the national level, it is important to assess relevance and policy and legal aspects in the particular country. The relevance of climate change varies by country, given different political dynamics, the characteristics of the country in terms of its carbon intensity and also in terms of its vulnerability to climate change impact. Climate change policies also vary by country, for example, there can be specific climate change strategies as well as mitigation and adaptation programmes in place, or the country could be participating in a mitigation of carbon emission programme. It is an important step when preparing climate change statistics to first understand the national relevance, conceptual aspects and existing policies and reporting needs so that the appropriate statistics can be compiled to inform these policies. Similarly, on the international level, an understanding of a country's participation[67] in specific conventions and related MEAs is a necessary step in preparing climate change statistics.

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

Application of the FDES to climate change statistics

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

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[67] 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.

events relating to climate change as per the IPCC, with the modifications noted previously.

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

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

Climate Process Drivers

Sub-component 1.3: Environmental Quality	Sub-component 3.1: Emissions to Air
1.3.1.d Global atmospheric concentrations of climate process drivers	3.1.1.a-b Total emissions of direct and indirect greenhouse gases (GHGs), by gas 3.1.2.a Consumption of ozone depleting substances (ODS), by substance

Climate Change Evidence

Sub-comp. 1.1: Physical Conditions	Sub-comp. 4.1: Natural Extreme Events and Disasters
1.1.1.a Temperature 1.1.1.b Precipitation 1.1.2.e.4 Sea level	4.1.1.a Occurrence of natural extreme events and disasters

Climate Change Impacts and Vulnerability

Sub-comp. 1.1: Physical Conditions	Sub-comp. 1.2: Land Cover, Ecosystems and Biodiversity	Sub-comp. 1.3: Environmental Quality	Sub-comp. 2.3: Land	Sub-comp. 4.1: Natural Extreme Events and Disasters	Sub-comp. 5.2: Environmental Health
1.1.2.a-c, g Lakes, rivers, reservoirs, glaciers 1.1.2.e.6 Area of sea ice 1.1.4.b.2 Area affected by desertification	1.2.1.a.1 Area of land cover 1.2.2.a-c Ecosystem characteristics and biological components 1.2.3.a Flora 1.2.3.b Fauna 1.2.4.a-b Forests	1.3.3.b Organic matter in marine water bodies 1.3.3.f Physical and chemical characteristics (of marine water bodies) 1.3.3.g Coral bleaching	2.3.1.i. Land use change	4.1.2.a-d People affected, economic loss, physical loss and effects on integrity of ecosystems	5.2.3.a Vector borne diseases

Mitigation and Adaptation

Sub-comp. 2.2: Energy Resources	Sub-comp. 6.1: Environment Protection and Resource Management Expenditure	Sub-comp. 6.2: Environmental Governance and Regulation	Sub-comp. 6.3: Extreme Event Preparedness and Disaster Management
2.2.2.a Production of energy from non-renewable and renewable sources	6.1.1.a Government environment protection and resource management expenditure 6.1.2.a Private sector environment protection and resource management expenditure	6.2.2.a Direct regulation 6.2.2.b Economic instruments 6.2.3.a Participation in MEAs and other global environmental conventions	6.3.1.a National natural extreme event and disaster preparedness and management systems

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

Climate Process Drivers
Sub-component 1.3: Environmental Quality
1.3.1.d: Global atmospheric concentrations of climate process drivers
1.3.1.d.1 Global atmospheric concentration levels of carbon dioxide (CO_2)
1.3.1.d.2 Global atmospheric concentration levels of methane (CH_4)
Sub-component 3.1: Emissions to Air
3.1.1.a: Total emissions of direct greenhouse gases (GHGs), by gas:
3.1.1.a.1: Carbon dioxide (CO_2)
3.1.1.a.2: Methane (CH_4)
3.1.1.a.3: Nitrous oxides (N_2O)
3.1.1.a.4: Perfluorocarbons (PFCs)
3.1.1.a.5: Hydrofluorocarbons (HFCs)
3.1.1.a.6: Sulphur hexafluoride (SF_6)
3.1.1.b: Total emissions of indirect greenhouse gases (GHGs), by gas:
3.1.1.b.1: Sulpher dioxide (SO_2)
3.1.1.b.2: Nitrogen oxides (NO_x)
3.1.1.b.3: Non-methane volatile organic compounds (NM-VOCs)
3.1.1.b.4: Other
3.1.2.a: Consumption of ozone depleting substances (ODS), by substance:
3.1.2.a.1: Chlorofluorocarbons (CFCs)
3.1.2.a.2: Hydrochlorofluorocarbons (HCFCs)
3.1.2.a.3: Bromofluorocarbons (BFCs)
3.1.2.a.4: Methyl chloroform
3.1.2.a.5: Carbon tetrachloride
3.1.2.a.6: Methyl bromide

Climate Change Evidence
Sub-component 1.1: Physical Conditions
1.1.1.a: Temperature
1.1.1.a.1: Monthly averages
1.1.1.a.2: Minimum monthly average
1.1.1.a.3: Maximum monthly average
1.1.1.b: Precipitation
1.1.1.b.1: Annual averages
1.1.1.b.2: Long-term annual averages
1.1.1.b.3: Monthly averages
1.1.1.b.4: Maximum monthly value
1.1.1.b.5: Minimum monthly value
1.1.2.e: Seas
1.1.2.e.4: Sea level
Sub-component 4.1: Natural Extreme Events and Disasters
4.1.1.a: Occurrence of natural extreme events and disasters
4.1.1.a.1: Type of natural disaster (e.g., flood, drought, etc.)
4.1.1.a.2: Location
4.1.1.a.3: Magnitude (where applicable)
4.1.1.a.4: Date of occurrence
4.1.1.a.5: Duration
4.1.1.a.6: Hazard prone areas
4.1.1.a.7: Population living in hazard prone areas

Climate Change Impacts and Vulnerability
Sub-component 1.1: Physical Conditions
1.1.2.a: Lakes
1.1.2.a.1: Surface area
1.1.2.b: Rivers
1.1.2.b.1: Length
1.1.2.b.2: Location
1.1.2.c: Reservoirs
1.1.2.c.1: Surface area
1.1.2.e: Seas
1.1.2.e.6: Area of sea ice
1.1.2.g: Glaciers
1.1.4.b: Degradation
1.1.4.b.2: Area affected by desertification
Sub-component 1.2: Land Cover, Ecosystems and Biodiversity
1.2.1.a: Extent and spatial distribution of main land cover categories
1.2.1.a.1: Area of land cover (Changes in area of forests, vegetative land, glaciers, ice shelves, ice sheets, etc.)
1.2.2.a: General ecosystem characteristics, extent and pattern
1.2.2.a.1: Area of ecosystem
1.2.2.b: Ecosystems' chemical and physical characteristics
1.2.2.b.2: Carbon
1.2.2.c: Biological components of ecosystems (also in 1.2.3.a-b)
1.2.2.c.3: Biodiversity (aggregated measure of diversity of flora and fauna)
1.2.3.a: Flora (terrestrial, freshwater and marine) (also in 1.2.2.c)
1.2.3.a.1: Number of known species by status category
1.2.3.a.2: Species population
1.2.3.b: Fauna (terrestrial, freshwater and marine) (also in 1.2.2.c)
1.2.3.b.1: Number of known species by status category
1.2.3.b.2: Species population
1.2.4.a: Forest area (also in 1.2.1.a and 1.2.2.a)
1.2.4.a.1: Total
1.2.4.a.2: Natural
1.2.4.a.3: Planted
1.2.4.a.4: Protected forest area (also in 1.3.1.c)
1.2.4.a.5: Area deforested
1.2.4.a.6: Area reforested
1.2.4.a.7: Area afforested
1.2.4.a.8: Forest area affected by fire
1.2.4.a.9: Natural growth
1.2.4.b: Forest biomass
1.2.4.b.1: Total
1.2.4.b.2: Carbon storage in living forest biomass
Sub-component 1.3: Environmental Quality
1.3.3.b: Organic matter in marine water bodies
1.3.3.b.1: Biochemical oxygen demand (BOD) in marine water bodies
1.3.3.b.2: Chemical oxygen demand (COD) in marine water bodies
1.3.3.b.3: Maximum allowable levels
1.3.3.f: Physical and chemical characteristics (of marine water bodies)
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) in marine water bodies
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
2.3.1.i: Land use change
2.3.1.i.3: Change of land use category by origin and destination

Sub-component 4.1: Natural Extreme Events and Disasters
4.1.2.a: People affected by natural extreme events and disasters
4.1.2.a.1: Number of people killed
4.1.2.a.2: Number of people injured
4.1.2.a.3: Number of people homeless
4.1.2.a.4: Number of people affected
4.1.2.b: Economic loss due to natural extreme events and disasters
4.1.2.c: Physical loss/damage due to natural extreme events and 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
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-component 5.2: Environmental Health
5.2.3.a: Vector borne diseases
5.2.3.a.1: Incidence
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

Mitigation and Adaptation

Sub-component 2.2: Energy Resources
2.2.2.a: Production of energy from non-renewable and renewable energy sources
2.2.2.a.3: Renewable sources

Sub-component 6.1: Environment Protection and Resource Management Expenditure
6.1.1.a: Government environment protection and resource management expenditure
6.1.1.a.1: Annual government environment protection expenditure (on climate change mitigation activities)
6.1.2.a: Private sector environment protection and resource management expenditure
6.1.2.a.1: Annual corporate environment protection expenditure (on climate change mitigation activities)
6.1.2.a.3: Annual non-profit institution environment protection expenditure (on climate change mitigation activities)
6.1.2.a.5: Annual household environment protection expenditure (on climate change mitigation activities)

Sub-component 6.2: Environmental Governance and Regulation
6.2.2.a: Direct regulation
6.2.2.a.1: List of regulated pollutants and description (e.g., by year of adoption and maximum allowable levels) (climate change related)
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 (climate change related)
6.2.2.a.3: Number of applications for licences received and approved per year (climate change related)
6.2.2.a.5: Budget and number of staff dedicated to enforcement of environmental regulations (climate change related)
6.2.2.b: Economic instruments
6.2.2.b.1: List and description (e.g., year of establishment) of green/ environmental taxes (climate change related)
6.2.2.b.2: List and description (e.g., year of establishment) of environmentally relevant subsidies (climate change related)
6.2.2.b.3: List of eco-labelling and environmental certification programmes (climate change related)
6.2.2.b.4: Emission permits traded
6.2.3.a: Participation in MEAs and other global environmental conventions
6.2.3.a.1: List and description (e.g., year of participation[a] of country) of MEAs and other global environment conventions (climate change related)

Sub-component 6.3: Extreme Event Preparedness and Disaster Management
6.3.1.a: National natural extreme event and disaster preparedness and management systems
6.3.1.a.1: Existence of national disaster plans/programmes (and private when available)
6.3.1.a.2: Description of national disaster plans/programmes (and private when available)
(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.

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

- Climate Process Drivers
  - Proportion of national versus global CO_2 and CH_4 emissions
  - CO_2 and CH_4 emissions per capita and per GDP
- Climate Change Evidence, Impacts and Vulnerability
  - Rate of snowmelt (Arctic/Antarctic)
  - Flora and fauna species located near the edge or lowest elevation portion of their range
  - Changes in agricultural productivity
  - Changes in water availability
  - Level of exposure of system to impacts of climate change (e.g., population living in areas where elevation is below five metres, proportion of total land area where elevation is below five metres, population living in disaster prone areas, etc.)
  - Resources for which demand exceeds supply
  - Factors which limit a system's ability to change
  - Climate change refugees
- Mitigation and Adaptation
  - Soil conservation schemes
  - Change in crop varieties
  - Change in farming type (from crop to livestock)
  - Changing time of planting and harvesting
  - Existence of national strategy for climate change
  - Budget allocated for programme to assess and address climate change
  - Participation in carbon trade/carbon markets
  - Waste management changes towards more reuse and
  - Investment in Clean Development Mechanisms and Joint Implementation

5.4 Agriculture and the Environment

5.42   Agriculture is one of the most important economic activities and it 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.

5.43   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.[68]

5.44   Large scale or intensive agriculture requires the increasing use of chemicals, infrastructure and machinery. In its race 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 concentrations, as well as alteration of ecosystems and biota through introduction of genetic material all influence the wellbeing and health 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.

5.45   Advances in agricultural production in recent decades have been realised with little or no regard to biodiversity. Many 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.

5.46   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

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[68] United Nations, 2012, "Resolution Adopted by the General Assembly, 66/288. The future we want". Available from http://daccess-dds-ny.un.org/doc/UNDOC/GEN/N11/476/10/PDF/N1147610.pdf?OpenElement (accessed 2 January 2013).

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.

5.47   Flows and balances of nutrients and their contribution to soil fertility are critical to agricultural production. Globally, human society has already more than doubled worldwide terrestrial cycling of nitrogen and phosphorus, 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.

5.48   Regarding livestock production, growth and productivity gains are frequently achieved through the use of chemicals, 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.

Application of the FDES to agriculture and the environment

5.49   In the following, the scope of agriculture is set according to groups 011 through 016 in ISIC Rev. 4, which comprise crop and animal production.69 Although the scope is restricted to these contents, using the pattern applied below similar exercises can be made about forestry, aquaculture and agro-industrial activities and their relationship to the environment.

5.50   Figure 5.11 is a schematic presentation of the relations between agriculture and the environment. The scheme also helps to illustrate how the FDES can be applied to study these relationships.

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[69] United Nations Statistics Division, 2008, "International Standard Industrial Classification of All Economic Activities, Rev. 4". Available from http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=27 (accessed 31 December 2012).

Figure 5.10: The relations between agriculture and the environment
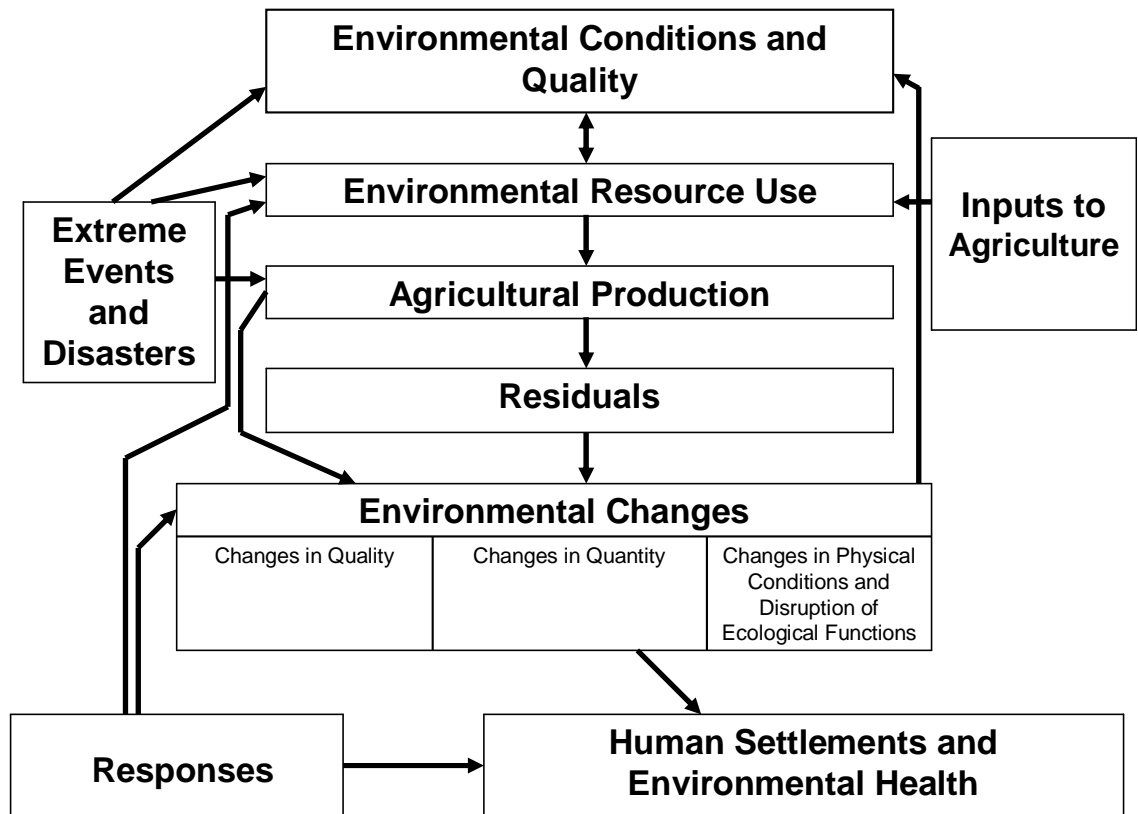
5.51　Environmental conditions and quality (FDES Component 1) largely determine the agricultural potential of a country, for these environmental conditions (such as climate and weather, hydrological conditions, terrain, soil types and fertility levels etc.) actually provide the basic ecological support for agriculture.

5.52　Agricultural production uses environmental resources (FDES Component 2) such as land, soil, water and energy. In this use the resources are modified both qualitatively and quantitatively, for example water can become polluted and overused compared to locally available stocks, or nutrients from soil can be depleted and would require replenishment by artificial means. Other natural inputs are also necessary to produce crops and livestock output, namely the permanent flux of solar luminescence, the continued photosynthesis processes and a wide range of other provisioning and regulating ecosystem services.

5.53　In addition to natural inputs, other inputs that originate in the economy such as fertilizers, pesticides and other agrochemicals, as well as inputs used in livestock

production (antibiotics, hormones, etc.) are also used in agricultural production and released to the environment.

5.54   The production of the different types of crops and livestock (FDES Component 2) might be carried out by different methods such as traditional, extensive, monocultural, or organic, and 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. Informing about the yields and monitoring their changes through time and space provides additional information to assess the sustainability and health of ecosystems.

5.55   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 also can emit ozone depleting substances into the environment, particularly methyl bromide that is commonly used as soil and structural fumigants 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.

5.56   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, out of date pesticides, medicines, used oil, gasoline and diesel containers, and used tyres.

5.57   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. As experienced ever more intensively by countries, droughts, floods, landslides, hurricanes, storms, etc. do 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 the nature of the extreme event and disaster, the ecosystem's resilience and the preparedness and response.

