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

Annexes

Prepared by the United Nations Statistics Division

The following is a modified version of the group of Annexes that were originally proposed for inclusion in the FDES. Two of the original Annexes: Annex D: Geospatial information and Annex F: The institutional dimension of environment statistics, have been deleted (as their content largely repeated discussions already provided in the text). Additionally, improvements have been made to the text of the other Annexes. As a result, the references to the Annexes may not be correct. Accordingly, please review these Annexes for their usefulness as supplementary documentation. All references will be corrected once the document is finalized.

Draft as of 25 September 2012 – Subject to Revision

Table of Contents

Annex A: Developments since 1984 3

Annex B: Multilateral environment agreements 25

Annex C: Sources of environment statistics 33

Annex D: Classifications and environment statistics 40

Annex A: Developments since 1984

A.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 A 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

A.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,[1] 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.

A.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

[1] 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.

degradation where 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;[2]

ii. The Statement of Forest Principles exhorting all countries to make an effort to "green the world" (through reforestation and forest conservation).

A.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.

A.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[3] and the Plan of Implementation of the World Summit on Sustainable Development, 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,

[2] Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992, Annex I.
[3] Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August - 4 September 2002, Johannesburg Declaration on Sustainable Development

social development and environmental protection, at the local, national, regional and global levels.

A.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 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.

A.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.

A.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.

A.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.

Climate Change

A.10 According to prevailing science,[4] "warming of the climate system is unequivocal".[5] The United Nations Framework Convention on Climate Change (Framework Convention)[6] has affirmed that climate change is one of the greatest challenges of our time.[7] 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.

A.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

[4] 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." (See "Climate Change science", UNFCCC, http://unfccc.int/essential_background/feeling_the_heat/items/2902.php).The resulting increase in global temperatures is altering the complex web of systems such as cloud cover, rainfall, wind patterns, ocean currents, and the distribution of plant and animal species that allow life to thrive on earth. With regard to the greenhouse effect and the carbon cycle, more of the sun's energy is being trapped in the atmosphere, and much more of the world's carbon (in the form of carbon dioxide) is resting in the air rather than in trees, soil, and subterranean deposits.

[5] UNFCCC, Framework Convention on Climate Change, Report of the Conference of the Parties on its sixteenth session, Cancun, 29 November – 10 December 2010

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

[7] http://unfccc.int/2860.php, See United Nations Framework Convention on Climate Change, Essential Background

(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.

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

A.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.

A.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 national statistical offices (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.

A.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)

A.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.

A.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

A.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[8] 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.

A.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 the UNEP Green Economy Report,[9] "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 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.

A.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:

[8] 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, http://www.stiglitz-sen-fitoussi.fr/documents/rapport_anglais.pdf
[9] See "Green Economy, How is a Green Economy Defined", United Nations Environment Programme

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.

A.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.[10] 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".[11] 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.

The natural capital and ecosystem approaches

A.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.

[10] UNEP, "Towards a green economy: Pathways to Sustainable Development and Poverty Eradication", 2011
[11] OECD, Towards Green Growth: Monitoring progress, OECD Indicators, 2011

Following is a short discussion of the basic principles of each of these two well-established lines of reasoning.

Natural Capital Approach

A.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.

A.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.

A.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.

A.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.

A.27 Furthermore, a task force of UNECE/Eurostat/OECD[12] 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".

A.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.

[12] First was the Working Group on Statistics for Sustainable Development (WGSSD) launched by the Conference of European Statisticians (CES) in 2005, mainly to develop a framework based on the capital theory, and charged with identifying a small set of sustainable development indicators. The CES Bureau reviewed the final report of the WGSSD in 2008, and thought it necessary to further elaborate some aspects of their work. Therefore a new Task Force was created, the Joint UNECE/Eurostat/OECD Task Force on Measuring Sustainable Development (TFSD), it aims to inform the CES, in 2012, on how to further pursue the conceptual development of the capital approach and how to 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.

