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Review of key concepts and analysis of explicit and implicit frameworks relevant to environment statistics

UNSD

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Introduction

These notes intend to analyze and synthesize relevant elements of different initiatives in environment statistics and related fields with a view to determining their usefulness and relevance in the revision of the Framework for the Development of Environment Statistics (FDES). The FDES will be used for developing and organizing basic environment statistics and their linkages with the economic and social dimensions. The analysis focuses on the implicit and explicit frameworks that organize the production and use of environmental statistics globally. The implicit and explicit frameworks and conceptual approaches which have been reviewed are, in general, wide in scope and do not only pertain to the environment statistics domain.

This review does not attempt to critically analyze every initiative that has been published globally. However, it does incorporate the documentation of the two Expert Group Meetings (EGM) that were held to discuss the FDES as well as reports to the Statistical Commission, along with selected relevant initiatives at the regional and global levels. **Policy** driven initiatives, environmental and related **assessment** initiatives and **statistical** initiatives linked to environment statistics complete its scope of inquiry.

Country specific work has not been reviewed because of time constraints, with the exception of the Canadian initiative which was presented at the Expert Group Meetings discussing the FDES and the State of the Nations Ecosystems USA 2008 which showcased wide coverage of different ecosystems within one territory. Also not under consideration in this document are theme-specific assessment and reporting frameworks (i.e forest, biodiversity, etc), for the same reasons.

These notes are offered as input to the Expert Group Meeting on the FDES of May 2011, as well as to the FDES revision process in general.

This review is a summary of a much more extensive background document with more detailed presentation of the surveyed initiatives and illustrations of their framework structure (see list in Annex I and background document “Notes on environmental policy, assessment and statistics initiatives relevant to the revision of the 1984 FDES”)

I. Global policy initiatives, their frameworks and derived statistical approaches and indicators

A. Sustainable Development Agenda

1. The **Rio Earth Summit in 1992**, its Agenda 21 and the subsequent Sustainable Development world summits have persisted in calling attention to the need to develop environmental information, indicators and integrated accounting to facilitate the monitoring of progress in the agreed actions. They have been less clear in making an explicit case for the need for basic environmental statistical series in order to facilitate measurement of the outcomes that they are seeking.

2. With regard to the framework in which the indicators of **Sustainable Development Indicators** have been presented, three clear stages can be distinguished. Originally in 1997, those indicators were presented in a framework containing Agenda 21 issues or themes as rows, along with three columns containing Driving Forces – State – Response (DF-S-R). This approach using the DF-S-R type of categories, which was presented in the original 1997 publication, was abandoned because countries and experts stated that although the approach could be useful within an environment context, it was not appropriate for the social, economic and institutional dimensions of sustainable development. Thus, in the revised handbook of 2001, a new theme-sub-theme arrangement was produced (within each of the classic economic, social, environmental and institutional pillars or dimensions). More recently (in 2007), a non-linear matrix-type of structure was adopted, where each indicator could be relevant for different dimensions and themes of SD. 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. 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.

3. With regard to **Rio+10**, the World Summit on Sustainable Development in Johannesburg, the emphasis was placed on various sustainable development themes, such as poverty eradication, changing unsustainable patterns of consumption and production and protecting the natural resource base. The institutional framework for sustainable development was also a focus of attention, establishing a different and complementary role for international and national institutions. Although environmental information, indicators and accounting are mentioned in the Plan of Implementation from Johannesburg, no specific and explicit discussion about the need for statistics could be found in the documentation.

4. **Rio + 20** (UN Conference on Sustainable Development – UNCSO 2012) will seek to: (a) secure renewed political commitment for sustainable development; (b) assess the progress and implementation gaps in meeting previously agreed commitments; and (c) address new and emerging challenges. The focus of the Conference includes the following themes which are to be discussed and refined during the preparatory process:

- (a) The green economy in the context of sustainable development and poverty eradication; and
- (b) The much needed institutional framework for sustainable development.

B. Monitoring the Millennium Development Goals

5. The framework for monitoring **Millennium Development Goals** 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 8 MD 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 4 targets and 10 indicators, of which only 2 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.

II. Global and regional environmental assessments and their frameworks

6. The **Millennium Ecosystem Assessment** (MEA, 2005) uses an innovative framework that considers both the ecosystem and its services (provisioning, regulating and cultural). It states that “People and ecosystems are bound together by the strands of a web of life that is both resilient and complex” (MEA 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” (MEA p.5). The MEA 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. The Reporting Categories of the MEA show potential to be considered in the revision of one axis of the FDES. MEA did not present a matrix for organizing their findings, but used 10 categories for reporting, each one containing a number of ecosystems. The MEA 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.

7. The **State of the Nations’ Ecosystem** report 2008 of the USA also innovated significantly in developing an assessment framework that was created specifically to present a complex set of indicators at a glance. In a final synthesis matrix, the columns present the main ecosystem types, while the rows contain the key ecosystem

characteristics for analysis (extent and pattern, chemical and physical characteristics, biological components and goods and services). Interestingly, in this approach a first indicator column has been structured that is not ecosystem specific. Instead, this structure accommodates nationally relevant cross-cutting information which is contained in the Core National Indicators.