5.58   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, and 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 change includes considerable land use changes (i.e., 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. These changes in the environment as a whole (FDES Component 1) retro-feed into the production process of agriculture, as an altered state of the environment, as depicted in the arrow from environmental changes to environmental conditions and quality.

5.59   These changes in the environment will also affect human environmental health (FDES Component 5). Of particular importance are human health problems related to waterborne and airborne diseases as well as toxic substance exposure and its consequences on health. The use of toxic substances in agriculture such as those found in pesticides (fungicides, herbicides, insecticides, rodenticides, etc.)

and their potential appearance in foodstuff are important environmental and health concerns.

5.60 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.

5.61 The statistical description of the relations 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.

5.62 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 agricultural activity and the environment. Figures 5.12 and 5.13 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.

5.63 Figures 5.12 and 5.13 are based on the sequence scheme relating agriculture and the environment as depicted in Figure 5.11, and they present the FDES components, sub-components, topics and environment statistics that are considered necessary to inform about this cross-cutting issue. Figure 5.12 presents the key information to describe the relations of agriculture and the environment down to the topic level. Figure 5.13 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 5.11 to the most detailed level possible. At the end of this analysis between agriculture and the environment, commonly used agri-environmental indicators are presented as an illustration of those that can be constructed with the selected environment statistics.

Figure 5.11: Agriculture and the environment, topic level

Environmental Conditions and Quality

1.1 Physical Conditions
Topic 1.1.1 Atmosphere, climate and weather (a-c, f)
Topic 1.1.2 Hydrographical Characteristics (b-d, f)

Topic 1.1.4 Soil characteristics
1.2 Land Cover, Ecosystems and Biodiversity
Topic 1.2.1 Land cover
Topic 1.2.2 Ecosystems (a)

Environmental Resource Use

2.2 Energy Resources
Topic 2.2.2 Production and use of energy from non-renewable and renewable sources (c)
2.3 Land
Topic 2.3.1 Land use (a, e-f, h)

2.5 Biological Resources
Topic 2.5.3 Crops
Topic 2.5.4 Livestock
2.6 Water Resources
Topic 2.6.1 Water resources
Topic 2.6.2 Abstraction, use and returns of water

Extreme Events and Disasters

4.1 Natural Extreme Events and Disasters
Topic 4.1.2 Impact of natural extreme events and disasters (b-d)
4.2 Technological Disasters
Topic 4.2.2 Impact of technological disasters (b-d)

Inputs to Agriculture

2.5 Biological Resources
Topic 2.5.3 Crops (b)
Topic 2.5.4 Livestock (b)
3.4 Application of Biochemicals
Topic 3.4.1 Application of biochemicals (a-b, d, f)

Agricultural Production

2.5 Biological Resources
Topic 2.5.3 Crops (a, c)
Topic 2.5.4 Livestock (a)

Residuals

3.1 Emissions to Air
Topic 3.1.1 Emissions of greenhouse gases (a)
Topic 3.1.2 Consumption of ozone depleting substances (a)

3.2 Generation and Management of Wastewater
Topic 3.2.1 Generation and pollutant content of wastewater
3.3 Generation and Management of Waste
Topic 3.3.1 Generation of waste

Environmental Changes

Changes in Quality	Changes in Quantity	Changes in Physical Conditions and Disruption of Ecological Functions
Topic 1.3.2 Freshwater quality (a, e) Topic 1.3.3 Marine water quality (a, e) Topic 1.3.4 Soil pollution (change associated with agriculture)	Topic 1.1.4 Soil characteristics (b-c) Topic 2.3.1 Land use (i) Topic 2.6.2 Abstraction, use and returns of water	Topic 1.1.1 Atmosphere, climate and weather (a-c) Topic 1.2.3 Biodiversity (a-b)

Responses

6.1 Environment Protection and Resource Management Expenditure
Topic 6.1.1 Government environment protection and resource management expenditure
Topic 6.1.2 Corporate, non-profit institution and household environment protection and resource management expenditure
6.2 Environmental Governance and Regulation
Topic 6.2.2 Environmental regulation and instruments
Topic 6.2.3 Participation in MEAs and environmental conventions
6.4 Environmental Information and Awareness
Topic 6.4.2 Environmental education
Topic 6.4.3 Environmental engagement
Topic 6.4.4 Environmental perception and awareness

Human Settlements and Environmental Health

5.1 Human Settlements
Topic 5.1.1 Urban and rural population (b, d)
5.2 Environmental Health
Topic 5.2.5 Toxic substance- and radiation-related diseases and conditions

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

Environmental Conditions and Quality	
Sub-component 1.1: Physical Conditions	

Topic 1.1.1: Atmosphere climate and weather	1.1.1.a: Temperature
	    1.1.1.a.1: Monthly averages
	    1.1.1.a.2: Minimum monthly average
	    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 averages
	    1.1.1.b.2: Long-term annual averages
	    1.1.1.b.3: Monthly averages
	    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: Hydrographical characteristics	1.1.2.b: Rivers
	    1.1.2.b.1: Length
	    1.1.2.b.2: Location
	1.1.2.c: Reservoirs
	    1.1.2.c.1: Surface area
	    1.1.2.c.2: Location
	1.1.2.d: Watersheds
	    1.1.2.d.1: Description of main watersheds
	1.1.2.f: Groundwater
	    1.1.2.f.1: Aquifers

Topic 1.1.4: Soil characteristics	1.1.4.a: Soil characterization
	    1.1.4.a.1: Area of soil types
	1.1.4.b: 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: Phosphorus (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-component 1.2: Soil and Land Cover	

Topic 1.2.1: Land cover	1.2.1.a: Extent and spatial distribution of main land cover categories
	    1.2.1.a.1: Area of land cover
	    1.2.1.a.2: Location of land cover

Topic 1.2.2: Ecosystems	1.2.2.a: General ecosystem characteristics, extent and pattern
	    1.2.2.a.1: Area of ecosystems
	    1.2.2.a.2: Location within country
	    1.2.2.a.3: Proximity of relevant ecosystem to urban areas and cropland

Environmental Resource Use	
Sub-component 2.2: Energy Resources	
Topic 2.2.2: Production and use of energy from non-renewable and renewable sources	**2.2.2.c: Total consumption of energy** (for agriculture)
Sub-component 2.3: Land	
Topic 2.3.1: Land use area	**2.3.1.a: Land use area** (for agriculture) 2.3.1.e: Land ownership *2.3.1.f: Area of land under organic farming* *2.3.1.h: Area of land under agroforestry*
Sub-component 2.5: Biological Resources	

Topic 2.5.3: Crops	2.5.3.a: Main annual and perennial 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.b: Amount used of:
	    2.5.3.b.1: Natural fertilizers (e.g., manure, compost, lime)
	    2.5.3.b.2: Chemical fertilizers
	    2.5.3.b.3: Pesticides
	2.5.3.c: Monoculture / resource-intensive crops
	    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
	2.5.3.e: Exports of crops

Topic 2.5.4: Livestock	2.5.4.a: Livestock
	    2.5.4.a.1: Number of live animals
	    2.5.4.a.2: Number of animals slaughtered
	2.5.4.b: Amount used of:
	    2.5.4.b.1: Antibiotics
	    2.5.4.b.2: Hormones
	2.5.4.c: Imports of livestock
	2.5.4.d: Exports of livestock

Sub-component 2.6: Water Resources	

Topic 2.6.1: Water resources	2.6.1.a: Inflow of water to inland water resources
	    2.6.1.a.1: Precipitation (also in 1.1.1.b)
	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 reservoir*s*
	    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
	    2.6.1.c.7: Water rights

Topic 2.6.2: Abstraction, use and returns of water	**2.6.2.a: Total water abstraction** (for agriculture)
	2.6.2.b: Water abstraction from surface water (for agriculture)
	2.6.2.c: Water abstraction from groundwater (for agriculture)
	    2.6.2.c.1: From renewable groundwater resources (for agriculture)
	    2.6.2.c.2: From non-renewable groundwater resources (for agriculture)
	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.i: Rainwater collection (for agriculture)
	2.6.2.j: Water abstraction from the sea (for agriculture)
	2.6.2.k: Losses in distribution (for agriculture)
	2.6.2.l: 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

Sub-component 2.5: Biological Resources	

Topic 2.5.3: Crops	2.5.3.b: Amount used of:
	      2.5.3.b.1: Natural fertilizers (e.g. manure, compost, lime)
	      2.5.3.b.2: Chemical fertilizers
	      2.5.3.b.3: Pesticides

Topic 2.5.4: Livestock	2.5.4.b: Amount used of:
	      2.5.4.b.1: Antibiotics
	      2.5.4.b.2: Hormones

Sub-component 3.4: Application of Biochemicals	
Topic 3.4.1: Application of biochemicals	3.4.1.a: Total amount of fertilizers used (also in 2.5.1.b and 2.5.3.b) 3.4.1.b: Total amount of pesticides used (also in 2.5.1.b and 2.5.3.b) *3.4.1.d: Total amount of hormones used* (also in 2.5.2.e and 2.5.4.b) *3.4.1.f: Total amount of antibiotics used* (also in 2.5.2.e and 2.5.4.b)

Agricultural Production

Sub-component 2.5: Biological Resources	

Topic 2.5.3: Crops	2.5.3.a: Main annual and perennial 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 crops:
	      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: Livestock	2.5.4.a: 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: Emissions of greenhouse gases	3.1.1.a: Total emissions of direct greenhouse gases (GHGs), by gas:
	    3.1.1.a.1: Carbon dioxide (CO_2)
	    3.1.1.a.2: Methane (CH_4)

Topic 3.1.2: Consumption of ozone depleting substances	3.1.2.a: Consumption of ozone depleting substances (ODS), by substance: 3.1.2.a.6: Methyl bromide
Sub-component 3.2: Generation and Management of Wastewater	
Topic 3.2.1: Generation and pollutant content of wastewater	**3.2.1.a: Volume of wastewater generated** (from agriculture) 3.2.1.b: Emissions of pollutants to wastewater (from agriculture)
Sub-component 3.2: Generation and Management of Waste	
Topic 3.3.1: Generation of waste	**3.3.1.a: Amount of waste generated by economic activity** (by agriculture) 3.3.1.b: Amount of waste generated by waste category (by agriculture) 3.3.1.c: Generation of hazardous waste (by agriculture) 3.3.1.c.1: Amount of hazardous waste generated (by agriculture)

Environmental Changes		
Changes in Quality		
Sub-component 1.3: Environmental Quality		
Topic 1.3.2: Freshwater quality	1.3.2.a: Nutrients and chlorophyll	
	1.3.2.a.1: Concentration of nitrates in freshwater bodies	
	1.3.2.a.2: Concentration of phosphates in freshwater bodies	
	1.3.2.a.3: Concentration of chlorophyll A in freshwater bodies	
	1.3.2.a.4: Maximum allowable levels	
	1.3.2.e: Organic contaminants (e.g., PCBs, DDT, pesticides, furans, dioxins, phenols, and radioactive waste)	
	1.3.2.e.1: Concentrations in the sediment and water	
	1.3.2.e.2: Concentrations in freshwater organisms	
	1.3.2.e.3: Maximum allowable levels	
Topic 1.3.3: Marine water quality	1.3.3.a: Nutrients and chlorophyll	
	1.3.3.a.1: Concentration of nitrates in marine water bodies	
	1.3.3.a.2: Concentration of phosphates in marine water bodies	
	1.3.3.a.3: Concentration of chlorphyll A in marine water bodies	
	1.3.3.a.4: Maximum allowable levels	
	1.3.3.e: Organic contaminants (e.g., PCBs, DDT, pesticides, furans, dioxins, phenols, and radioactive waste)	
	1.3.3.e.1: Concentrations in the sediment and water	
	1.3.3.e.2: Concentrations in marine organisms	
	1.3.3.e.3: Maximum allowable levels	
Topic 1.3.4: Soil pollution	1.3.4.a: Sites affected by pollution	
	1.3.4.a.1: Contaminated sites	
	1.3.4.a.2: Potentially contaminated sites	
	1.3.4.a.3: Remediated sites	
	1.3.4.a.4: Other sites	
Changes in Quantity		
Sub-component 1.1: Physical Conditions		
Topic 1.1.4: Soil characteristics	1.1.4.b: 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: Phosphorus (P)	
	1.1.4.c.5: *Potassium (K)*	
Sub-component 2.3: Land		
Topic 2.3.1: Land use	2.3.1.i: Land use change	
	2.3.1.i.1: Increase of area within category	
	2.3.1.i.2: Decrease of are within category	
	2.3.1.i.3: Change of land use category by origin and destination	
Sub-component 2.6: Water Resources		
Topic 2.6.2: Abstraction, use and returns of water	**2.6.2.a: Total water abstraction** (for agriculture)	
	2.6.2.b: Water abstraction from surface water (for agriculture)	
	2.6.2.c: Water abstraction from groundwater (for agriculture)	
	2.6.2.c.1: From renewable groundwater resources (for agriculture)	
	2.6.2.c.2: From non-renewable groundwater resources (for agriculture)	
	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.i: Rainwater collection (for agriculture)	

	2.6.2.j: Water abstraction from the sea (for agriculture)
	2.6.2.k: Losses in distribution (for agriculture)
	2.6.2.l: Exports of water (for agriculture)
	2.6.2.m: Imports of water (for agriculture)
	2.6.2.n: Returns of water (for agriculture)

Changes in Physical Conditions and Disruption of Ecological Functions	
Sub-component 1.1: Physical Conditions	
Topic 1.1.1: Atmosphere, climate and weather	1.1.1.a: Temperature
	1.1.1.a.1: Monthly averages
	1.1.1.a.2: Minimum monthly average
	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 averages
	1.1.1.b.2: Long-term annual averages
	1.1.1.b.3: Monthly averages
	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
Sub-component 1.2: Land Cover, Ecosystems and Biodiversity	
Topic 1.2.3: Biodiversity	1.2.3.a: Flora - terrestrial, freshwater and marine (also in 1.2.2.c)
	1.2.3.a.1: Number of known species by status category
	1.2.3.a.2: Species population
	1.2.3.a.3: Number of endemic species
	1.2.3.a.4: Number of invasive alien species
	1.2.3.a.5: Habitat fragmentation
	1.2.3.b: Fauna - terrestrial, freshwater and marine (also in 1.2.2.c)
	1.2.3.b.1: Number of known species by status category
	1.2.3.b.2: Species population
	1.2.3.b.3: Number of endemic species
	1.2.3.b.4: Number of invasive alien species
	1.2.3.b.5: Habitat fragmentation

Human Settlements and Environmental Health	
Sub-component 5.1: Natural Extreme Events and Disasters	
Topic 5.1.1: Urban and rural population	5.1.1.b: Total population living in rural areas
	5.1.1.d: Total rural area
Sub-component 5.2: Environmental Health	
Topic 5.2.5: Toxic substance- and nuclear radiation-related diseases and conditions	5.2.5.a: Toxic substance- and nuclear radiation-related diseases and conditions
	5.2.5.a.1: Incidence (agrochemical-related only)
	5.2.5.a.2: Prevalence (agrochemical-related only)

Extreme Events and Disasters	
Sub-component 4.1: Natural Extreme Events and Disasters	
Topic 4.1.2: Impact of natural extreme events and disasters	**4.1.2.b: Economic loss due to natural extreme events and disasters** (e.g., damage to buildings, transportation networks, loss of revenue for businesses, utility disruption, etc.)
	4.1.2.c: Physical loss/damage due to natural extreme events and disasters (e.g., area and amount of crops, livestock, aquaculture, biomass, etc.)
	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

Sub-component 4.2: Technological Disasters	

Topic 4.2.2: Impact of technological disasters	4.2.2.b: Economic loss due to technological disasters (e.g., damage to buildings, transportation networks, loss of revenue for businesses, utility disruption, etc.)
	4.2.2.c: Physical loss/damage due to technological disasters (e.g., area and amount of crops, livestock, aquaculture, biomass, etc.)
	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

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

Topic 6.1.1: Government environment protection and resource management expenditure	6.1.1.a: Government environmental protection and resource management expenditure (only in agriculture)
	    6.1.1.a.1: Annual government environmental protection expenditure
	    6.1.1.a.2: Annual government resource management expenditure

Topic 6.1.2: Corporate, non-profit institution and household environment protection and resource management expenditure	6.1.2.a: Private sector environment protection and resource management expenditure (only in agriculture)
	    6.1.2.a.1: Annual corporate environment protection expenditure
	    6.1.2.a.2: Annual corporate resource management expenditure
	    6.1.2.a.3: Annual non-profit institution environment protection expenditure
	    6.1.2.a.4: Annual non-profit institution resource management expenditure
	    6.1.2.a.5: Annual household environment protection expenditure
	    6.1.2.a.6: Annual household resource management expenditure

Sub-component 6.2: Environmental Governance and Regulation	

Topic 6.2.2: Environmental regulation and instruments	6.2.2.a: Direct regulation (agriculture-related)
	    6.2.2.a.1: List of regulated pollutants and description (e.g., by year of adoption and maximum allowable levels)
	    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 (agriculture-related)
	    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: Participation in MEAs and environmental conventions	6.2.3.a: Participation in MEAs and other global environmental conventions **6.2.3.a.1: List and description (e.g., year of participation[a] of country) of MEAs and other global environmental conventions** (agriculture related only; desertification, POPs, etc.)
(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.	
Sub-component 6.4: Environmental Information and Awareness	

Topic 6.4.2: Environmental education	6.4.2.a: Environmental education (related to food/health from agriculture, and/or organic and sustainable agriculture)
	    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: Environmental engagement	6.4.3.a: Environmental engagement (related to food/health from agriculture, and/or organic and sustainable agriculture)	
	6.4.3.a.1: Existence of pro-environmental NGOs (number of, human and financial resources)	
	6.4.3.a.2: Number of people participating in pro-environmental activities	
	6.4.3.a.3: Number of pro-environmental programmes	
Topic 6.4.4: Environmental perception and awareness	6.4.4.a: Public environmental perception and awareness (related to food/health from agriculture, and/or organic and sustainable agriculture)	
	6.4.4.a.1: Knowledge and attitudes about environmental issues or concerns	
	6.4.4.a.2: Knowledge and attitudes about environmental policies	

Additional indicators commonly used in Agriculture and the Environment

The OECD has compiled a list of indicators which relate to agri-environmental issues faced by most OECD countries. These indicators are reproduced below:

Table 5.1: OECD indicators relating to agri-environmental issues faced by most OECD countries[70]

Theme	Indicator Title	Indicator definition (trends over time for all indicators)
I. Soil	i. Soil erosion	1. Area of agricultural land affected by water erosion in terms of different classes of erosion, i.e. tolerable, low, moderate, high and severe. 2. Area of agricultural land affected by wind erosion in terms of different classes of erosion, *i.e.* tolerable, low, moderate, high and severe.
II. Water	ii. Water use	3. Agricultural water use in total national water utilisation. 4. Agriculture's use of groundwater in total national groundwater utilisation. 5. Area of irrigated land in total agricultural land area.
	iii. Water quality	6. Nitrate and phosphate contamination derived from agriculture in surface water and coastal waters. 7. Monitoring sites in agricultural areas that exceed recommended drinking water limits for nitrates and phosphorus in surface water and groundwater (nitrates only). 8. Monitoring sites in agricultural areas that exceed recommended drinking water limits for pesticides in surface water and groundwater. 9. Monitoring sites in agricultural areas where one or more pesticides are present in surface water and groundwater.
III. Air	iv. Ammonia emissions, acidification and eutrophication	10. Share of agricultural ammonia emissions in national total ammonia (NH3) emissions.
	v. Methyl bromide use and ozone depletion	11. Agricultural methyl bromide use expressed in tonnes of ozone depletion potential.
	vi. Greenhouse gas emissions and climate change	12. Gross total agricultural greenhouse gas emissions (carbon dioxide, methane and nitrous oxide), and their share in total greenhouse gas emissions.
IV. Biodiversity	vii. Genetic diversity	13. Plant varieties registered and certified for marketing for the main crop categories (i.e. cereals, oilcrops, pulses and beans, root crops, fruit, vegetables and forage). 14. Five dominant crop varieties in total marketed production for selected crops (i.e. wheat, barley, maize, oats, rapeseed, field peas and soyabeans). 15. Area of land under transgenic crops in total agricultural land. 16. Livestock breeds registered and certified for marketing for the main livestock categories (i.e. cattle, pigs, poultry, sheep and goats).