A.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 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

A.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,[13] 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.

A.31 The ecosystem approach has been used mostly for integrated natural resources management[14] (forests, river basins, etc.) and more recently for integrated assessment purposes.

A.32 The assessment perspective has been implemented in the Millennium Ecosystem Assessment called for by the United Nations in 2001. The Millennium Ecosystem Assessment[15] 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.

[13] Convention on Biological Diversity, COP 5 Decision V/6, Section A paragraph 1

[14] 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.

[15] 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, - Ecosystems and Human Well-being, http://www.maweb.org/en/Framework.aspx).

A.33 The Millennium Ecosystem Assessment did not present a matrix for organizing their findings, but used 10 ecosystem categories for reporting, each one containing a number of ecosystems. The reporting categories are not mutually exclusive as their areas can and do overlap. Ecosystems within each reporting category share a suite of biological, climatic and social factors that tend to differ across categories. Within each category, 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 for the global assessment, showed potential first as a possible structuring set of ecosystem types, and finally as a rich conceptual construct[16] behind the structure of the revised FDES.

A.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.

A.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

[16] The Millennium Ecosystem Assessment states that "People and ecosystems are bound together by the strands of a web of life that is both resilient and complex" (Millennium Ecosystem Assessment, p.5) and adds that "Ecosystems are the productive engines of the natural world, providing us with food, water, and the fiber used for clothing, paper and lumber. Yet accelerating human demand's for nature's goods and services are degrading nature's capacity to provide them" (Millennium Ecosystem Assessment, p.5).

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.

A.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 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".[17]

A.37 The revised FDES 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

A.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.

[17] UNEP, Our Planet, September 2010

The Stress-Response framework and its derivates

A.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)".[18] The stress-response approach relates a set of activities that exert stress on the environment (such as waste generation, extraction of natural resources and the production of hazardous substances) to the following data categories:

i. Measures of stressors, that is, of human and natural activities which possess the potential to degrade the quality of the natural environment, to affect the health of man, to threaten the survival of species, to place pressures on non-renewable resources, and to cause a deterioration in the quality of human settlements;
ii. Measures of stress, that is, of the elements that place pressures on and contribute to the breakdown of the natural and human-made environment such as the emission of pollutants;
iii. Measures of environmental response, that is, of the observed effects of stress on the natural and human-made environment;
iv. Measures of collective and individual response, that is, of human's reactions to environmental changes such as environmental protection and conservation; and
v. Measures of stocks, that is of the stocks of natural resources, human-made structures and potentially hazardous substances.

A.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.[19]

A.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

[18] See Statistics Canada, Towards a comprehensive Framework for Environment Statistics: a Stress-response approach, (Ottawa, 1979), p. 80.
[19] Criteria for a conceptual framework for developing environment statistics, Robert Smith and Michael Bordt, Statistics Canada.

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.[20] One important shortcoming of the FDES was that practitioners and users could assume linearity in the relationships among the different stages of the sequence.

A.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 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.[21]

A.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.[22] PSR frameworks also tend to suggest or at least have been interpreted as stating linear relationships in the human activity-environment

[20] The Framework for the Development of Environment Statistics, which was published by the United Nations in 1984 and followed by two methodological publications Statistics of the Natural Environment and Human Settlements Statistics.

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

[22] See Criteria for a conceptual framework for developing environment statistics, Robert Smith and Michael Bordt, Statistics Canada

interaction. This serves to obstruct the view of more complex relationships in ecosystems and in environment-economy interactions.

A.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.[23] 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.

A.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.

A.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

[23] 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

chapters, its strength was that it managed to better satisfy its original intent by putting more emphasis on policy-oriented topics.

A.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.

A.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:[24] 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.

A.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

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

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.

A.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.