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[70] OECD, 2008, "Environmental Performance of Agriculture in OECD Countries Since 1990: Full List of Agri-Environmental Indicators". Available from http://www.oecd.org/agriculture/sustainableagriculture/40673091.pdf (accessed 2 January 2013).

	viii. Wild species diversity	17. Three dominant livestock breeds in total livestock numbers for the main livestock categories (i.e. cattle, pigs, poultry, sheep and goats). 18. Livestock (i.e. cattle, pigs, poultry and sheep) in endangered and critical risk status categories and under conservation programmes. 19. Status of plant and livestock genetic resources under in situ and ex situ national conservation programmes. 20. Wild species that use agricultural land as primary habitat. 21. Populations of a selected group of breeding bird species that are dependent on agricultural land for nesting or breeding.
	ix. Ecosystem diversity	22. Conversion of agricultural land area to (land exits) and from (land entries) other land uses (i.e. forest land; built-up land, wetlands, and other rural land). 23. Area of agricultural semi-natural habitats (i.e. fallow land, farm woodlands) in the total agricultural land area. 24. National important bird habitat areas where intensive agricultural practices are identified as either posing a serious threat or a high impact on the area's ecological function.
V. Farm management	x. Nutrient management	25. Number (area) of farms (agricultural land area) under nutrient management plans. 26. Farms using soil nutrient testing (agricultural land regularly sampled and analysed for nutrient content).
	xi. Pest management	27. Arable and permanent crop area under integrated pest management.
	xii. Soil management	28. Arable land area under soil conservation practices. 29. Agricultural land area under vegetative cover all year.
	xiii. Water management	30. Irrigated land area using different irrigation technology systems.
	xiv. Biodiversity management	31. Agricultural land area under biodiversity management plans.
	xv. Organic management	32. Agricultural land area under certified organic farm management (or in the process of conversion to an organic system).
VI. Agricultural inputs	xvi. Nutrients	33. Gross balance between the quantities of nitrogen (N) inputs (e.g. fertilisers, manure) into, and outputs (e.g. crops, pasture) from farming. 34. Gross balance between the quantities of phosphorus (P) inputs (e.g. fertilisers, manure) into, and outputs (e.g. crops, pasture) from farming.
	xvii. Pesticides	35. Pesticide use (or sales) in terms of tonnes of active ingredients. 36. Risk of damage to terrestrial and aquatic environments, and human health from pesticide toxicity and exposure.
	xviii. Energy	37. Direct on-farm energy consumption in national total energy consumption.

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Annexes

Annex A: Basic Set of Environment Statistics

A.1 The tables containing the complete Basic Set include additional columns which provide further guidance. The third column in this table provides illustrations of possible temporal, spatial and subject-based disaggregations for the statistics. It should be noted that these are not mutually exclusive and may overlap. The fourth column refers to existing available methodological guidance from international sources that offer concepts, descriptions, specifications, lists, classifications and statistical methodologies for the given topic of the FDES.

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

Table A.1: The Basic Set of Environment Statistics

Component 1: Environmental Conditions and Quality				
Sub-component 1.1: Physical Conditions				
Topic	**Statistics and Related Information** (**Bold Text - Core Set/Tier 1**; Regular Text - Tier 2; *Italicized Text - Tier 3*)	**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
Topic 1.1.1: Atmosphere, climate and weather (CONTINUES ON NEXT PAGE)	a. Temperature		▪ National ▪ Sub-national	▪ World Meteorological Organization (WMO) ▪ Intergovernmental Panel on Climate Change (IPCC) ▪ National Oceanic and Atmospheric Administration (NOAA)/ National Aeronautics and Space Administration (NASA)
	1. **Monthly averages**	Degrees		
	2. **Minimum monthly average**	Degrees		
	3. **Maximum monthly average**	Degrees		
	b. Precipitation (also in 2.6.1.a)			
	1. **Annual averages**	Height		
	2. **Long-term annual averages**	Height		
	3. Monthly averages	Height		
	4. Minimum monthly value	Height		
	5. Maximum monthly value	Height		
	c. Relative humidity			
	1. Minimum monthly value	Number		
	2. Maximum monthly value	Number		
	d. Pressure		▪ National ▪ Sub-national ▪ By station	
	1. *Minimum monthly value*	Pressure unit		
	2. *Maximum monthly value*	Pressure unit		
	e. Wind speed		▪ National ▪ Sub-national	
	1. *Minimum monthly value*	Speed		
	2. *Maximum monthly value*	Speed		

Table A.1: The Basic Set of Environment Statistics (continued)

Topic	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 1.1.1: Atmosphere, climate and weather (CONTINUED FROM PREVIOUS PAGE)	f. Solar radiation		▪ National ▪ Sub-national	▪ World Meteorological Organization (WMO) ▪ Intergovernmental Panel on Climate Change (IPCC) ▪ National Oceanic and Atmospheric Administration (NOAA)/ National Aeronautics and Space Administration (NASA)
	1. *Average daily value*	Area, Energy unit		
	2. *Average monthly value*	Area, Energy unit		
	3. *Number of hours with sunshine*	Number	▪ National ▪ Sub-national ▪ By month and per year	
	g. UV radiation		▪ National ▪ Sub-national	▪ WHO-UV Radiation Index ▪ WMO-UV Radiation
	1. *Maximum daily value*	Area, Energy unit		
	2. *Average daily value*	Area, Energy unit		
	3. *Maximum monthly value*	Area, Energy unit		
	4. *Average monthly value*	Area, Energy unit		
	h. Occurrence of El Niño, La Niña events, when relevant			
	1. *Occurrence*	Number		
	2. *Location*	Location		
	3. *Time period*	Time period		

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Component 1: Environmental Conditions and Quality				
Sub-component 1.1: Physical Conditions				
Topic	**Statistics and Related Information** (**Bold Text - Core Set/Tier 1**; Regular Text - Tier 2; *Italicized Text - Tier 3*)	**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
Topic 1.1.2: Hydrographical characteristics	a. Lakes		▪ By watershed/ river basin ▪ National ▪ Sub-national	▪ United Nations Statistics Division (UNSD): International Recommendations for Water Statistics (IRWS) ▪ UN-Water
	1. *Surface area*	Area, Depth, Location		
	2. *Location*			
	b. Rivers			
	1. *Length*	Length		
	2. *Location*	Location		
	c. Reservoirs			
	1. *Surface area*	Area, Volume		
	2. *Location*	Location		
	d. Watersheds			
	1. **Description of main watersheds**	Area, Descriptive, Location		
	e. Seas		▪ National, within coastal waters or EEZ	
	1. Coastal waters	Area		
	2. Territorial sea	Area		
	3. Exclusive Economic Zone (EEZ) (also in 2.3.1.d)	Area		
	4. *Sea level*	Depth		
	5. *Location*	Location		
	6. *Area of sea ice*	Area		
	f. Groundwater		▪ By watershed	
	1. *Aquifers*	Depth, Descriptive, Number, Volume	▪ National ▪ Sub-national ▪ Renewable ▪ Non-renewable ▪ By salinity levels	
	g. Glaciers	Area, Volume	▪ National ▪ Sub-national	

Component 1: Environmental Conditions and Quality				
Sub-component 1.1: Physical Conditions				
Topic	**Statistics and Related Information** (**Bold Text - Core Set/Tier 1**; Regular Text - Tier 2; *Italicized Text - Tier 3*)	**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
Topic 1.1.3: Geological and geographical information	a. Geological, geographical and geomorphological conditions of terrestrial areas and islands		▪ National	▪ UNSD: Demographic Yearbook ▪ UN Food and Agriculture Organization of the United Nations (FAO) ▪ Center for International Earth Science Information Network (CIESIN)
	1. Length of border	Length		
	2. **Area of country or region**	Area		
	3. Geographical location	Location		
	4. Number of islands	Number		
	5. Area of islands	Area		
	6. Location of islands	Location		
	7. *Main geomorphological characteristics of islands*	Descriptive		
	8. *Spatial distribution of land relief*	Descriptive, Location		
	9. *Characteristics of landforms* (e.g., location, area and height, as applicable, for plains, hills, plateaus, dunes, volcanoes, mountains, sea mounts, etc.)	Descriptive		
	10. *Area of rock types*	Area		
	11. *Location of rock types*	Location		
	12. *Area of tectonic plates*	Area		
	13. *Location of tectonic plates*	Location		
	14. *Length of fault lines*	Length		
	15. *Location of fault lines*	Location		
	b. **Coastal area** (includes area of coral reefs, mangroves, etc.) (also in 2.3.1.c)	Area, Descriptive		
	c. **Length of marine coastline**	Length		
Topic 1.1.4: Soil characteristics	a. Soil characterization		▪ By location ▪ By soil type ▪ National ▪ Sub-national	▪ FAO and the International Institute for Applied Systems Analysis (IIASA) Harmonized World Soil Database ▪ International Soil Reference and Information Centre (ISRIC) World Data Centre for Soils ▪ United Nations Convention to Combat Desertification (UNCCD) ▪ FAO Global Assessment of Human-induced Soil Degradation (GLASOD)
	1. **Area of soil types**	Area		
	b. Degradation			
	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		
	c. Nutrient content of soil, measured in levels of:		▪ By soil type ▪ By nutrient ▪ National ▪ Sub-national	
	1. Nitrogen (N)	Concentration		
	2. Phosphorus (P)	Concentration		
	3. *Calcium (Ca)*	Concentration		
	4. *Magnesium (Mg)*	Concentration		
	5. *Potassium (K)*	Concentration		
	6. *Zinc (Zn)*	Concentration		

Component 1: Environmental Conditions and Quality				
Sub-component 1.2: Land Cover, Ecosystems and Biodiversity				
Topic	**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 1.2.1: Land cover	a. Extent and spatial distribution of main land cover categories		• By type of land cover (e.g., artificial surfaces including urban and associated areas; herbaceous crops; woody crops; multiple or layered crops; grassland; tree covered areas; mangroves; shrub covered areas; shrubs and/or herbaceous vegetation, aquatic or regularly flooded; sparsely natural vegetated areas; terrestrial barren land; permanent snow and glaciers; inland water bodies; and coastal water bodies and inter-tidal areas)[a] • National • Sub-national	• FAO Land Cover Classification System • System of Environmental-Economic Accounting (SEEA) Central Framework (2012) land cover categories • European Environment Agency (EEA)
	1. **Area of land cover**	Area		
	2. **Location of land cover**	Location		
Topic 1.2.2: Ecosystems	a. General ecosystem characteristics, extent and pattern		• By ecosystem (e.g., Marine, Coastal, Inland Water, Forest, Dryland, Island, Mountain, Polar, Cultivated, Urban)[b] • By biome • By habitat • By biogeographical region • By river basin • National • Sub-national	Millennium Ecosystem Assessment • UN Convention on Biological Diversity • UNECE Standard Statistical Classification of Flora, Fauna and Biotopes (1996) • The International Union for the Conservation of Nature (IUCN) Red List of Threatened Species • Convention on Wetlands of International Importance, especially as Waterfowl Habitat (The Ramsar Convention)
	1. **Area of ecosystems**	Area		
	2. Location within country	Location		
	3. *Proximity of relevant ecosystem to urban areas and cropland*	Location		
	b. Ecosystems' chemical and physical characteristics			
	1. *Nutrients*	Concentration		
	2. *Carbon*	Concentration		
	3. *Pollutants*	Concentration		
	c. Biological components of ecosystems (also in 1.2.3.a-b)			
	1. Biota (flora and fauna)	Number		
	2. Endemic species	Number		
	3. Biodiversity (aggregated measure of diversity of flora and fauna)	Number		
	4. **Threatened species**	Number		
(a) SEEA land cover categories, based on FAO Land Cover Classification System (http://unstats.un.org/unsd/envaccounting/seearev/Chapters/cAnnex.pdf)				

Component 1: Environmental Conditions and Quality				
Sub-component 1.2: Land Cover, Ecosystems and Biodiversity				
Topic	**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 1.2.3: Biodiversity	a. Flora - terrestrial, freshwater and marine (also in 1.2.2.c)		▪ By class (e.g., mammals, fishes, birds, reptiles, etc.) ▪ By ecosystem (Marine, Coastal, Inland Water, Forest, Dryland, Island, Mountain, Polar, Cultivated, Urban)[b]	▪ Millennium Ecosystem Assessment ▪ UN Convention on Biological Diversity ▪ IUCN Red List of Threatened Species ▪ UN Economic Commission of Europe (ECE) Standard Statistical Classification of Flora, Fauna and Biotopes (1996) ▪ FAO FISHSTAT (Species population and number of invasive alien species)
	1. **Number of known species by status category**	Number		
	2. Species population	Number		
	3. Number of endemic species	Number		
	4. Number of invasive alien species	Number		
	5. *Habitat fragmentation*	Area, Descriptive, Location, Number		
	b. Fauna - terrestrial, freshwater and marine (also in 1.2.2.c)		▪ By biome ▪ By habitat ▪ By status category (e.g., threatened) ▪ National ▪ Sub-national	
	1. **Number of known species by status category**	Number		
	2. Species population	Number		
	3. Number of endemic species	Number		
	4. Number of invasive alien species	Number		
	5. *Habitat fragmentation*	Area, Descriptive, Location, Number		
	c. Protected areas		▪ By management category [c] ▪ By ecosystem ▪ By biome ▪ By habitat ▪ National ▪ Sub-national	▪ IUCN Protected Area Management Categories ▪ UNSD: Millennium Development Goal (MDG) Indicator 7.6 Metadata
	1. **Protected terrestrial (including inland water) and marine area** (also in 1.2.4.a)	Area		
	d. Protected species		▪ By relevant species ▪ By ecosystem ▪ By biome ▪ By habitat ▪ By status category ▪ National ▪ Sub-national	▪ IUCN Red List of Threatened Species ▪ UNSD: MDG Indicator 7.7 Metadata
	1. Number of terrestrial, freshwater and marine protected flora species	Number		
	2. Number of terrestrial, freshwater and marine protected fauna species	Number		
	e. Other		▪ By status category ▪ National ▪ Sub-national	▪ Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
	1. *Trade in wildlife and captive-bred species*	Descriptive, Mass, Number		

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

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

Table A.1: The Basic Set of Environment Statistics (continued)

Topic	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
Component 1: Environmental Conditions and Quality				
Sub-component 1.2: Land Cover, Ecosystems and Biodiversity				
Topic 1.2.4: Forests	a. Forest area (also in 1.2.1.a and 1.2.2.a)		▪ By forest type, as appropriate ▪ National ▪ Sub-national	▪ FAO Global Forest Resources Assessment (FRA) ▪ UN Forum on Forests (UNFF) Monitoring, Assessment and Reporting (MAR) ▪ UNSD: MDG Indicator 7.1 Metadata ▪ Montreal Process (Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests) ▪ State of Europe's Forests (Forest Europe/UNECE-FAO Forestry and Timber Section)
	1. **Total**	Area		
	2. Natural	Area		
	3. Planted	Area		
	4. Protected forest area (also in 1.3.1.c)	Area		
	5. **Area deforested**	Area		
	6. Area reforested	Area		
	7. Area afforested	Area		
	8. Forest area affected by fire	Area		
	9. *Natural growth*	Area		
	b. Forest biomass			
	1. Total	Volume		
	2. *Carbon storage in living forest biomass*	Mass		

Table A.1: The Basic Set of Environment Statistics (continued)

Component 1: Environmental Conditions and Quality				
Sub-component 1.3: Environmental Quality				
Topic	**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 1.3.1: Air quality	a. Breathable particles		▪ Sub-national ▪ Daily maximum ▪ Monthly maximum and average ▪ Yearly maximum and average	▪ World Health Organization (WHO) ▪ UNECE Standard Statistical Classification of Ambient Air Quality (1990)
	1. **Concentration levels of particulate matter (PM_{10})**	Concentration		
	2. **Concentration levels of particulate matter ($PM_{2.5}$)**	Concentration		
	3. Maximum allowable levels	Concentration		
	4. Number of days where maximum allowable levels were surpassed per year	Number		
	b. Breathable gases			
	1. **Concentration levels of tropospheric ozone (O_3)**	Concentration		
	2. **Concentration levels of carbon monoxide (CO)**	Concentration		
	3. Maximum allowable levels	Concentration		
	4. Number of days where maximum allowable levels were surpassed per year	Number		
	c. Ambient concentrations of other relevant pollutants			
	1. **Concentration levels of sulphur dioxide (SO_2)**	Concentration		
	2. **Concentration levels of nitrogen oxides (NO_X)**	Concentration		
	3. Concentration levels of heavy metals	Concentration		
	4. Concentration levels of non-methane volatile organic compounds (NMVOCs)	Concentration		
	5. *Concentration levels of dioxins*	Concentration		
	6. *Concentration levels of furans*	Concentration		
	7. Other pollutants	Concentration		
	8. Maximum allowable levels	Concentration		
	9. Number of days where maximum allowable levels were surpassed per year	Number		
	d. Global atmospheric concentrations of climate process drivers			
	1. Global atmospheric concentration levels of carbon dioxide (CO_2)	Concentration		
	2. Global atmospheric concentration levels of methane (CH_4)	Concentration		

Component 1: Environmental Conditions and Quality

Sub-component 1.3: Environmental Quality

Topic	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 1.3.2: Freshwater quality	a. Nutrients and chlorophyll		▪ By water body ▪ By watershed/river basin ▪ By point measurement ▪ By type of water resource	▪ UNECE Standard Statistical Classification of Freshwater Quality for the Maintenance of Aquatic Life (1992) ▪ UN Environment Programme Global Environment Monitoring System - Water (UNEP GEMS-Water) ▪ WHO
	1. **Concentration of nitrates in freshwater bodies**	Concentration		
	2. **Concentration of phosphates in freshwater bodies**	Concentration		
	3. Concentration of chlorophyll A in freshwater bodies	Concentration		
	4. Maximum allowable levels	Concentration		
	b. Organic matter in freshwater bodies			
	1. **Biochemical oxygen demand (BOD) in freshwater bodies**	Concentration		
	2. Chemical oxygen demand (COD) in freshwater bodies	Concentration		
	3. Maximum allowable levels	Concentration		
	c. Pathogens			
	1. **Concentration of faecal coliforms in freshwater bodies**	Concentration		
	2. Maximum allowable levels	Concentration		
	d. Metals (e.g., mercury, lead, nickel, arsenic, cadmium)			
	1. Concentrations in the sediment and water	Concentration		
	2. Concentrations in freshwater organisms	Concentration		
	3. Maximum allowable levels	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 Aquatic Life (1992) ▪ UN Environment Programme Global Environment Monitoring System - Water (UNEP GEMS-Water) ▪ Stockholm Convention
	1. Concentrations in the sediment and water	Concentration		
	2. Concentrations in freshwater organisms	Concentration		
	3. Maximum allowable levels	Concentration		
	f. Physical and chemical characteristics			▪ UNECE Standard Statistical Classification of Freshwater Quality for the Maintenance of Aquatic Life (1992) ▪ UN Environment Programme Global Environment Monitoring System - Water (UNEP GEMS-Water)
	1. pH/Acidity/Alkalinity	Concentration, Level		
	2. Temperature	Degrees		
	3. *Total suspended solids (TSS)*	Concentration		
	4. Salinity	Concentration		
	5. Dissolved oxygen (DO) in freshwater bodies	Concentration		
	g. Plastic waste and other freshwater debris			
	1. Amount of plastic waste and other debris in freshwater	Area, Mass		

Component 1: Environmental Conditions and Quality

Sub-component 1.3: Environmental Quality

Topic	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 1.3.3: Marine water quality (CONTINUES ON NEXT PAGE)	a. Nutrients and chlorophyll		▪ By coastal zone, delta, estuary or other local marine environment ▪ Sub-national ▪ National ▪ Supranational ▪ By point measurement ▪ By type of water resource	▪ UNECE Standard Statistical Classification of Marine Water Quality (1992) ▪ NOAA/NASA ▪ UNEP Regional Seas Programme
	1. **Concentration of nitrates in marine water bodies**	Concentration		
	2. **Concentration of phosphates in marine water bodies**	Concentration		
	3. Concentration of chlorophyll A in marine water bodies	Concentration		
	4. Maximum allowable levels	Concentration		
	b. Organic matter in marine water bodies			
	1. **Biochemical oxygen demand (BOD) in marine water bodies**	Concentration		
	2. Chemical oxygen demand (COD) in marine water bodies	Concentration		
	3. Maximum allowable levels	Concentration		
	c. Pathogens			
	1. Concentration of faecal coliforms in recreational marine waters	Concentration		
	2. Maximum allowable levels	Concentration		
	d. Metals (e.g., mercury, lead, nickel, arsenic, cadmium)			
	1. Concentrations in the sediment and water	Concentration		
	2. Concentrations in marine organisms	Concentration		
	3. Maximum allowable levels	Concentration		
	e. Organic contaminants (e.g., PCBs, DDT, pesticides, furans, dioxins, phenols, and radioactive waste)			▪ UNECE Standard Statistical Classification of Marine Water Quality (1992) ▪ NOAA/NASA ▪ UNEP Regional Seas Programme ▪ Stockholm Convention
	1. *Concentrations in the sediment and water*	Concentration		
	2. *Concentrations in marine organisms*	Concentration		
	3. *Maximum allowable levels*	Concentration		
	f. Physical and chemical characteristics			▪ UNECE Standard Statistical Classification of Marine Water Quality (1992) ▪ NOAA/NASA ▪ UNEP Regional Seas Programme
	1. *pH/Acidity/Alkalinity*	Concentration, Level		
	2. Temperature	Degrees		
	3. *Total suspended solids (TSS)*	Concentration		
	4. *Salinity*	Concentration		
	5. Dissolved oxygen (DO) in marine water bodies	Concentration		
	6. *Density*	Density		
	g. Coral bleaching			
	1. **Area affected by coral bleaching**	Area		

Table A.1: The Basic Set of Environment Statistics (continued)

Component 1: Environmental Conditions and Quality				
Sub-component 1.3: Environmental Quality				
Topic	**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 1.3.3: Marine water quality (CONTINUED FROM PREVIOUS PAGE)	h. Plastic waste and other marine debris		▪ By coastal zone, delta, estuary or other local marine environment ▪ Sub-national ▪ National ▪ Supranational ▪ By point measurement	▪ UNECE Standard Statistical Classification of Marine Water Quality (1992) ▪ NOAA/NASA ▪ UNEP Regional Seas Programme
	1. *Amount of plastic waste and other debris in marine waters*	Area, Mass		
	i. Red tide			
	1. *Occurrence*	Number		
	2. *Impacted area*	Area		
	3. *Location*	Location		
	4. *Duration*	Duration		
	j. Oil pollution			
	1. *Area of oil slicks*	Area		
	2. *Amount of tar balls*	Area, Diameter, Number		
Topic 1.3.4: Soil pollution	a. Sites affected by pollution		▪ Sub-national ▪ By type of pollutant ▪ By source	
	1. Contaminated sites	Area, Number		
	2. Potentially contaminated sites	Area, Number		
	3. Remediated sites	Area, Number		
	4. Other sites	Area, Number		
Topic 1.3.5: Noise	a. Levels of noise from specific sources	Intensity, Level	▪ Sub-national	▪ WHO
	b. Levels of noise in specific locations	Intensity, Level		
	c. Maximum allowable levels from different sources or in specific surrounding locations	Intensity		

Component 2: Environmental Resources and their Use

Sub-component 2.1: Non-energy Mineral Resources

Topic	Statistics and Related Information (**Bold Text - Core Set/Tier 1**; Regular Text - Tier 2; *Italicized Text - Tier 3*)	Category of Measurement	Potential Aggregations and Scales	Methodological Guidance
Topic 2.1.1: Stocks and changes of non-energy mineral resources	a. Non-energy mineral resources		▪ By mineral ▪ National ▪ Sub-national	▪ United Nations Framework Classification for Energy and Mineral Resources (UNFC) ▪ SEEA Central Framework (2012) Asset and physical flow accounts ▪ ISIC Rev. 4, Section B, Division 05-08
	1. **Stocks of commercially recoverable resources**	Mass, Volume		
	2. New discoveries	Mass, Volume		
	3. *Upward reappraisals*	Mass, Volume		
	4. *Upward reclassifications*	Mass, Volume		
	5. **Extraction**	Mass, Volume		
	6. *Catastrophic losses*	Mass, Volume		
	7. *Downward reappraisals*	Mass, Volume		
	8. *Downward reclassifications*	Mass, Volume		
	9. Stocks of potentially commercially recoverable resources	Mass, Volume		
	10. *Stocks of non-commercial and other known resources*	Mass, Volume		
Topic 2.1.2: Production and trade of non-energy minerals	a. Production of non-energy minerals	Mass, Volume		
	b. Imports of non-energy minerals	Currency, Mass, Volume		
	c. Exports of non-energy minerals	Currency, Mass, Volume		

	Component 2: Environmental Resources and their Use			
	Sub-component 2.2: Energy Resources			
Topic	**Statistics and Related Information** (**Bold Text - Core Set/Tier 1**; Regular Text - Tier 2; *Italicized Text - Tier 3*)	**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
Topic 2.2.1: Stocks and changes of mineral energy resources	a. Mineral energy resources		▪ By resource (e.g., natural gas, crude oil and natural gas liquids, oil shale, natural bitumen and extra heavy oil (includes oil extracted from oil sands), coal and lignite, peat, non-metallic minerals except for coal or peat, uranium and thorium ores, and other metallic minerals) ▪ National ▪ Sub-national	▪ UNSD: International Recommendations for Energy Statistics (IRES) ▪ Asset and physical flow accounts in SEEA Central Framework (2012) ▪ International Energy Agency (IEA) Energy Statistics Manual ▪ ISIC Rev. 4, Section B, Divisions 05-08 ▪ UNFC
	1. **Stocks of commercially recoverable resources**	Mass, Volume		
	2. New discoveries	Mass, Volume		
	3. *Upward reappraisals*	Mass, Volume		
	4. *Upward reclassifications*	Mass, Volume		
	5. **Extraction**	Mass, Volume		
	6. *Catastrophic losses*	Mass, Volume		
	7. *Downward reappraisals*	Mass, Volume		
	8. *Downward reclassifications*	Mass, Volume		
	9. Stocks of potentially commercially recoverable resources	Mass, Volume		
	10. *Stocks of non-commercial and other known resources*	Mass, Volume		
	11. **Imports of energy minerals**	Currency, Mass, Volume		
	12. **Exports of energy minerals**	Currency, Mass, Volume		

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Component 2: Environmental Resources and their Use				
Sub-component 2.2: Energy Resources				
Topic	**Statistics and Related Information** (**Bold Text - Core Set/Tier 1**; Regular Text - Tier 2; *Italicized Text - Tier 3*)	**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
Topic 2.2.2: Production and use of energy from non-renewable and renewable sources	a. Production of energy from non-renewable and renewable sources		• By non-renewable resource (e.g., petroleum, natural gas, coal, fission fuels, non-sustainable firewood, waste, other non-renewables) • By renewable resource (e.g., solar, wind, geothermal, hydropower and ocean resources, solid biomass, biogas and liquid biofuels) • National • Sub-national	• IEA Energy Statistics Manual • UNSD: IRES • Joint Wood Energy Enquiry (UNECE-FAO Forestry and Timber Section)
	1. **Total**	Energy unit, Mass, Volume		
	2. **Non-renewable sources**	Energy unit, Mass, Volume		
	3. **Renewable sources**	Energy unit, Mass, Volume		
	b. Production of energy		• By primary energy resource (e.g., petroleum, natural gas, coal, hydroenergy, geothermal, fission fuels, cane products, other primary) • By secondary energy resource (e.g., electricity, liquefied petroleum gas, gasoline/alcohol, kerosene, diesel oil, fuel oil, coke, charcoal, gases, other secondary) • National • Sub-national	
	1. **Primary energy production**	Energy unit, Mass, Volume		
	2. **Secondary energy production**	Energy unit, Mass, Volume		
	c. **Total consumption of energy**	Energy unit, Mass, Volume	• By energy source • By household • By ISIC economic activity • National • Sub-national	
	d. Electric energy		• By energy source • National • Sub-national	
	1. **Electricity production**	Energy unit		
	2. **Installed capacities**	Energy unit		

Topic	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 2.3.1: Land use	a. **Land use area**	Area	▪ By land use category (e.g., agriculture, forestry, aquaculture, built up and related area, land used for maintenance and restoration of environmental functions, other land use not elsewhere classified, land not in use, aquaculture, maintenance and restoration of environmental functions, other inland water use not elsewhere classified, inland water not in use) ▪ National ▪ Sub-national	▪ FAO ▪ ECE Standard Classification of Land Use (1989) ▪ SEEA Central Framework (2012) Annex 1
	b. **Area of inland water use**	Area	▪ By inland use category (e.g., aquaculture, maintenance and restoration of environmental functions, other inland water use not elsewhere classified, inland water not in use) ▪ National ▪ Sub-national	
	c. **Coastal area** (includes area of coral reefs, mangroves, etc.) (also in 1.1.3.b)	Area	▪ National	
	d. Exclusive Economic Zone (EEZ) (also in 1.1.2.e and 1.1.3.c)	Area		
	e. Land ownership	Area	▪ By ownership category ▪ National ▪ Sub-national	▪ FAO
	f. *Area of land under organic farming*	Area	▪ National ▪ Sub-national	▪ FAO Inter-departmental Working Group on Organic Agriculture
	g. Area of land under sustainable forest management	Area		▪ Forest Stewardship Council
	h. *Area of land under agroforestry*	Area		
	i. Land use change		▪ By land use category (see 2.3.1.a above for examples) ▪ National ▪ Sub-national	▪ FAO ▪ ECE Standard Classification of Land Use (1989)
	1. Increase of area within category	Area		
	2. Decrease of area within category	Area		
	3. **Change of land use category by origin and destination**	Area		

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Component 2: Environmental Resources and their Use				
Sub-component 2.4: Soil Resources				
Topic	**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 2.4.1: Soil resources	Statistics in this topic are under development.			
Sub-component 2.5: Biological Resources				
Topic 2.5.1: Timber resources and their use	a. Timber resources		▪ By type (e.g., natural or planted)	▪ FAO Forest Resources Assessment
	1. **Stocks of timber resources**	Volume		▪ State of Europe's Forests (Forest Europe/UNECE-FAO
	2. Natural growth	Volume	▪ National	Forestry and Timber Section)
	3. Fellings	Volume	▪ Sub-national	▪ UNECE/FAO Joint Working Party on Forest Statistics,
	4. Removals	Volume		Economics and Management
	5. *Felling residues*	Volume		▪ ISIC Rev. 4, Section A, Division 02
	6. *Natural losses*	Volume		▪ FAOSTAT database
	7. *Catastrophic losses*	Volume		
	8. *Reclassifications*	Volume		
	b. Amount used of:		▪ National	
	1. Fertilizers	Area, Mass, Volume	▪ Sub-national	
	2. Pesticides	Area, Mass, Volume		
	c. Forest production	Volume	▪ By type of product (e.g., timber, industrial roundwood, fuelwood, pulp, chips) ▪ National ▪ Sub-national	▪ Central Product Classification (CPC) ▪ Joint Forest Sector Questionnaire (UNECE/FAO/Eurostat International Tropical Timber Organization [ITTO]) ▪ FAO/ITTO/UNECE/Eurostat Inter-secretariat Working Group on Forest Sector Statistics ▪ UNECE Timber Committee ▪ UNECE/FAO Joint Working Party on Forest Statistics, Economics and Management ▪ ISIC Rev. 4, Section A, Division 02 ▪ FAOSTAT database
	d. Fuelwood consumption	Volume	▪ National	▪ FAO/ITTO/UNECE/Eurostat Inter-secretariat Working
	e. Imports of forest products	Currency, Mass, Volume	▪ By type of product	Group on Forest Sector Statistics ▪ State of Europe's Forests (Forest Europe/UNECE-FAO
	f. Exports of forest products	Currency, Mass, Volume		Forestry and Timber Section) ▪ ISIC Rev. 4, Section A, Division 02 ▪ Harmonized System (HS) ▪ FAOSTAT database

Component 2: Environmental Resources and their Use				
Sub-component 2.5: Biological Resources				
Topic	**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 2.5.2: Aquatic resources and their use	a. **Fish capture production**	Mass	▪ By relevant species ▪ National ▪ Sub-national	▪ FAO ISCAAP ▪ ISIC Rev. 4, Section A, Division 03 ▪ The United Nations Convention on the Law of the Sea (UNCLOS) ▪ UNSD: MDG Indicator 7.4 Metadata
	b. **Aquaculture production**	Mass		
	c. Imports of fish and fishery products	Currency, Mass, Volume	▪ By relevant species ▪ By type of product ▪ By species ▪ National ▪ Sub-national	
	d. Exports of fish and fishery products	Currency, Mass, Volume		
	e. Amount used of:		▪ National ▪ Sub-national	
	1. *Pellets*	Mass, Volume		
	2. *Hormones*	Mass, Volume		
	3. *Colourants*	Mass, Volume		
	4. *Antibiotics*	Mass, Volume		
	5. *Fungicides*	Mass, Volume		
	f. Fish resources (natural; cultivated)		▪ By relevant species ▪ By type (e.g., cultivated or natural) ▪ By species ▪ National	
	1. Stocks of fish resources	Mass		
	2. *Additions to fish resources*	Mass		
	3. *Reductions in fish resources*	Mass		
Topic 2.5.3: Crops	a. Main annual and perennial crops		▪ By crop ▪ National ▪ Sub-national	▪ FAO Indicative Crop Classification (for 2010 round of agricultural censuses) ▪ FAO/WHO Specifications for Pesticides (2010) ▪ FAO Specifications for Commonly Used Fertilizers (2009) ▪ ISIC Rev. 4, Section A, Division 1 ▪ FAOSTAT database
	1. **Area harvested**	Area		
	2. **Area planted**	Area		
	3. **Amount produced**	Mass		
	4. *Amount of organic production*	Mass		
	5. *Amount of genetically modified crops produced*	Mass		
	b. Amount used of:		▪ By type of fertilizer ▪ By type of pesticide ▪ By crop ▪ National ▪ Sub-national	
	1. **Natural fertilizers** (e.g., manure, compost, lime)	Area, Mass, Volume		
	2. **Chemical fertilizers**	Area, Mass, Volume		
	3. **Pesticides**	Area, Mass, Volume		
	c. Monoculture / resource-intensive crops		▪ By crop ▪ National ▪ Sub-national	
	1. Area being used for production	Area		
	2. Amount produced	Mass		
	3. *Amount of genetically modified crops produced*	Mass		
	d. Imports of crops	Currency, Mass		
	e. Exports of crops	Currency, Mass		