A.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)[25]

A.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

[25] 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

capacity. Shortly afterwards, in 1992, the recommendations of the UN Conference on Environment and Development "Earth Summit" contained in Agenda 21 (UN 1992) recommended that countries implement environmental-economic accounts at the earliest date.

A.53 In response, the United Nations Statistical Division (UNSD) published the handbook of national accounting – Integrated Environmental and Economic Accounting (UN 1993), 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.

A.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.

A.55 The publication, Integrated Environmental and Economic Accounting – An Operational Manual (UN 2000), 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.

A.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 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.

A.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.

A.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.

A.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.

A.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.

A.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.

A.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.

A.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.

A.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 B: Multilateral Environmental Agreements

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

The Basel Convention[26]

B.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.

B.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.

B.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.

[26] http://www.basel.int, Secretariat of the Basel Convention

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

B.5 The Rotterdam Convention is a multilateral treaty to promote shared responsibilities during the process of importation of hazardous chemicals.[27] 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.

B.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.[28]

The Stockholm Convention on Persistent Organic Pollutants (POPs)

B.7 The Stockholm Convention[29] 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.

B.8 In 1995, the Governing Council of UNEP called for global action to be taken on POPs, which it 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".

[27] http://www.pic.int/TheConvention/Overview/TextoftheConvention/tabid/1048/language/en-US/Default.aspx, Text of the Rotterdam Convention

[28] http://www.fao.org/docrep/007/y5423e/y5423e0a.htm, Guidance to Designated National Authorities on the operation of the Rotterdam Convention, Secretariat for the Rotterdam Convention, Rome/Geneva 2004

[29] http://chm.pops.int/Convention/ConventionText/tabid/2232/language/en-GB/Default.aspx, Text on the Stockholm Convention on POPs

B.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.

B.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.[30] 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)

B.11 The CBD entered into force on 29 December 1993.[31] 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)

B.12 CITES is an international agreement between governments.[32] Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their

[30] http://chm.pops.int/Portals/0/Repository/COP4/UNEP-POPS-COP.4-19.English.PDF, Text on the Stockholm Convention on POPs
[31] http://www.cbd.int/convention/text, Text of the Convention on Biological Diversity
[32] http://www.cites.org/eng/disc/text.php, Text of the Convention on International Trade in Endangered Species of Wild Fauna and Flora

survival. The trade is diverse, ranging from live animals and plants to a vast array of wildlife products derived from them. Levels of exploitation of some animal and plant species are high and the trade in them, together with other factors, such as habitat loss, is capable of heavily depleting their populations and even bringing some species close to extinction. Many wildlife species in trade are not endangered, but the existence of an agreement to ensure the sustainability of the trade is important in order to safeguard these resources for the future. Because the trade in wild animals and plants crosses borders between countries, efforts to regulate it require international cooperation to safeguard certain species from over-exploitation. CITES provides varying degrees of protection to more than 30,000 species of animals and plants, whether or not they are traded as live specimens. CITES entered into force on 1 July 1975. Countries adopt their own domestic legislation to ensure that CITES is implemented at the national level. 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)

B.13 The CMS[33] 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.

B.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

[33] http://www.cms.int/documents/convtxt/cms_convtext.htm, Text of the Convention on Migratory Species

development of models tailored according to the conservation needs throughout the migratory range is a unique capacity of CMS.

B.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

B.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.[34]

B.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[35]

B.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.[36] A

[34] http://whc.unesco.org/en/convention/, World Heritage Convention UNESCO
[35] http://ozone.unep.org/pdfs/Montreal-Protocol2000.pdf, Text of the Montreal Protocol on Substances that Deplete the Ozone Layer
[36] 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.
http://www.unido.org/fileadmin/user_media/Publications/Pub_free/Manual_on_operations_under_multilateral_environmental_agreements.pdf, 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.

number of UNEP Ozone indicators[37, 38] are used for tracking the production and consumption of ODSs under the Montreal Protocol.