	Component 2: Environmental Resources and their Use			
	Sub-component 2.5: Biological Resources			
Topic	**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 2.5.4: Livestock	a. Livestock		▪ By type of animal	▪ FAOSTAT database
	1. **Number of live animals**	Number	▪ National	▪ ISIC Rev. 4, Section A, Division 1
	2. Number of animals slaughtered	Number	▪ Sub-national	
	b. Amount used of:			
	1. *Antibiotics*	Mass		
	2. *Hormones*	Mass		
	c. Imports of livestock	Currency, Number		
	d. Exports of livestock	Currency, Number		
Topic 2.5.5: Wild, uncultivated biological resources (other than fish and timber)	a. Permits for regulated hunting of wild animals			▪ ISIC Rev. 4, Section A, Division 1
	1. Number of permits issued per year	Number		
	2. Total number of animal kills allowed by permits	Number		
	b. Imports of endangered species	Currency, Number		▪ CITES
	c. Exports of endangered species	Currency, Number		
	d. *Reported wild animals killed or trapped for food or sale*	Number		▪ ISIC Rev. 4, Section A, Division 1
	e. *Non-wood forest products and other plants*	Mass, Volume	▪ By type of product ▪ National ▪ Sub-national	▪ ISIC Rev. 4, Section A, Group 0230

Component 2: Environmental Resources and their Use				
Sub-component 2.6: Water Resources				
Topic	**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 2.6.1: Water resources	a. Inflow of water to inland water resources		▪ Inflow secured through treaties/not secured through treaties ▪ National ▪ Sub-national ▪ By territory of origin and destination	▪ UNSD: IRWS ▪ UNECE Standard Statistical Classification of Water Use (1989) ▪ UNSD: MDG Indicator 7.5 Metadata ▪ FAO AQUASTAT ▪ SEEA Central Framework (2012) Asset accounts ▪ SEEA Water ▪ UNSD: Environment Statistics Section - Water Questionnaire
	1. **Precipitation** (also in 1.1.1.b)	Volume		
	2. **Inflow from neighbouring territories**	Volume		
	3. *Inflow subject to treaties*	Volume		
	b. Outflow of water from inland water resources			
	1. **Evapotranspiration**	Volume		
	2. Outflow to neighbouring territories	Volume		
	3. Outflow subject to treaties	Volume		
	4. Outflow to the sea	Volume		
	c. Inland water stocks		▪ National ▪ Sub-national	
	1. Surface water stocks in artificial reservoirs	Volume		
	2. *Surface water stocks in lakes*	Volume		
	3. *Surface water stocks in rivers and streams*	Volume		
	4. *Surface water stocks in wetlands*	Volume		
	5. *Surface water stocks in snow, ice and glaciers*	Volume		
	6. Groundwater stocks	Volume		
	7. *Water rights*	Volume		

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Component 2: Environmental Resources and their Use				
Sub-component 2.6: Water Resources				
Topic	**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 2.6.2: Abstraction, use and returns of water	a. **Total water abstraction**	Volume	▪ By type of source ▪ National ▪ Sub-national	▪ UNSD: IRWS ▪ UNECE Standard Statistical Classification of Water Use (1989) ▪ FAO AQUASTAT ▪ SEEA Central Framework (2012) ▪ SEEA Water ▪ UNSD: Environment Statistics Section - Water Questionnaire
	b. **Water abstraction from surface water**	Volume		
	c. Water abstraction from groundwater			
	1. **From renewable groundwater resources**	Volume		
	2. **From non-renewable groundwater resources**	Volume		
	d. Water abstracted for own use	Volume	▪ By ISIC economic activity ▪ National ▪ Sub-national	
	e. Water abstracted for distribution	Volume	▪ By ISIC economic activity ▪ National ▪ Sub-national	
	f. Desalinated water	Volume	▪ National ▪ Sub-national	
	g. Reused water	Volume		
	h. Water use	Volume	▪ By ISIC economic activity ▪ National ▪ Sub-national	
	i. *Rainwater collection*	Volume	▪ National ▪ Sub-national	
	j. *Water abstraction from the sea*	Volume		
	k. Losses in distribution	Volume	▪ By ISIC economic activity ▪ National ▪ Sub-national	
	l. *Exports of water*	Volume	▪ National ▪ Sub-national	
	m. *Imports of water*	Volume		
	n. *Returns of water*	Volume	▪ By ISIC economic activity ▪ National ▪ Sub-national	

Component 3: Residuals				
Sub-component 3.1: Emissions to Air				
Topic	**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 3.1.1: Emissions of greenhouse gases	a. Total emissions of direct greenhouse gases (GHGs), by gas:		▪ By ISIC economic activity ▪ National ▪ Sub-national ▪ By IPCC Reporting Guidelines	▪ IPCC Emission Factor Database ▪ UN Framework Convention on Climate Change (UNFCCC) Reporting Guidelines) ▪ UNECE Standard Statistical Classification of Ambient Air Quality (1990) ▪ UNSD: MDG Indicator 7.2 Metadata ▪ WHO
	1. **Carbon dioxide (CO_2)**	Mass		
	2. **Methane (CH_4)**	Mass		
	3. **Nitrous oxide (N_2O)**	Mass		
	4. Perfluorocarbons (PFCs)	Mass		
	5. Hydrofluorocarbons (HFCs)	Mass		
	6. Sulphur hexafluoride (SF_6)	Mass		
	b. Total emissions of indirect greenhouse gases (GHGs), by gas:			
	1. **Sulphur dioxide (SO_2)**	Mass		
	2. **Nitrogen oxides (NO_x)**	Mass		
	3. Non-methane volatile organic compounds (NM-VOCs)	Mass		
	4. Other	Mass		
Topic 3.1.2: Consumption of ozone depleting substances	a. Consumption of ozone depleting substances (ODS), by substance:			▪ UNEP Ozone Secretariat ▪ IPCC Emission Factor Database ▪ UNECE Standard Statistical Classification of Ambient Air Quality (1990) ▪ UNSD: MDG Indicator 7.3 Metadata ▪ WHO
	1. Chlorofluorocarbons (CFCs)	Mass		
	2. Hydrochlorofluorocarbons (HCFCs)	Mass		
	3. Bromofluorocarbons	Mass		
	4. Methyl chloroform	Mass		
	5. Carbon tetrachloride	Mass		
	6. Methyl bromide	Mass		
	7. Other	Mass		
Topic 3.1.3. Emissions of other substances	a. Emissions of other substances:			▪ UNECE Standard Statistical Classification of Ambient Air Quality (1990) ▪ European Monitoring and Evaluation Programme (EMEP) is under the Convention on Long-range Transboundary Air Pollution
	1. Particulate matter (PM)	Mass		
	2. Heavy metals	Mass		
	3. *Other*	Mass		

Table A.1: The Basic Set of Environment Statistics (continued)

Topic	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
Component 3: Residuals				
Sub-component 3.2: Generation and Management of Wastewater				
Topic 3.2.1: Generation and pollutant content of wastewater	a. **Volume of wastewater generated**	Volume	• By ISIC economic activity • National • Sub-national	• UNSD: IRWS • ISIC Rev. 4, Section E, Division 35 and 36 • SEEA Water • UNSD: Environment Statistics Section - Water Questionnaire
	b. Emissions of pollutants to wastewater	Mass	• By pollutant or pollution parameter (e.g., BOD, COD, N, P, TSS) • By ISIC economic activity • National • Sub-national	

Component 3: Residuals				
Sub-component 3.2: Generation and Management of Wastewater				
Topic	**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 3.2.2: Collection and treatment of wastewater	a. **Volume of wastewater collected**	Volume	▪ National ▪ Sub-national	▪ UNSD: IRWS ▪ ISIC Rev. 4, Section E, Division 35 and 36 ▪ UNSD: Environment Statistics Section - Water Questionnaire
	b. **Volume of wastewater treated**	Volume	▪ By treatment type (e.g., primary, secondary, tertiary) ▪ National ▪ Sub-national	
	c. Total urban wastewater treatment capacity			
	1. Number of plants	Number		
	2. Capacity of plants	Volume		
	d. Total industrial wastewater treatment capacity			
	1. Number of plants	Number		
	2. Capacity of plants	Volume		
Topic 3.2.3: Discharge of wastewater to the environment	a. Wastewater discharge		▪ By treatment type (e.g., primary, secondary, tertiary) ▪ By recipient (e.g., surface water, groundwater, wetland, sea, soil) ▪ By ISIC economic activity ▪ National ▪ Sub-national ▪ By source (point / non-point source)	
	1. **Total volume of wastewater discharged to the environment after treatment**	Volume		
	2. **Total volume of wastewater discharged to the environment without treatment**	Volume		
	b. Pollutant content of discharged wastewater	Mass	▪ By pollutant or pollution parameter (e.g., BOD, COD, N, P) ▪ National ▪ Sub-national ▪ Net emission by ISIC economic activity ▪ By source (point / non-point source)	

	Component 3: Residuals			
	Sub-component 3.3: Generation and Management of Waste			
Topic	**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 economic activity**	Mass	· By ISIC economic activity · National · Sub-national	· European Commission: European List of Waste, pursuant to European Waste Framework Directive · Eurostat: Data Centre on Waste · Eurostat: European Waste Classification for Statistics, version 4 (Waste categories) · Basel Convention: Waste categories and hazardous characteristics · Eurostat: Manual on Waste Statistics · Eurostat: Guidance on classification of waste according to EWC-Stat categories · SEEA Central Framework (2012) · UNSD: Environment Statistics Section - Waste Questionnaire
	b. Amount of waste generated by waste category	Mass	· By waste category (e.g., chemical waste, municipal waste, combustion waste, etc.) · National · Sub-national	
	c. Generation of hazardous waste		· By ISIC economic activity · National · Sub-national	
	1. **Amount of hazardous waste generated**	Mass		

Component 3: Residuals				
Sub-component 3.3: Generation and Management of Waste				
Topic	**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 3.3.2: Management of waste	a. Municipal waste		▪ By type of treatment or disposal (e.g., recycling, composting, incineration, landfilling) ▪ By type of waste, when possible ▪ National ▪ Sub-national	▪ Eurostat: Data Centre on Waste ▪ Eurostat metadata: OECD/Eurostat definition of municipal waste ▪ UNSD: Environment Statistics Section - Waste Questionnaire ▪ Basel Convention: Waste categories and hazardous characteristics ▪ Eurostat: European Waste Classification for Statistics, version 4 (Waste categories) ▪ European Commission: European Waste Framework Directive (Waste treatment operations) ▪ Eurostat: Manual on Waste Statistics ▪ Eurostat: Guidance on classification of waste according to EWC-Stat categories ▪ Rotterdam Convention
	1. **Total municipal waste collected**	Mass		
	2. **Amount of municipal waste treated by type of treatment**	Mass		
	3. **Number of municipal waste treatment and disposal facilities**	Number		
	4. Capacity of municipal waste treatment and disposal facilities	Volume		
	b. Hazardous waste			
	1. **Total hazardous waste collected**	Mass		
	2. **Amount of hazardous waste treated by type of treatment**	Mass		
	3. **Number of hazardous waste treatment and disposal facilities**	Number		
	4. Capacity of hazardous waste treatment and disposal facilities	Volume		
	c. Other/industrial waste			
	1. Total other/industrial waste collected	Mass		
	2. Amount of other/industrial waste treated by type of treatment	Mass		
	3. Number of treatment and disposal facilities by type of treatment	Number		
	4. Capacity of industrial waste treatment and disposal facilities	Volume		
	d. **Amount of recycled waste**	Mass	▪ By specific waste streams (e.g., e-waste, packaging waste, end of life vehicles) ▪ By waste category ▪ National ▪ Sub-national	
	e. Imports of waste	Mass	▪ By waste category (e.g., chemical waste, municipal waste, combustion waste, etc.)	
	f. Exports of waste	Mass		
	g. Imports of hazardous waste	Mass		
	h. Exports of hazardous waste	Mass		

Table A.1: The Basic Set of Environment Statistics (continued)

Component 3: Residuals				
Sub-component 3.4: Application of Biochemicals				
Topic	**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 3.4.1: Application of biochemicals	a. Total amount of fertilizers used (also in 2.5.1.b and 2.5.3.b)	Area, Mass, Volume	▪ National ▪ Sub-national	▪ FAOSTAT database
	b. Total amount of pesticides used (also in 2.5.1.b and 2.5.3.b)	Area, Mass, Volume	▪ By ISIC economic activity (forestry, agriculture)	▪ FAOSTAT database
	c. *Total amount of pellets used (also in 2.5.2.e)*	Mass, Volume	▪ National ▪ Sub-national ▪ By ISIC economic activity (aquaculture)	
	d. *Total amount of hormones used (also in 2.5.2.e and 2.5.4.b)*	Mass, Volume	▪ National ▪ Sub-national ▪ By ISIC economic activity (aquaculture, livestock production)	
	e. *Total amount of colourants used (also in 2.5.2.e)*	Mass, Volume	▪ National ▪ Sub-national ▪ By ISIC economic activity (aquaculture)	
	f. *Total amount of antibiotics used (also in 2.5.2.e and 2.5.4.b)*	Mass, Volume	▪ National ▪ Sub-national ▪ By ISIC economic activity (aquaculture, livestock production)	

Component 4: Extreme Events and Disasters				
Sub-component 4.1: Natural Extreme Events and Disasters				
Topic	**Statistics and Related Information** (**Bold Text - Core Set/Tier 1**; Regular Text - Tier 2; *Italicized Text - Tier 3*)	**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
Topic 4.1.1: Occurrence of natural extreme events and disasters	a. Occurrence of natural extreme events and disasters:		• By event • National • Sub-national	▪ Centre for Research on the Epidemiology of Disasters Emergency Events Database (CRED EM-DAT) ▪ Economic Commission for Latin America and the Caribbean (UNECLAC) Handbook for Estimating the Socio-economic and Environmental Effects of Disasters
	1. **Type of natural disaster** (geophysical, meteorological, hydrological, climatological, biological)	Descriptive		
	2. **Location**	Location		
	3. Magnitude (where applicable)	Intensity		
	4. Date of occurrence	Date		
	5. Duration	Time period		
	6. Hazard prone areas	Area		
	7. Population living in hazard prone areas	Number		
Topic 4.1.2: Impact of natural extreme events and disasters	a. People affected by natural extreme events and disasters			
	1. **Number of people killed**	Number		
	2. Number of people injured	Number		
	3. Number of people homeless	Number		
	4. Number of people affected	Number		
	b. **Economic loss due to natural extreme events and disasters** (e.g., damage to buildings, transportation networks, loss of revenue for businesses, utility disruption, etc.)	Currency	• By event • By ISIC economic activity • National • Sub-national • By direct and indirect damage	
	c. Physical loss/damage due to natural extreme events and disasters (e.g., area and amount of crops, livestock, aquaculture, biomass etc.)	Area, Descriptive, Number		
	d. Effects of natural extreme events and disasters on integrity of ecosystems		• By event • By ecosystem • National • Sub-national	
	1. *Area affected by natural disasters*	Area		
	2. *Loss of vegetation cover*	Area		
	3. *Area of watershed affected*	Area		
	4. *Other*	Descriptive		
	e. *External assistance received*	Currency	• By event • National	

Component 4: Extreme Events and Disasters				
Sub-component 4.2: Technological Disasters				
Topic	**Statistics and Related Information**	**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
Topic 4.2.1: Occurrence of technological disasters	a. Occurrence of technological disasters		▪ By event	▪ CRED EM-DAT
	1. Type of technological disaster (industrial, transportation, miscellaneous)	Descriptive	▪ By ISIC economic activity	▪ UNECLAC: Handbook for Estimating the Socio-economic and Environmental Effects of Disasters
	2. *Location*	Location	▪ National	
	3. *Date of occurrence*	Date	▪ Sub-national	
	4. *Duration*	Time period		
Topic 4.2.2: Impact of technological disasters	a. People affected by technological disasters		▪ By event	
	1. Number of people killed	Number	▪ National	
	2. *Number of people injured*	Number	▪ Sub-national	
	3. *Number of people homeless*	Number		
	4. *Number of people affected*	Number		
	b. Economic loss due to technological disasters (e.g., damage to buildings, transportation networks, loss of revenue for businesses, utility disruption, etc.)	Currency	▪ By event ▪ By ISIC economic activity	
	c. Physical loss/damage due to technological disasters (e.g., area and amount of crops, livestock, aquaculture, biomass etc.)	Area, Descriptive, Number	▪ National ▪ Sub-national ▪ By direct and indirect	
	d. Effects of technological disasters on integrity of ecosystems		▪ By event	
	1. *Area affected by technological disasters*	Area	▪ National	
	2. *Loss of vegetation cover*	Area	▪ Sub-national	
	3. *Area of watershed affected*	Area		
	4. *Other (e.g., for oil spills: volume of oil released into the environment, impact on ecosystem)*	Descriptive		
	e. *External assistance received*	Currency	▪ By event ▪ National	

Component 5: Human Settlements and Environmental Health				
Sub-component 5.1: Human Settlements				
Topic	**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 5.1.1: Urban and rural population	a. Total population living in urban areas	Number	▪ Urban ▪ Rural	▪ UN Population Division ▪ UN Population Fund (UNFPA)
	b. Total population living in rural areas	Number		
	c. Total urban area	Number		
	d. Total rural area	Number		
Topic 5.1.2: Access to water, sanitation and energy	a. **Population using an improved drinking water source**	Number	▪ Urban ▪ Rural ▪ National ▪ Sub-national	▪ UNSD: MDG Indicator 7.8 and 7.9 Metadata ▪ UN-Water ▪ UNSD: Environment Statistics Section - Water Questionnaire ▪ WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation
	b. **Population using an improved sanitation facility**	Number		
	c. Population served by municipal waste collection	Number		
	d. **Population connected to wastewater collection**	Number	▪ By treatment type (e.g., primary, secondary, tertiary) ▪ National ▪ Sub-national	▪ UNSD: IRWS ▪ ISIC Rev. 4, Section E, Division 35 and 36 ▪ UNSD: Environment Statistics Section -Water Questionnaire
	e. **Population connected to wastewater treatment**	Number		
	f. Population served by water supply industry	Number		
	g. Population with access to electricity	Number		
Topic 5.1.3: Housing conditions	a. Urban population living in slums	Number		▪ UN Habitat ▪ UNSD: MDG Indicator 7.10 Metadata
	b. *Houses in zones vulnerable to particular environmental health issues, natural extreme events and disasters*	Number	▪ Urban ▪ Rural ▪ National ▪ Sub-national	
	c. *Population living in a precarious dwelling*	Number		
	d. *Population living in informal settlements*	Number		
	e. *Homeless population*	Number		
	f. *Number of dwellings with adequacy of building materials defined by national or local standards*	Number		

Table A.1: The Basic Set of Environment Statistics (continued)

	Component 5: Human Settlements and Environmental Health			
	Sub-component 5.1: Human Settlements			
Topic	**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 5.1.4: Exposure to ambient pollution related to spatial location of population	a. Population exposed to air pollution (e.g., SO$_2$, NO$_X$, O$_3$) in main cities	Number	▪ By pollutant (e.g., SO$_2$, NOx, O$_3$)	▪ WHO
	b. *Population exposed to noise pollution in main cities*	Number		
Topic 5.1.5: Environmental concerns specific to urban settlements	a. Extent of urban sprawl	Area		▪ UN Habitat ▪ WHO ▪ UNEP Urban Environment Unit
	b. Available green areas	Area		
	c. **Number of private and public vehicles**	Number	▪ By type of engine or type of fuel	
	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. *Existence of urban planning and zoning regulations and instruments in main cities*	Descriptive		
	h. *Effectiveness of urban planning and zoning regulations and instruments in main cities*	Descriptive		

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Table A.1: The Basic Set of Environment Statistics (continued)

Component 5: Human Settlements and Environmental Health				
Sub-component 5.2: Environmental Health				
Topic	**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 5.2.1: Airborne diseases and conditions	a. Airborne diseases and conditions (e.g., upper and lower respiratory disease, obstructive pulmonary disease, asthma and allergic rhinitis):		▪ By disease or condition ▪ National ▪ Sub-national ▪ Urban ▪ Rural ▪ By gender ▪ By age group ▪ By time period	▪ WHO
	1. Incidence	Number		
	2. Prevalence	Number		
	3. *Loss of work days*	Number		
	4. *Estimates of economic cost in monetary terms*	Currency		
Topic 5.2.2: Water-related diseases and conditions	a. Water-related diseases and conditions (e.g., diarrhoeal disease, gastroenteritis and water borne parasite infections):			
	1. **Incidence**	Number		
	2. **Prevalence**	Number		
	3. **Mortality**	Number		
	4. *Loss of work days*	Number		
	5. *Estimates of economic cost in monetary terms*	Currency		
Topic 5.2.3: Vector borne diseases	a. Vector borne diseases (e.g., malaria, dengue fever, yellow fever and Lyme disease):			
	1. **Incidence**	Number		
	2. **Prevalence**	Number		
	3. **Mortality**	Number		
	4. *Loss of work days*	Number		
	5. *Estimates of economic cost in monetary terms*	Currency		
Topic 5.2.4: Health problems associated with excessive UV radiation exposure	a. Problems associated with excessive UV radiation exposure (e.g., skin cancer, cataracts):			
	1. *Incidence*	Number		
	2. *Prevalence*	Number		
	3. *Loss of work days*	Number		
	4. *Estimates of economic cost in monetary terms*	Currency		

Table A.1: The Basic Set of Environment Statistics (continued)

Component 5: Human Settlements and Environmental Health				
Sub-component 5.2: Environmental Health				
Topic	**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 5.2.5: Toxic substance- and nuclear radiation-related diseases and conditions	a. Toxic substance- and nuclear radiation-related diseases and conditions		▪ By category of toxic substance ▪ By disease or condition ▪ National ▪ Sub-national ▪ Urban ▪ Rural ▪ By gender ▪ By age group	▪ WHO
	1. Incidence	Number		
	2. Prevalence	Number		
	3. *Loss of work days*	Number		
	4. *Estimates of economic cost in monetary terms*	Currency		

Component 6: Environment Protection, Management and Engagement

Sub-component 6.1: Environment Protection and Resource Management Expenditure

Topic	Statistics and Related Information (Bold Text - Core Set/Tier 1; Regular Text - Tier 2; 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		▪ By environmental activity ▪ By ministry ▪ National ▪ Sub-national ▪ By funding	▪ Classification of Environmental Activities (CEA) ▪ SEEA Central Framework (2012) Annex 1 ▪ Eurostat - SERIEE Environmental Protection Expenditure Accounts Compilation Guide
	1. **Annual government environment protection expenditure**	Currency		
	2. Annual government resource management expenditure	Currency		
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		▪ By environmental activity ▪ By ISIC economic activity ▪ National ▪ Sub-national	
	1. Annual corporate environment protection expenditure	Currency		
	2. *Annual corporate resource management expenditure*	Currency		
	3. *Annual non-profit institution environment protection expenditure*	Currency		
	4. *Annual non-profit institution resource management expenditure*	Currency		
	5. *Annual household environment protection expenditure*	Currency		
	6. *Annual household resource management expenditure*	Currency		

Table A.1: The Basic Set of Environment Statistics (continued)

	Component 6: Environment Protection, Management and Engagement			
	Sub-component 6.2: Environmental Governance and Regulation			
Topic	**Statistics and Related Information** (Bold Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
Topic 6.2.1: Institutional strength	a. Environmental institutions and their resources		▪ National ▪ Sub-national	
	1. Name of the main environmental authority/agency and year of establishment	Descriptive		
	2. Annual budget of main environmental authority/agency	Currency		
	3. Number of staff of main environmental authority/agency	Number		
	4. List of environmental departments in other ministries/agencies and year of establishment	Descriptive		
	5. Annual budget of environmental departments in other ministries/agencies	Currency		
	6. Number of staff of environmental departments in other ministries/agencies	Number		
Topic 6.2.2: Environmental regulation and instruments	a. Direct regulation		▪ Per media (e.g., water, air, land, soil, oceans) ▪ By ISIC economic activity ▪ National ▪ Sub-national	
	1. **List of regulated pollutants and description** (e.g., by year of adoption and maximum allowable levels)	Descriptive, Number		
	2. Description (e.g., name, year established) of licensing system to ensure compliance with environmental standards for businesses or other new facilities	Descriptive		
	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*	Descriptive, Value		
	2. *List and description (e.g., year of establishment) of environmentally relevant subsidies*	Descriptive, Value		
	3. *List of eco-labelling and environmental certification programmes*	Descriptive		
	4. Emission permits traded	Number, Value		
Topic 6.2.3: Participation in MEAs and environmental conventions	a. Participation in MEAs and other global environmental conventions			▪ Secretariats of MEAs
	1. **List and description (e.g., year of participation[(d)] of country) of MEAs and other global environmental conventions**	Descriptive, 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: accession, acceptance, approval, formal confirmation, ratification, and succession. Countries or areas who have signed but not become party to the agreements under a given convention or treaty are not considered to be participating.

Component 6: Environment Protection, Management and Engagement				
Sub-component 6.3: Extreme Event Preparedness and Disaster Management				
Topic	**Statistics and Related Information** (Bold Text - Core Set/Tier 1; Regular Text - Tier 2; Italicized Text - Tier 3)	**Category of Measurement**	**Potential Aggregations and Scales**	**Methodological Guidance**
Topic 6.3.1: Preparedness for natural extreme events and disasters	a. National natural extreme event and disaster preparedness and management systems		▪ National ▪ Sub-national	▪ International Emergency Management Organization (IMEO) ▪ The United Nations Office for Disaster Risk Reduction (UNISDR) ▪ Hyogo Framework for Action
	1. Existence of national disaster plans/programmes	Descriptive		
	2. Description (e.g., number of staff) of national disaster plans/programmes	Descriptive		
	3. Number and type of shelters in place or able to be deployed	Descriptive, Number		
	4. *Number and type of internationally certified emergency and recovery management specialists*	Descriptive, Number		
	5. *Number of volunteers*	Number		
	6. *Quantity of first aid, emergency supplies and equipment stockpiles*	Number		
	7. *Existence of early warning systems for all major hazards*	Descriptive		
	8. *Expenditure on disaster prevention, preparedness, clean-up and rehabilitation*	Currency		
Topic 6.3.2: Preparedness for technological disasters	a. National technological disaster preparedness and management systems			
	1. *Existence and description (e.g., number of staff) of public disaster management plans/programmes (and private when available)*	Descriptive		
	2. *Expenditure on disaster preparedness, clean-up and rehabilitation*	Currency		

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

Annex B: Developments since 1984

B.1 A number of relevant policy and conceptual developments have occurred since the original FDES was published. 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, but also have either used or proposed a specific conceptualization about 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,[71] 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 a development framework.

B.3 Subsequent to the work of that Commission, the United Nations Conference on Environment and Development (UNCED), or the Rio Summit, held in June 1992 gave rise to a fresh round of interest and this time, policy directive 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

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[71] See the "Report of the World Commission on Environment and Development":
http://daccess-dds-ny.un.org/doc/UNDOC/GEN/N87/184/67/IMG/N8718467.pdf?OpenElement.

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;[72]

    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 also came into being as a direct result of the Rio Summit. These "Rio Conventions" are:

    i. The United Nations Framework Convention on Climate Change (UNFCCC), with the objective of stabilizing greenhouse gas (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 was opened for signature at the Rio Summit and 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 was adopted as a direct recommendation of the 1992 Rio Summit. UNCCD 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 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[73], 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.

B.6 The next follow-up conference, the United Nations Conference on Sustainable Development, Rio+20, was held in Rio de Janeiro, Brazil, in June 2012. The outcome of the Conference, titled "The Future We Want" (A/CONF.216/L.1) contains six sections: Our common vision; Renewing political commitment; Green economy in the context of sustainable development

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[72] UN, "Report of the United Nations Conference on Environment and Development", Rio de Janeiro, 3-14 June 1992, Annex I. Available from http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm (accessed 30 October 2012).
[73] UN, "Report of the World Summit on Sustainable Development", Johannesburg, South Africa, 26 August - 4 September 2002. Available from http://www.johannesburgsummit.org/html/documents/summit_docs/131302_wssd_report_reissued.pdf (accessed 16 October 2012).

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 take decisions on designating a body to operationalize the 10-year framework of programmes on sustainable consumption and production; determining the modalities for the Third International Conference on Small Island Developing States (SIDS), which is to convene in 2014; identifying the format and organizational aspects of the high-level forum, which is to replace the Commission on Sustainable Development (CSD); strengthening the United Nations Environment Programme (UNEP); constituting a working group to develop global Sustainable Development Goals (SDGs) to be agreed by the UNGA; establishing an intergovernmental process under the UNGA to prepare a report proposing options on an effective sustainable development financing strategy; and considering 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 Advancing the conceptual development 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 aspects of sustainable development.

B.8 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.9 Twenty years after Rio, and 28 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 international levels.

B.10   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 greenhouse gases around the earth "thicker." [74] The United Nations Framework Convention on Climate Change (Framework Convention) has affirmed that climate change is one of the greatest challenges of our time.[75] 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.11   Arising out of the Framework Convention was the Kyoto Protocol, an international agreement whose major feature is that it sets binding targets for 37 industrialized countries and the European community for reducing GHG emissions (as of mid-2011), rather than simply encouraging them to attain these goals, as is the case with the Framework Convention. 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.12   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

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[74] UNFCCC, "Climate Change Information Sheet 1". Available from http://unfccc.int/essential_background/background_publications_htmlpdf/climate_change_information_kit/items/60.php (accessed 12 November 2012).
[75] UNFCCC, "Background on the UNFCCC: The international response to climate change". Available from http://unfccc.int/essential_background/items/6031.php (accessed 14 November 2012).

iv. Promote and cooperate in research and systematic observations of the climate system, including through support to existing international programmes and networks.

B.13 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, concentration changes to radiative forcing, and forcing to climate change. This will go a long way in solidifying analysis and assessment in this area of the environment.

B.14 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 or sequences of climate change such as contributing emissions, mitigation, impact and adaptation. Generally, the 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.

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; but the policy aspect and the supporting information that must inform it also remain pressing requirements that need to be confronted with a view to integration and coherence.

Monitoring the Millennium Development Goals (MDGs)

B.16 The framework for monitoring MDGs is intended as a tool to follow up on the Millennium Declaration of 2000. 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.

B.17   Proposals and work from delegations to Rio+20 have been put forward to produce an after 2015 initiative on new global SDGs, which will possibly be structured through a framework similar to that of the MDG, that is, containing a hierarchy of goals, targets and indicators aimed at measuring progress at different levels. These proposals were discussed and agreed upon in the Rio+20 deliberations, but are not expected to be launched until after 2015, when the MDG goals were committed to be attained globally.

Beyond GDP, Green Economy and Green Growth

B.18   Continuing with developments relating to environment statistics, at the beginning of 2008, the Stiglitz 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, the Gross Domestic Product (GDP), was not in itself a sufficient guide for modern policy making to cover social and environmental objectives.   Among its recommendations, the Stiglitz Report[76] 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 our 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.19   Complementing the concept of sustainable development are two initiatives, "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,[77] "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. It 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

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[76] See Recommendation 12 of the "Report by the Commission on the Measurement of Economic Performance and Social Progress", Joseph E. Stiglitz, Amartya Sen, Jean-Paul Mitosis. Available from http://www.stiglitz-sen-fitoussi.fr/documents/rapport_anglais.pdf (accessed 20 October 2012).
[77] UNEP, "Measuring Progress Towards an Inclusive Green Economy". Available from http://www.unep.org/greeneconomy/Portals/88/documents/research_products/Measuring%20Progress%20report.pdf (accessed 30 January 2013).

intensive production, lower waste and pollution and significantly lower GHG emissions." 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.20   Core 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.21   Green growth, a strategy for achieving sustainable development, emphasizes the implementation of policies that promote environmentally sustainable economic progress and foster low-carbon, socially inclusive development at the same time.[78] The OECD elaborates that "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".[79] Essentially, green growth occurs when economies progress on a path of sustainable development, food security and poverty alleviation, towards a green economy. Proposed groups of indicators for this concept are the following:

    i. Indicators for monitoring the environmental and resource productivity of production and consumption;

    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.

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[78] UNEP, "Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication". Available from http://www.grida.no/publications/green-economy/ (accessed 10 October 2012).
[79] OECD, "Towards Green Growth: Monitoring Progress - OECD Indicators". Available from http://www.oecd.org/greengrowth/towardsgreengrowthmonitoringprogress-oecdindicators.htm (accessed 4 October 2012).

B.22   In terms of conceptual approaches that can go beyond academic pursuits and show potential for organizing environment statistics, there are two conceptual approaches. 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.23   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 can be divided into three principal categories: natural resource stocks, land and ecosystems. Natural capital provides goods and essential functions to the economy, as well as services to humans and to other living beings.

B.24   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.

B.25   This approach incorporates the stock concept of natural capital as well as a flow concept of provision of services. Long term economic growth and sustainability depend on both of these factors which are critical to the survival of humankind and other species.

B.26   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 the System of Environmental-Economic Accounting (SEEA), which provides a useful statistical framework to measure natural capital using the asset and the physical flow accounts.

B.27   Furthermore, a task force of UNECE/Eurostat/OECD[80] has been working to develop
        statistics of sustainable development based on a general capital approach. The work of the
        Joint UNECE/Eurostat/OECD Task Force on Measuring Sustainable Development (TFSD) is
        implicitly linked to and inspired by other initiatives such as GDP and Beyond (European
        Commission), Progress of Societies (OECD) and the Sponsorship Group for Progress, Well-
        being and Sustainable Development (Eurostat/INSEE). The work of the TFSD aims to
        provide not only statistical offices but also international organizations and the public with the
        latest scientific and statistical methods for measuring sustainable development and a system
        of sustainable development indicators (SDIs) is proposed based on a general capital approach.
        The TFSD noted that "A combination of academic insights and practical data availability
        results in a list of sustainability themes and suggested ideal indicators", but advise that when
        assessing data availability, "in many cases no ideal indicators can be found, in most cases
        good proxies are available. A thorough survey of the data availability indicates that most
        indicators (i.e., the proxies) can be derived from the existing datasets". The resulting SDIs are
        presented in two different ways: "The conceptual dashboard stresses the main trade-offs of
        human wellbeing 'here and now', 'elsewhere' and 'later', while the policy dashboard
        organizes the data in a more straightforward manner and classifies them along the lines of
        classic policy domains".

B.28   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, probably
        because of the immaturity of the diverse methods available for valuing ecosystem stocks and
        services. 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.29   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

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[80] The Joint UNECE/Eurostat/OECD Working Group on Statistics for Sustainable Development (WGSSD) had been launched by the Conference of European Statisticians (CES) in 2005, to develop a framework based on the capital theory, and identifying a small set of sustainable development indicators. The outcome of this work is presented in the publication on Measuring Sustainable Development issued in 2009. A new Task Force, the Joint UNECE/Eurostat/OECD Task Force on Measuring Sustainable Development (TFSD) was then created to further pursue the conceptual development of the capital approach and identify indicators for presenting the long-term dimension of sustainable development, in addition to furnishing indicators that could present quality of life and distributional characteristics.

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.30   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,[81] 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.31   The ecosystem approach has been used mostly for integrated natural resources management[82] (forests, river basins, etc.) and more recently for integrated assessment purposes.

B.32   The assessment perspective has been implemented in the Millennium Ecosystem Assessment called for by the United Nations in 2001. The Millennium Ecosystem Assessment[83] 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 we are running short of stocks and when the fabric of life is being compromised.

B.33   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 emphasis. These reporting categories contain a number of

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[81] Convention on Biological Diversity, COP 5 Decision V/6, paragraph A.1. Available from http://www.cbd.int/decision/cop/?id=7148 (accessed 23 November 2012).