B.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)

B.20 The Ramsar Convention is an international treaty for the conservation and sustainable utilisation of wetlands.[39] 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.[40]

United Nations Convention to Combat Desertification (UNCCD)

B.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.[41]

B.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.[42] 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

[37] http://ozone.unep.org/Data_Reporting/; http://ozone.unep.org/Data_Reporting/New_Ozone-Depleting_Substances_that_have_been_reported_by_the_Parties.shtml, New Ozone depleting substances reported by Parties Decisions (8 February 2011)
[38] Source: UNEP Production and Consumption of Ozone Depleting Substances under the Montreal Protocol 1986-2004 (2005), TOC http://ozone.unep.org/Publications/Production_and_consumption2005.pdf (List and data available)
[39] http://www.ramsar.org/cda/en/ramsar-documents-texts/main/ramsar/1-31-38_4000_0__, Text of the Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat.
[40] Source: International Expert Workshop on the 2010 Biodiversity Indicators and Post-2010 Indicator Development pg 4-5 http://www.cbd.int/doc/meetings/ind/emind-02/official/emind-02-08d-en.pdf (3 February 2011)
[41] http://www.unccd.int/en/about-the-convention/Pages/Text-overview.aspx,, Text of the United Nations Convention to Combat Desertification
[42] http://www.un.org/esa/dsd/agenda21/, Agenda 21

and decentralization - the backbone of good governance and sustainable development. The core set of impact indicators used for monitoring purposes are:[43]

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)

B.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.[44] 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.

B.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).

B.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.[45] Following are the fishery-related UNCLOS

[43] http://www.unccd.int/cop/officialdocs/cop9/pdf/18add1eng.pdf, Source: Report of the Conference of the Parties on its ninth session September to October 2009 ICCD/COP(9)/18/Add.1, Annex 1
[44] http://www.un.org/Depts/los/convention_agreements/texts/unclos/unclos_e.pdf, Text of the United Nations Convention on the Law of the Sea.
[45] http://www.un.org/Depts/los/convention_agreements/convention_overview_convention.htm, United Nations Convention on the Law of the Sea.

sustainability indicators which have been posited by the FAO for monitoring of this Convention. The fishery-related indicators are:[46]

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;
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

B.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”.[47] 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.

[46] http://www.fao.org/docrep/W4745E/w4745e0f.htm, Land quality indicators and their use in sustainable agriculture and rural development, Indicators of Sustainable Development of Fisheries, Appendix 2
[47] http://unfccc.int/essential_background/items/2877.php, UNFCCC, Essential Background, The Convention and the Protocol

Annex C: Sources of environment statistics

C.1 The main data sources used for the production of environment statistics are listed in Chapter 1, paragraph 1.35 as follows:

i. Statistical surveys;
ii. Administrative records;
iii. Estimates and modelling;
iv. Monitoring systems;
v. Remote sensing
vi. Scientific research; and
vii. Projects and special studies.

C.2 Annex C will review the main characteristics, advantages and disadvantages of these data sources and the related data types.[48]

Statistical surveys

C.3 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, i.e., in which data are collected from a portion of the population of interest and not the whole population.[49]

C.4 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.

C.5 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, there is usually limited space available for additional questions in existing surveys; the survey frame, stratification of the population and sampling selection may not be ideal for environment statistics; and respondents may not be familiar with environmental terms nor the information needed to answer environment-related questions.

[48] Based on *International Recommendations for Water Statistics*, United Nations, 2012, http://unstats.un.org/unsd/envaccounting/irws/irwswebversion.pdf
[49] International Statistical Institute, *The Oxford Dictionary of Statistical Terms*, Yadolah Dodge, ed. (Oxford University Press, 2003)

C.6 Examples of adding environment-related questions to surveys primarily intended to collect data on other topics are: adding questions on water supply, sanitation, waste removal, environment-related health issues or questions on environmental concerns to population and housing censuses; or adding questions on environment protection expenditures to enterprise surveys etc.

C.7 Environment-specific surveys can be censuses or sample surveys. The advantages of using environment specific surveys are that: the survey frame and sampling used can be selected according to the requirements of environment statistics; consistent concepts and definitions can be used in survey questions; 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, 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.

C.8 Examples of environment-specific surveys are: surveys of establishments engaged in water supply, wastewater treatment or waste removal and treatment; or surveys on water abstraction, use and reuse by economic units etc.

Administrative records

C.9 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, as well as different information about them 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 (such as various industry or services associations, environmental associations and groups etc), may be also of use in environment statistics.

C.10 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.

C.11 Examples of administrative records used in environment statistics are: government budgets; emission permits; permits for water abstraction and wastewater discharge; records of protected areas; cadastral maps of land parcels; records of civil society or humanitarian organizations on emergencies related to natural disasters etc.

Estimates and modelling, monitoring, remote sensing, research, projects and studies

C.12 Environment statistics rely to a high extent on scientific 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 (derived) data.

C.13 ***Measurements from field-monitoring stations*** are used in environment statistics to describe the qualitative (e.g., air, water or soil quality, or noise) and quantitative aspects (e.g., hydrological or meteorological characteristics) of the environment. The main advantages of these data are that they: are based on observations; are usually collected using scientific methods; are usually validated; are available as time series; and frequently use models to improve data quality.

C.14 The disadvantages of data from monitoring are the consequences of the fact that 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 large numbers of population affected. Therefore, the measurements will be location-specific and they will not allow for aggregation over space to arrive at measures of quality over larger territories.

C.15 ***Remote sensing*** makes it possible to collect data on dangerous or inaccessible areas. Remote sensing also replaces 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, 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 forest cover or land use, or to estimate populations of different animal species. These can

be mapped, imaged, tracked and observed. The process of remote sensing is also helpful for city planning and geomorphological surveying. Remote sensing, combined with sufficient field measurements, usually provides high quality data for environment statistics.

C.16 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.

C.17 ***Research data*** are collected by universities, other research agencies and organizations and 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, etc. Scientific research programmes focus on specific areas and the data collected and produced will depend on the focus of the research. Many research projects consist of one-time ***special studies***.

C.18 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.

C.19 The main advantages of using data from scientific research are that: these data are usually available for free or for low cost; they minimize response burden; they can be used to fill in data gaps; and they are useful to developing coefficients. However, they often use terms and definitions that differ from those used in statistics; access to microdata may be limited; metadata may be missing; often data are available only for case examples (i.e., limited areas or industries); and often data are available on a one-time basis.

C.20 The use of data from monitoring, remote sensing, modeling or other scientific methods in statistics will need scientific expertise and will necessitate the close collaboration of statisticians with experts of the different scientific fields.

C.21 *Table C.1: Types of sources of environment statistics and main characteristics*[50] 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.

[50] Adapted from UN ECLAC, Handbook 61, op cit.

Table C.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**	Although these are general purpose instruments, censuses may often include environmental aspects of areas inhabited by the population.	Drinking water supply Basic sanitation Housing quality Electricity connections to households	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 and business 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 in the universe of informants can be a concern	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 environment protection	High periodicity of production (annual, quarterly and even monthly) and thus high frequency of updating	Questionable quality of records in terms of lack of continuity, and insufficiency of metadata to ensure compatibility of series	Building statistical capacities in sectoral ministries and public services Requires stable national inter-institutional coordination