[82] The decision by the Fifth Conference of the Parties to the Convention on Biological Diversity has highlighted one example of the management aspect of the ecosystem approach. This approach espouses a number of interlinked and complementary principles in its implementation. In particular this decision called for the management imperatives of: decentralization; management of land, water and living resources as a matter of societal choice; recognition of the effects of the ecosystem's activities on adjacent ecosystems; and managing optimally in an economic context, but managing with a view to conservation within the limits of the ecosystem's structure and functions. Yet other of its stated principles called for the ecosystem approach to be undertaken at the appropriate spatial and temporal scale, and for the setting of long term objectives that could take account of lag-effects. This implementation of the ecosystem approach also called for an awareness of the context within which the ecosystem functions, namely, that change should be expected and that information relevant for its implementation could be found in varied forms, including in scientific, indigenous and local knowledge, innovations and practices. Finally, an overarching principle of the ecosystem approach is that it should be implemented inclusively, involving all relevant sectors of society and scientific disciplines.

[83] 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 Well-being: Synthesis. Island Press, Washington, DC. Available at http://www.millenniumassessment.org/documents/document.356.aspx.pdf (accessed 9 August 2012)).

ecosystems, and they are not mutually exclusive, as their areas can and do overlap. Ecosystems within each reporting category[84] 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,[85] 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.34   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. Delineation of 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.

B.35   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.36   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

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[84] These categories, that are also denominated systems, are used throughout the Millennium Ecosystem Assessment's reports; i.e. see Table 1.1 in page 31 of Ecosystems and Human Well-being: Synthesis, 2005, *Op. cit.*
[85] *Idem.*

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".[86]

B.37   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

B.38   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 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.39   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 Stress-Response Environmental Statistical System (S-RESS)".[87] The stress-response approach relates a set of activities that exert stress on the

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[86] UNEP, "Our Planet, September 2010". Available from http://www.unep.org/pdf/OP_sept/2010/EN/OP-2010-09-EN-FULLVERSION.pdf (accessed 5 August 2012).
[87] Rapport, David and Friend, Anthony, Statistics Canada, "Towards a Comprehensive Framework for Environment Statistics: a Stress-response Approach", (Ottawa, 1979), p. 80.

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.

B.40   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.[88]

B.41   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.[89] 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.42   Another of the environmental frameworks that has been widely used since the development of the FDES is the Pressure-State-Response (PSR) framework. The PSR is itself an

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[88] UNSD Expert Group Meeting on the Revision of the FDES, "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 2012).

[89] UNSD, "A Framework for the Development of Environment Statistics", (1984). Available at http://unstats.un.org/unsd/environment/fdes.htm (accessed 18 October 2012). UNSD, "Concepts and Methods of Environment Statistics: Human Settlements Statistics". Available at http://unstats.un.org/unsd/publication/SeriesF/SeriesF_51E.pdf (accessed 18 October 2012). "Concepts and Methods of Environment Statistics: Statistics of the Natural Environment". Available at http://unstats.un.org/unsd/publication/SeriesF/SeriesF_57E.pdf (accessed 18 October 2012).

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.[90]

B.43   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 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.[91] 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.44   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.[92] 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 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 (hence D-S-R framework), where "driving force" represented human activities, processes or patterns that impact on sustainable development; "state" indicators provide information on the condition of sustainable development and "response" indicators represented societal actions aimed at moving towards sustainable development.

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[90] See Environment Monographs, No. 83, OECD Core set of indicators for Environmental Performance Reviews, OECD, Paris 1993

[91] UNSD Expert Group Meeting on the Revision of the FDES, "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 2012).

[92] This was established by the UN General Assembly in December 1992 to ensure effective follow-up of United Nations Conference on Environment and Development (UNCED), known as the Rio Summit. The Commission has been responsible for reviewing progress in the implementation of Agenda 21 and the Rio Declaration on Environment and Development; as well as for providing policy guidance to follow up the Johannesburg Plan of Implementation at the local, national, regional and international levels. See Division for Sustainable Development, UN Department of Economic and Social Affairs, http://www.un.org/esa/dsd/csd/csd_aboucsd.shtml

B.45   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.46   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-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.47   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.48   The Driving force-Pressure-State-Impact-Response framework (DPSIR) is yet another framework that attempts to provide a logical organization to the different components of the environment:[93] Following are its components:

> D - **Driving forces** are 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.

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[93] See Environmental Indicators: Typology and Use in Reporting, Chapter 3.1, Peder Gabrielson and Peter Bosch, European Environment Agency, August 2003

B.49   Here, Driving forces are the social, demographic and economic developments in societies and the corresponding changes in life styles 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 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 presents data on the impact of the change of the state of the environment on the foregoing factors. 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.50   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.51   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)

(Based on Chapters 1 and 2 of the System of Environmental-Economic Accounting Central Framework)[94]

B.52   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)[95] recommended that countries implement environmental-economic accounts at the earliest date.

B.53   In response, the United Nations Statistical Division (UNSD) published the handbook of national accounting – Integrated Environmental and Economic Accounting (UN 1993)[96], 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.54   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 (UNSC) 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.55   The publication, Integrated Environmental and Economic Accounting – An Operational Manual (UN 2000)[97], 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 organisations). 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.56   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

[94] United Nations, 2012. *System of Environmental-Economic Accounting*. White cover publication, pre-edited text subject to official editing. https://unstats.un.org/unsd/envaccounting/White_cover.pdf
[95] UN "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 2012).
[96] UN, "Integrated Environmental and Economic Accounting (interim version)". Available from http://unstats.un.org/unsd/publication/SeriesF/SeriesF_61E.pdf (accessed 17 October 2012).
[97] UN, "Integrated Environmental and Economic Accounting – An Operational Manual". Available from http://unstats.un.org/unsd/publication/SeriesF/SeriesF_78E.pdf (accessed 21 October 2012).

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

B.57   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 Statistical Commission agreed at its thirty-eighth session in February 2007 to start a second revision process with the aim of adopting the SEEA as an international statistical standard for environmental-economic accounting within five years. This process was managed under the auspices of the then newly formed United Nations Committee of Experts in 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 Central Framework represents the major outcome of the process.

B.58   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 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.59   A second area of work is focused on accounting for the environment from the perspective of ecosystems and will be presented in SEEA Experimental Ecosystem Accounts. This part will describe the measurement of the flow of benefits to humanity provided by ecosystems, and measurement of environmental conditions in terms of the capacity of ecosystems to provide benefits. The SEEA Experimental Ecosystem Accounts will not be a statistical

standard but will provide a consistent and coherent summary of the state of the art of using a systems approach to the measurement of ecosystems within a broad framework that can be related to the SEEA Central Framework. The SEEA Experimental Ecosystem Accounts will provide the basis for countries to advance the implementation of ecosystem accounts using terms and concepts which facilitate the comparison of statistics and the exchange of experiences. The SEEA Experimental Ecosystem Accounts will describe both the measurement of ecosystems in physical terms, and the valuation of ecosystems in so far as it is consistent with market valuation principles, noting that only those issues for which broad consensus has emerged will be included. In accounting terms, many of the structures for ecosystem accounting will be drawn from the structures in the SEEA Central Framework and, in this regard, the accounting conventions of the SEEA Central Framework will be applied consistently.

B.60   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 Extensions and Applications will be developed. SEEA Extensions and Applications will present various monitoring and analytical approaches that could be adopted, and will describe ways in which SEEA data can be used to inform policy analysis. It will not be a statistical standard. Topics being considered for inclusion include resource efficiency and productivity indicators, decomposition analysis, analysis of net wealth and depletion, sustainable production and consumption, structural input-output analysis and general equilibrium modelling, consumption based input-output analysis and footprint techniques, analysis using geospatially referenced data, and extensions to link SEEA based information to social and demographic data sets.

B.61   The SEEA Central Framework covers the interactions between the economy and the environment following an accounting structure similar to that of the System of National Accounts (SNA) and uses concepts, definitions and classifications consistent with the SNA. A satellite account of the central SNA, the SEEA 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 framework 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.62   The SEEA Central Framework 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.63   The strength of the Central Framework comes from: (i) using consistent definitions for different types of stocks and flows; (ii) defining the different economic units and locations in the same way; and (iii) using consistent classifications for physical and monetary accounts.

B.64   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.

Annex C: Multilateral Environmental Agreements

C.1 This Annex presents the most relevant multilateral environmental agreements as they relate to the field of environment statistics.

The Basel Convention[98]

C.2 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.

C.3 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" (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;
   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.4 Since its entry into force, compliance requirements have dictated that the reporting needs for this Convention continue to centre on the generation, export and import of hazardous waste. As such these remain pressing data requirements.

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[98] Secretariat of the Basel Convention. Available from http://www.basel.int (accessed 30 November 2012).

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

C.5 The Rotterdam Convention is a multilateral treaty to promote shared responsibilities during the process of importation of hazardous chemicals.[99] 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 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.6 National reporting on the Rotterdam Convention, by Designated National Authorities, was developed to help in the identification of formulations meeting the criteria for inclusion in the Rotterdam Convention and to provide a clear description of incidents related to the use of severely hazardous pesticide formulations, including their adverse effects and the way in which the formulations were used.[100]

The Stockholm Convention on Persistent Organic Pollutants (POPs)

C.7 The Stockholm Convention[101] 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. Co-signatories agree to outlaw nine of the "dirty dozen" chemicals identified, limit the use of DDT to malaria control, and curtail inadvertent production of dioxins and furans.

C.8 POPs are defined 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".[102] In 1995, the Governing Council of UNEP called for global action to be taken on POPs.

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[99] Text of the Rotterdam Convention. Available from http://www.pic.int/TheConvention/Overview/TextoftheConvention/tabid/1048/language/en-US/Default.aspx (accessed 24 November 2012).
[100] Secretariat for the Rotterdam Convention, "Guidance to Designated National Authorities on the operation of the Rotterdam Convention" (Rome/Geneva 2004). Available from http://www.fao.org/docrep/007/y5423e/y5423e0a.htm (accessed 24 November 2012).
[101] Text on the Stockholm Convention on POPs. Available from http://chm.pops.int/Convention/ConventionText/tabid/2232/language/en-GB/Default.aspx (accessed 25 November 2012).
[102] UNEP, "Persistent Organic Pollutants". Available from http://www.chem.unep.ch/pops/ (accessed 4 August 2012).

C.9 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 (dirty dozen) pollutants and the nine additional new pollutants, as well as to listed chemicals.

C.10 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.[103] The intent is that these synergies would foster sound chemicals management of the relevant pollutants over their life-cycles.

The Convention on Biological Diversity (CBD)

C.11 The CBD entered into force on 29 December 1993.[104] 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. Following are the stated strategic goals of the Convention:
   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 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

C.12 CITES is an international agreement between governments.[105] Its aim is to ensure that 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

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[103] Text on the Stockholm Convention on POPs. Available from http://chm.pops.int/Portals/0/Repository/COP4/UNEP-POPS-COP.4-19.English.PDF (accessed 3 August 2012).
[104] Text of the Convention on Biological Diversity. Available from http://www.cbd.int/convention/text (accessed 3 August 2012).
[105] 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 2012).

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. 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.

The Convention on Migratory Species (CMS)

C.13   The CMS[106] or Bonn Convention is an intergovernmental treaty that aims to conserve terrestrial, aquatic and avian migratory species throughout their range. 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.14   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.

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[106] Text of the Convention on Migratory Species. Available from http://www.cms.int/documents/convtxt/cms_convtxt.htm (accessed 7 August 2012).

C.15   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.

World Heritage Convention

C.16   A 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.[107]

C.17   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.

Montreal Protocol[108]

C.18   The chief aim of the Montreal Protocol on Substances that Deplete the Ozone Layer is to reduce and eventually eliminate the production and use of man-made Ozone Depleting Substances (ODSs). 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 ODSs. National monitoring and reporting focuses on accurate tracking of transboundary shipments of ODSs.[109] A number of UNEP Ozone indicators[110, 111] are used for tracking the production and consumption of ODSs under the Montreal Protocol.

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[107] UNESCO, World Heritage Convention. Available from http://whc.unesco.org/en/convention/ (accessed 6 August 2012).
[108] Text of the Montreal Protocol on Substances that Deplete the Ozone Layer. Available from http://ozone.unep.org/pdfs/Montreal-Protocol2000.pdf (accessed 6 August 2012).
[109] UNIDO, "Manual on operations under multilateral environmental agreements, Montreal Protocol on substances that deplete the ozone layer and Stockholm Convention on persistent organic pollutants", Introduction, pg 5. Available from http://www.unido.org/fileadmin/user_media/Publications/Pub_free/Manual_on_operations_under_multilateral_environmental_agreements.pdf (accessed 7 August 2012).
[110] UNEP, "Data reporting and access". Available from http://ozone.unep.org/Data_Reporting/ (accessed 7 August 2012). New Ozone depleting substances reported by Parties Decisions. Available from http://ozone.unep.org/Data_Reporting/New_Ozone-Depleting_Substances_that_have_been_reported_by_the_Parties.shtml (accessed 7 August 2012).
[111] UNEP, "Production and Consumption of Ozone Depleting Substances under the Montreal Protocol 1986-2004", (2005), http://ozone.unep.org/Publications/Production_and_consumption2005.pdf (accessed 7 August 2012).

C.19   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 ODSs as one of its indicators on which reporting should be done.

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

C.20   The Ramsar Convention is an international treaty for the conservation and sustainable utilisation of wetlands.[112] Signed in 1971, it is an intergovernmental treaty that provides a framework for national action and international cooperation. 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'). 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.[113]

United Nations Convention to Combat Desertification (UNCCD)

C.21   The UNCCD, particularly in Africa, 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.[114]

C.22   The Convention, stemming from a direct recommendation of Agenda 21, was adopted in Paris in June 1994 and entered into force in December 1996.[115] 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. The core set of impact indicators used for monitoring purposes are:[116]

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[112] Text of the Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat. Available from http://www.ramsar.org/cda/en/ramsar-documents-texts/main/ramsar/1-31-38_4000_0 (accessed 8 August 2012).
[113] International Expert Workshop on the 2010 Biodiversity Indicators and Post-2010 Indicator Development pg 4-5, (3 February 2011). Available from http://www.cbd.int/doc/meetings/ind/emind-02/official/emind-02-08d-en.pdf (accessed 4 November 2012).
[114] Text of the United Nations Convention to Combat Desertification. Available from http://www.unccd.int/en/about-the-convention/Pages/Text-overview.aspx (accessed 5 November 2012).
[115] UN "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 2012).
[116] Report of the Conference of the Parties on its ninth session September to October 2009 ICCD/COP(9)/18/Add.1, Annex 1. Available from http://www.unccd.int/cop/officialdocs/cop9/pdf/18add1eng.pdf (accessed 22 October 2012).

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.

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

C.23　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.[117] 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. UNCLOS came into force in 1994.

C.24　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.25　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.[118] 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:[119]

i. Yield-related indicators such as Catches, Catch value, Pelagic/Demersal ratio (P/D);

ii. Capacity-related indicators such as Fishing effort, Fishing intensity, etc;

iii. Other economic indicators such as Investment, Level of subsidies, etc;

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[117] 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 2012).
[118] United Nations Convention on the Law of the Sea. Available from http://www.un.org/Depts/los/convention_agreements/convention_overview_convention.htm (accessed 17 October 2012).
[119] FAO, Land quality indicators and their use in sustainable agriculture and rural development, Indicators of Sustainable Development of Fisheries, Appendix 2. Available from http://www.fao.org/docrep/W4745E/w4745e0f.htm (accessed 18 October 2012).

iv. Technological indicators such as Lists of acceptable gear, etc;

v. Social indicators such as Coastal populations and Ratio between fisheries and other revenues, etc; and

vi. Institutional indicators such as Percent of fisheries covered by measurement committees.

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

C.26 The UNFCCC has the goal of preventing "dangerous" human interference with the climate system. Its immediate objectives included beginning "to consider what can be done to reduce global warming and to cope with whatever temperature increases are inevitable".[120] 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, Parties to the Convention submit national GHG inventories to the Climate Change secretariat GHG Inventory data categories are:

i. Energy;

ii. Industrial processes;

iii. Solvent and other product use;

iv. Agriculture;

v. Land Use, Land-Use Change and Forestry (LULUCF)

vi. Waste; and

vii. Other.

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[120] UNFCCC, Essential Background, The Convention and the Protocol. Available from http://unfccc.int/essential_background/items/2877.php (accessed 19 October 2012).

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.

D.2 Considerable work has been done by FAO and partner agencies including UNEP and the European Environment Agency 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 Central Framework.[121] These 14 classes have been generated using the Land Cover Classification System (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: SEEA Land Cover Classification based on FAO LCCS (interim)
1 Artificial surfaces (including urban and associated areas)
2 Herbaceous crops
3 Woody crops
4 Multiple or layered crops
5 Grassland
6 Tree covered areas
7 Mangroves
8 Shrub covered areas
9 Shrubs and/or herbaceous vegetation, aquatic or regularly flooded
10 Sparsely natural vegetated areas
11 Terrestrial barren land
12 Permanent snow and glaciers
13 Inland water bodies
14 Coastal water bodies and inter-tidal areas

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[121] United Nations, 2012. "System of Environmental-Economic Accounting". White cover publication, pre-edited text subject to official editing. Available from https://unstats.un.org/unsd/envaccounting/White_cover.pdf (accessed 20 December 2012).

D.3 A reference framework for the classification of land use is provided in the SEEA Central
Framework[122] as agreed after a comprehensive global consultation process. The development
of the land use classification included in the SEEA, led by the FAO, has been based on
practices already in use in major international and national land use databases adjusted to
meet the different needs which have arisen during the global consultation process on this
issue.

Table D.2: SEEA Land Use Classification (interim)		
1. Land		
1.1 Agriculture	1.1.1 Land under temporary crops	1.1.1.1 Cereals
		1.1.1.2 Vegetables and melons
		1.1.1.3 Temporary oilseed 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 temporary meadows and pastures	
	1.1.3 Land with temporary fallow	
	1.1.4 Land under permanent crops	1.1.4.1 Fruit and nuts
		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 permanent meadows and pastures	1.1.5.1 Cultivated permanent meadows and pastures
		1.1.5.2 Naturally grown permanent meadows and pastures
	1.1.6 Agricultural land under protective cover	
1.2 Forestry	1.2.1 Forest land	1.2.1.1 Primary regenerated forest
		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 aquaculture	1.3.1 Land use for hatcheries	
	1.3.2 Managed grow-out sites on land	

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[122] United Nations, 2012. "System of Environmental-Economic Accounting". White cover publication, pre-edited text subject to official editing.
Available from https://unstats.un.org/unsd/envaccounting/White_cover.pdf (accessed 20 December 2012).