Estimates and modelling	Estimates made using different methods such as regression, modelling, simulation, scenarios, extrapolation and interpolation.	CO_2 emissions Degradation of natural resources	Can be used when it is not possible to monitor or gather information directly	Results may be questionable, depending on methodologies used	Require close collaboration of statisticians with experts of the different scientific fields
Monitoring systems	Includes various natural resource quality and pollution monitoring stations and systems, such as: Urban air pollution monitoring stations, surface water quality monitoring systems (principal rivers), 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)
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
Scientific research, projects and special studies	Their main purpose is usually to fill gaps in knowledge, assess effectiveness of different measures, to develop alternative policies, etc. Scientific research programmes focus on specific areas and the data collected and produced will depend on the focus of the research.	Leakage of pollutants from waste deposits Leakage from fertilizer and pesticide use Pollution of aquifers	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

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.[51] 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

[51] 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

D.3 A reference framework for the classification of land use is provided in the SEEA Central Framework[52] 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	

[52] 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

1.4 Use of built up and related areas	1.4.1 Mining and quarrying
	1.4.2 Construction
	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.[53]

[53] 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

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 resources	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 D.4*;
iii. ECE Standard Statistical Classification of Freshwater Quality for the Maintenance of Aquatic Life (1992) – See *Table D.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 D.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 D.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]*	Class interpretation: [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*	Class interpretation: Class I: Constant near-saturation of oxygen content. Insignificant presence of oxygen demanding substances from the point of view of aquatic life. Class II: The oxygen saturation of water is good. Oxygen demanding substances do not normally disturb oxygen saturation. Class III: Oxygen deficiencies may occur in the hypolimnion. The presence of oxygen-demanding substances risks sometimes considerable negative impacts on aquatic life through the reduction of oxygen content. Class IV: Oversaturation of oxygen or oxygen deficiency occur in the epilimnion and oxygen deficiencies are frequent in the hypolimnion, possibly owing to chronic problems with the presence of oxygen- demanding substances. Class V: Acute problems occur in oxygen regime, i.e. oversaturation or oxygen deficiency in the epilimnion, and oxygen deficiency leading to anaerobic conditions in

	the hypolimnion. The high level of presence of oxygen-demanding substances may equally cause acute oxygen deficiencies.
Eutrophication *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*	<u>Class interpretation:</u> 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*	<u>Class interpretation:</u> Class I: No anthropogenic pollution with inorganic

aquatic life as established in US-EPA practices	matter. Class II: Concentrations are below midpoint between natural and chronically toxic levels. Class III: Concentrations are above midpoint between natural and chronically toxic levels. Class IV: Excursions beyond chronic criteria concentrations occur, but do not establish chronically toxic conditions in terms of concentration levels, duration or frequency. Class V: Excursions beyond chronic criteria concentrations allow acutely toxic conditions in terms of concentration levels, duration or frequency.
Chlorinated micropollutants and other hazardous substances *Major criteria:* *Toxicological impact on aquatic life as established in US-EPA practices*	<u>Class interpretation:</u> Class I: Not applicable Class II: Not applicable Class III: Loadings are evident, but concentrations are below chronic and acute criteria levels. Class IV: Excursions beyond chronic criteria concentrations occur, but do not establish chronically toxic conditions in terms of concentration levels, duration or frequency. Class V: Excursions beyond chronic criteria concentrations allow acutely toxic conditions in terms of concentration levels, duration or frequency.
Radioactivity *Major criteria:* *Toxicological impact on aquatic life*	<u>Class interpretation:</u> [To be determined after experience is gained through data collection and interpretation.]

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.	Oxidized nitrogen compounds and oxidants					
	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.	Reduced nitrogen compounds					
	3.1	Ammonia	X	X	X	
	3.2	Particulate ammonium compounds		X	X	X
4.	Inorganic carbon compounds					
	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[54] (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

[54] 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.