	1.4.1 Mining and quarrying
	1.4.2 Construction
1.4 Use of built up and related areas	1.4.3 Manufacturing
	1.4.4 Technical infrastructure
	1.4.5 Transport and storage
	1.4.6 Commercial, financial, and public services
	1.4.7 Recreational facilities
	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	

D.4 The Classification of Environmental Protection Activities (CEPA) has been in place since 2000, covering the classes of activities pertaining to environment protection. Subsequent work to develop an overarching Classification for Environmental Activities (CEA) that incorporates the CEPA and an interim listing of resource management activities has been undertaken. The CEA classification has been developed as part of the SEEA Central Framework.[123]

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[123] United Nations, 2012. "System of Environmental-Economic Accounting". White cover publication, pre-edited text subject to official editing. Available from https://unstats.un.org/unsd/envaccounting/White_cover.pdf (accessed 20 December 2012).

Table D.3: Classification of Environmental Activities		
I. Environmental Protection		
1. Protection of ambient air and climate	1.1 Prevention of pollution through in-process modifications	1.1.1 for the protection of ambient air
		1.1.2 for the protection of climate and ozone layer
	1.2 Treatment of exhaust gases and ventilation air	1.2.1 for the protection of ambient air
		1.2.2 for the protection of climate and ozone layer
	1.3 Measurement, control, laboratories and the like	
	1.4 Other activities	
2. Wastewater management	2.1 Prevention of pollution though in-process modification	
	2.2 Sewerage networks	
	2.3 Wastewater treatment	
	2.4 Treatment of cooling water	
	2.5 Measurement, control, laboratories and the like	
	2.6 Other wastewater management activities	
3. Waste management	3.1 Prevention of pollution through in-process modifications	
	3.2 Collection and transport	
	3.3 Treatment and disposal of hazardous waste	3.3.1 Thermal treatment
		3.3.2 Landfill
		3.3.3 Other treatment and disposal
	3.4 Treatment and disposal of non-hazardous waste	3.4.1 Incineration
		3.4.2 Landfill
		3.4.3 Other treatment and disposal
	3.5 Measurement, control, laboratories and the like	
	3.6 Other waste management activities	
4. Protection and remediation of soil, groundwater and surface water	4.1 Prevention of pollutant infiltration	
	4.2 Cleaning up of soil and water bodies	
	4.3 Protection of soil from erosion and other physical degradation	
	4.4 Prevention and remediation of soil salinity	
	4.5 Measurement, control, laboratories and the like	
	4.6 Other activities	
5. Noise and vibration abatement (excluding workplace protection)	5.1 Preventive in-process modifications at the source	5.1.1 Road and rail traffic
		5.1.2 Air traffic
		5.1.3 Industrial and other noise
	5.2 Construction of anti noise/vibration facilities	5.2.1 Road and rail traffic
		5.2.2 Air traffic
		5.2.3 Industrial and other noise
	5.3 Measurement, control, laboratories and the like	
	5.4 Other activities	

6. Protection of biodiversity and landscapes	6.1 Protection and rehabilitation of species and habitats	
	6.2 Protection of natural and semi-natural landscapes	
	6.3 Measurement, control, laboratories and the like	
	6.4 Other activities	
7. Protection against radiation (excluding external safety)	7.1 Protection of ambient media	
	7.2 Transport and treatment of high level radioactive waste	
	7.3 Measurement, control, laboratories and the like	
	7.4 Other activities	
8. Research and development for environmental protection	8.1 Protection of ambient air and climate	8.1.1 Protection of ambient air
		8.1.2 Protection of atmosphere and climate
	8.2 Protection of water	
	8.3 Waste	
	8.4 Protection of soil and groundwater	
	8.5 Abatement of noise and vibration	
	8.6 Protection of species and habitats	
	8.7 Protection against radiation	
	8.8 Other research on the environment	
9. Other environmental protection activities	9.1 General environmental administration and management	9.1.1 General administration, regulation and the like
		9.1.2 Environmental management
	9.2 Education, training and information	
	9.3 Activities leading to indivisible expenditure	
	9.4 Activities n.e.c.	
II. Resource management (Interim)		
10. Management of mineral and energy resources	10.1 Reduction of the intake of mineral and energy resources	
	10.2 Reduction of minerals use through the reduction of scraps and the production and the 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. Management of timber resources	11.1 Reduction of the intake of timber resources	
	11.2 Reduction of the consumption of forest (wood and non wood)-related products	
	11.3 Reforestation and afforestation	
	11.4 Forest fires	
	11.5 Measurement, control, laboratories and the like related to natural timber resources	
	11.6 Other activities for the management of timber resources	
12. Management of aquatic	12.1 Reduction of the intake of aquatic resources	
	12.2 Replenishment of aquatic resources stocks	

	12.3 Measurement, control, laboratories and the like related to aquatic resources	
	12.4 Other activities for the management of aquatic resources	
13. Management of other biological resources (excl. timber and aquatic resources)	13.1 Reduction of the intake of biological resources (excl. timber and aquatic resources)	
	13.2 Replenishment of biological resources stocks (excl. timber and aquatic resources)	
	13.3 Measurement, control, laboratories and the like related to biological resources stocks (excl. timber and aquatic resources)	
	13.4 Other activities for the management of biological resources (excl. timber and aquatic resources)	
14. Management of water resources	14.1 Reduction of the intake of water resources	
	14.2 Reduction of water losses and leaks, water reuse and savings	
	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 development activities for resource management	15.1 Mineral and energy resources	
	15.2 Timber resources	
	15.3 Aquatic resources	
	15.4 Other biological resources	
	15.5 Water resources	
	15.6 Other R&D activities for natural resource management	
16. Other resource management activities	16.1 General administration of natural resources	16.1.1 General administration, regulation and the like
		16.1.2 Environmental management
	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 Economic Commission for Europe (ECE) between 1989 and 1996 have been used extensively for international data collection. The ECE 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. ECE Standard Statistical Classification of Water Use (1989);

    ii. ECE Standard Statistical Classification of Marine Water Quality (1992) – See Table C.4;

    iii. ECE Standard Statistical Classification of Freshwater Quality for the Maintenance of Aquatic Life (1992) – See Table C.5;

    iv. ECE Standard Statistical Classification of Land Use (1989);

    v. ECE Standard Statistical Classification of Wastes (1989);

vi. ECE Standard Statistical Classification of Ambient Air Quality (1990) – See Table C.6;

vii. ECE 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 C.1-3). The following Tables 4-6 contain the ECE classifications that are still in use in environment statistics and have global relevance.

Table D.4: ECE Standard Statistical Classification of Marine Water Quality (1992)	
Oxygen regime *Major criteria: Oxygen content in marine bottom waters*	Class interpretation: Class I: Excellent oxygen conditions for the maintenance of aquatic life. 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 *Major criteria: Trophic state of marine surface water and the best available expert judgement regarding the impact of trophic state on aquatic life.*	Class interpretation: Class I: Oligotrophic Class II: Mesothrophic Class III: Slightly eutrophic Class IV: Strongly eutrophic Class V: Hypertrophic
Pollution by harmful substances *Major criteria: Toxicological impact on aquatic life as established by US-EPA.*	Class interpretation: Class I: Approximate natural level or very low background contamination. Class II: [To be determined in accordance with the absence of observable effects ('no observable effects') on aquatic life.] Class III: [To be determined in accordance with occurrence of lowest observable effects on aquatic life, not exceeding threshold levels in species.]

	Class IV: Chronic toxicity Class V: Acute toxicity
Pollution by radioactivity *Major criteria: [To be determined]*	<u>Class interpretation:</u> [To be determined]

Table D.5: ECE Standard Statistical Classification of Surface Freshwater Quality for the Maintenance of Aquatic Life (1992)

Oxygen regime *Oxygen content, together with presence of oxygen-demanding substances, and the impact of oxygen content levels on aquatic life*	<u>Class interpretation:</u> 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 *Major criteria: Trophic state and best available expert judgement regarding the impact of trophic state on aquatic life, maintaining consistency between the three variables*	<u>Class interpretation:</u> Class I: Clear, oligotrophic water with, at most, a very slight, occasional anthropogenic pollution with organic matter. Low nutrient content, provides spawning grounds for salmonids. Class II: Slightly polluted, mesotrophic water receiving small discharges of organic matter. The loadings may 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 species do not occur permanently.
Acidification *Major criteria:* *Toxicological impact of acidity on aquatic life as established in US-EPA practices*	Class interpretation: Class I: The buffering capacity of the water is very good. Class II: The buffering capacity of the water is good. Class III: The buffering capacity is weak but keeps the acidity of the water at levels still suitable for most fish. Class IV: The buffering capacity is exceeded, leading to levels of acidity which affect the development of spawn. Class V: The water is without buffering capacity and its acidity is toxic for fish species.
Metals *Major criteria:* *Toxicological impact on aquatic life as established in US-EPA practices*	Class interpretation: 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	Class interpretation: Class I: Not applicable

hazardous substances	Class II: Not applicable
Major criteria: *Toxicological impact on aquatic life as established in US-EPA practices*	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.]

Table D.6: ECE Standard Statistical Classification of Ambient Air Quality (1990)

Chemicals and their relevance in measurement estimation
(E = emissions; C = concentrations; I = at impact stations; B = at national or regional background stations; G = at global background stations)

		E	CI	CB	**G**
1.	<u>Sulphur compounds</u>				
	1.1 Sulphur oxides (incl. emissions of hydrogen sulphide)	X	X	X	
	1.2 Particulate sulphate			X	X
2.	<u>Oxidized nitrogen compounds and oxidants</u>				
	2.1 NO$_X$ (excluding nitrous oxide)	X	X	X	
	2.2 Nitric acid and particulate nitrate		X	X	X
	2.3 Ozone - tropospheric			X	X
	- stratospheric				X
	2.4 Nitrous oxide (tropospheric)				X
3.	<u>Reduced nitrogen compounds</u>				
	3.1 Ammonia	X	X	X	
	3.2 Particulate ammonium compounds		X	X	X
4.	<u>Inorganic carbon compounds</u>				

		col1	col2	col3	col4
4.1	Carbon monoxide	X	X		X
4.2	Carbon dioxide	X			X
5.	Halogens and inorganic halogen compounds	X		X	
6.	Volatile organic compounds[124] (incl. halogenated compounds)				
6.1	Methane	X			X
6.2	Non-methane compounds				
6.2.1	Aldehydes	X	X	X	
6.2.2	CFCs	X			X
6.2.3	Halons	X			X
6.2.4	Other halogenated hydrocarbons	X			X
7.	Heavy metals (to be specified)	X	X	X	
8.	Suspended particulate matter	X	X	X	X
9.	Chemical composition of precipitation water			X	X

Emissions [tons/year]
1. Emissions from stationary sources

    1.1   By process

        1.1.1   Combustion of fuels
            1.1.1.1   In power plants
            1.1.1.2   In industrial establishments, excl. power plants
            1.1.1.3   In other economic activities and domestic heating

        1.1.2   Other processes, incl. evaporation
            1.1.2.1   In industrial sources
            1.1.2.2   In non-industrial and domestic sources

    1.2   By activity

        1.2.1   Agricultural etc. (ISIC 01)
        1.2.2   Mining and quarrying (ISIC 10-14)
        1.2.3   Manufacture of paper and paper products (ISIC 21)
        1.2.4   Manufacture of coke (ISIC 231)
        1.2.5   Manufacture of refined petroleum products (ISIC 232)
        1.2.6   Manufacture of chemicals and chemical products (ISIC 24)
        1.2.7   Manufacture of rubber and plastic products (ISIC 25)
        1.2.8   Manufacture of other non-metallic mineral products (ISIC/26)
    1.2.9 Manufacture of basic iron and steel (ISIC 271)

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[124] 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.

        1.2.10   Manufacture of basic precious and non-ferrous metal (ISIC/272)
        1.2.11   Electricity, gas, steam and hot water supply (ISIC 40)
        1.2.12   Other economic activities
        1.2.13   Households

    1.3   By availability of cleaning

        1.3.1   Without cleaning
        1.3.2   With cleaning or equivalent device

2.   <u>Emission from mobile sources</u>

    2.1   From road transport

        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_2]
- NO_X, excl. nitrous oxide [in units of NO_2]
- Ammonia
- Carbon monoxide
- Carbon dioxide [in units of CO_2]
- 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_2]

```
          2.1.2    Nitrogen oxides [expressed as NO₂]
          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 SO₂]
          2.2.2    Particulate sulphate
          2.2.3    Nitrogen oxides [expressed as NO₂]
          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
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Depositions

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    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.

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 (CRED) Emergency Disasters Database (EM-DAT). 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:

Table D.7: Record for individual natural disaster occurrence	
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
	1.7 Appeal for international assistance
2. Type of natural disaster	2.1 Disaster sub-group
	2.2 Disaster main type

Table D.8: CRED EM-DAT general classifications[125]					
Disaster Sub-group		**Disaster Main Type**		**Disaster Subtype**	
1	**Geophysical**	1.1	Earthquake	1.1.1	Ground Shaking
				1.1.2	Tsunami
		1.2	Volcano	1.2.1	Volcanic eruption
		1.3	Mass movement (dry)	1.3.1	Rockfall
				1.3.2	Avalanche
				1.3.3	Landslide
				1.3.4	Subsidence
2	**Meteorological**	2.1	Storm	2.1.1	Tropical Storm
				2.1.2	Extra-Tropical cyclone (winter storm)
				2.1.3	Local / Convective Storm
3	**Hydrological**	3.1	Flood	3.1.1	General river flood
				3.1.2	Flash flood
				3.1.3	Storm surge/coastal flood

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[125] CRED, EM-DAT, "Classification". Available from http://www.emdat.be/classification (accessed 7 January 2013).

		3.2	Mass Movement (wet)	3.2.1	Rockfall
				3.2.2	Debris flow
				3.2.3	Debris avalanche
				3.2.4	Sudden Subsidence
				3.2.5	Long-lasting subsidence
4	**Climatological**	4.1	Extreme Temperatures	4.1.1	Heat Wave
				4.1.2	Cold Wave
				4.1.3	Extreme winter conditions
		4.2	Drought	4.2.1	Drought
		4.3	Wild fire	4.3.1	Forest fire
				4.3.2	Land fires (grass, scrub, bush, etc.)
5	**Biological**	5.1	Epidemic	5.1.1	Viral infectious diseases
				5.1.2	Bacterial infectious diseases
				5.1.3	Parasitic infectious diseases
				5.1.4	Fungal infectious diseases
				5.1.5	Prion infectious diseases
		5.2	Insect infestation	5.2.1	Type of insect
		5.3	Animal stampede	5.3.1	Type of animal

D.7 Through its World Commission on Protected Areas (WCPA), the International Union for Conservation of Nature (IUCN) has provided the international guidelines on the categorisation of protected areas for nearly a quarter of a century.[126] These categories are internationally recognised and facilitate a global system 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.

| Table D.9 Classification of protected areas	
Ia: Strict Nature Reserve	Category Ia are strictly protected areas set aside to protect biodiversity 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.

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[126] UNEP, IUCN Management Categories. Available from http://www.unep-wcmc.org/iucn-protected-area-management-categories_591.html (accessed 6 January 2013).

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 Monument or Feature	Category III protected areas are set aside to protect a specific natural monument, which can be a landform, sea mount, submarine cavern, 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 Management Area	Category IV protected areas aim to protect particular species or 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 Landscape/Seascape	A protected area where the interaction of people and nature over time has produced an area of distinct character with significant ecological, 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 with sustainable use of natural resources	Category VI protected areas conserve ecosystems and habitats, together with associated cultural values and traditional natural 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.

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.[127]

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[127] IUCN, Red List. Available from http://www.iucnredlist.org/documents/redlist_cats_crit_en.pdf (accessed 14 January 2013).

Figure D.1: Structure of the categories
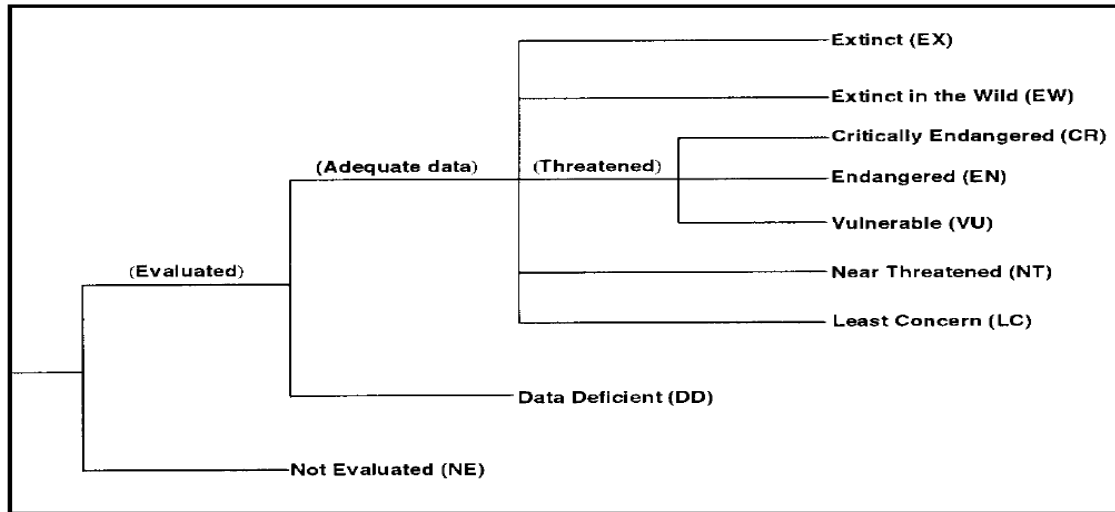
Source: IUCN Red List Categories and Criteria Version 3.1

Glossary
(Under development.)