1.1.1 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)
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. Emission from mobile sources

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 NO_2]
2.1.3 Carbon monoxide
2.1.4 VOCs (to be specified)
2.1.5 Lead
2.1.6 Mercury
2.1.7 Cadmium
2.1.8 Suspended particulate matter

2.2 Concentrations at national/regional background stations

2.2.1 Sulphur oxides [expressed as SO_2]
2.2.2 Particulate sulphate
2.2.3 Nitrogen oxides [expressed as NO_2]
2.2.4 Nitric acid and particulate nitrate
2.2.5 Ozone (tropospheric)
2.2.6 Ammonia
2.2.7 Particulate ammonium compounds
2.2.8 VOCs (to be specified)
2.2.9 Chemical composition of precipitation (pH/H+ ammonium, nitrate, chloride and sulphate ions, sodium, potassium, magnesium and calcium ions, conductivity)

2.3 Concentrations at global background stations

2.3.1 Ozone (stratospheric)
2.3.2 Carbon dioxide
2.3.3 Methane
2.3.4 CFCs
2.3.5 Halons
2.3.6 Nitrous oxide
2.3.7 Suspended particulate matter

Depositions

3.1 Wet acidifying deposition

3.1.1 Sulphur dioxide and sulphate expressed in sulphur content
3.1.2 Nitrogen dioxide, nitric acid and nitrate expressed in nitrogen content
3.1.3 Ammonia and ammonium compounds expressed in nitrogen content
3.1.4 pH/H+

Note: Other deposition indicators may be added, once their development is sufficiently advanced.

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[55]					
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
		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

[55] http://www.emdat.be/classification

				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.[56] 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.

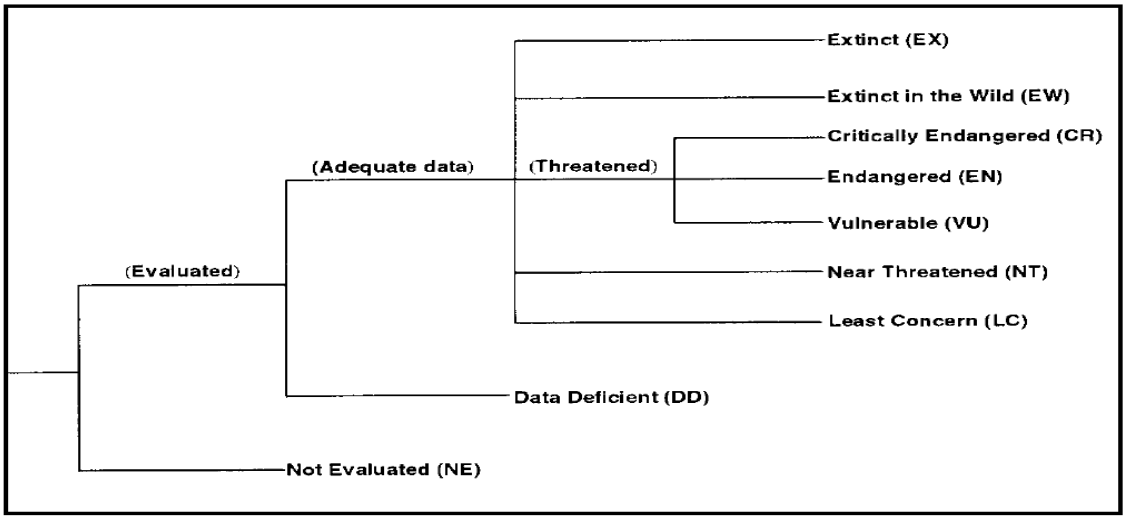
Table D.9 Classification of Protected Areas	
Ia: Strict Nature Reserve	Category Ia are strictly protected areas set aside to protect biodiversity and also possibly geological/geomorphological features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values. Such protected areas can serve as indispensable reference areas for scientific research and monitoring.
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

[56] http://www.unep-wcmc.org/iucn-protected-area-management-categories_591.html UNEP, IUCN Management Categories

	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.[57]

Figure 1 Structure of the categories



Source: IUCN Red List Categories and Criteria Version 3.1

[57] http://www.iucnredlist.org/documents/redlist_cats_crit_en.pdf IUCN, Red List