8. The **Global (regional, national) Environment Outlooks (GEOs)**, led by the United Nations Environment Programme (UNEP), are produced using the DPSIR framework for analysis and involve stakeholders and collaborating academic and research centers 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.

III. Relevant global and regional statistical initiatives related to environment statistics

A. Examples of frameworks traditionally used for the organization of environment statistics and indicators

9. As has been documented before, the **FDES framework** containing a (implicit) **Pressure – State - Response** sequence in its columns has been used mostly by countries for organizing their indicators and statistics. It has also been proven useful at the regional level, for example in an Asian Pacific project conducted by the Asian Development Bank (ADB). It is primarily used to organize environment statistics and indicators. The FDES has been used extensively and adapted according to local and regional priorities.

10. At the regional level, the **Latin American and Caribbean** region developed a regional environment statistics database and yearbook organized in a **theme-sub-theme** structure facilitated by the Economic Commission for Latin America and the Caribbean (ECLAC). Also, indicators of sustainable development were developed for the Latin American and Caribbean Initiative for Sustainable Development (ILAC) (agreed upon after Rio +10 by the regions' Environmental Ministries Forum, facilitated by regional UNEP); the framework consisted of goals, indicative purposes and indicators.

11. Most international and multilateral agencies are currently using some form of the **DPSIR** framework to organize their production and dissemination of environmental compendia and indicator sets (OECD, EEA, etc). Multi-scale assessment efforts such as the Global Environment Outlook (GEO) processes also rely on DPSIR for structuring information. Within the DPSIR framework, most use basic media-type categories where European Environmental Agency (EEA) is working towards ecosystem categories, depending on the respective level of statistical development.

B. Measuring sustainable development

12. Most developed countries and multilateral agencies are working towards refining sets of environmental statistics and indicators that go **beyond the traditional metrics** for wellbeing, development and sustainable development. These latest developments in statistics are generally policy and demand driven. The advanced maturity of their statistical systems enables them to pursue more research and development activities.

13. Most developed countries and multilateral agencies, and particularly the **Stiglitz Commission**, are critical of the current capacity to provide adequate statistics on the state of the environment and particularly to provide the vital link to social and economic data. They tend to support the natural capital (along with other capital formation) approach, but understand its challenges (in terms of commensurability, valuation methods, and data insufficiency). A set of carefully developed indicators seems to be the second best used alternative.

14. The **Stiglitz Report** and other recent initiatives seem to have influenced the statistical programmes of work of the European Union and OECD countries, as can be seen from the recent documents being produced (See paragraph 18. below).

15. The recent **green economy** and green growth initiatives are derived from the multi-crises of the past years. The concept of green economy has been resisted by developing countries and now is one of the main themes of Rio+20, only if considered in the context of sustainable development and poverty eradication. The green economy has not been clearly defined and therefore neither a framework nor indicators for monitoring its progress have yet been determined.

16. The OECD indicators for the green growth strategy are still work-in-progress – this includes the framework and 5 types of indicators (*1: Indicators of environmental efficiency of production and changes in production patterns, 2: Indicators of environmental efficiency of consumption and changes in consumption patterns, 3: Indicators of stocks of natural capital and environmental quality, 4: Indicators of objective and subjective environmental quality of life, and 5: Indicators of responses by economic actors*). The work is carried out by the *Horizontal Task Force on Green Growth Indicators* (composed of OECD STD, ECO, ENV, STI, and IEA).

17. Two task forces of **UNECE/Eurostat/OECD** have been working to develop statistics of sustainable development based on a general capital approach. The 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.

18. Therefore a new **Task Force** was created, the Joint **UNECE/Eurostat/OECD** Task force on measuring sustainable development (TFSD). Its aim is 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. In its final report summary to the CES (draft as of March, 2011), the TFSD stated that they are 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, Wellbeing and Sustainable Development (Eurostat/INSEE). The report 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. Its measurement theory is based on a general capital approach. A system of sustainable development indicators (SDI) is proposed, but they caution that the work of the TFSD is of an academic nature and that it cannot be considered to lead to a statistical standard in the short run. They note 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 SDI is 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”.

19. As possibly one of the most important statistical developments in the field, the System of Integrated Environmental Economic Accounting (**SEEA**) is currently undergoing revision. The new SEEA (Volume 1) is expected to be elevated to an international statistical standard in 2012, at the same level as the System of National Accounts (SNA). The physical accounts have gained more importance in the development of the SEEA. Notably the SEEA 2012 has expanded the boundary of natural assets to include some, but not all of the elements that are not captured by the market. The SEEA is a satellite account of the central SNA, the accounting framework used worldwide to provide economic accounts that are comprehensive (in that all designated activities and the consequences for all agents in an economy are covered), consistent (identical values are used to establish the consequences of a single action on all parties concerned using the same accounting rules); and integrated (in that all the consequences of a single action by one agent are necessarily reflected in resulting accounts, including the impact on measurement of wealth captured in balance sheets) [SNA 2008]. The current work carried out for the SEEA 2012 Volume 1 could be useful in the revision of the FDES, particularly its ongoing work on the different classifications of assets and physical flows.

IV. Conceptual approaches underlying the reviewed initiatives

20. When reviewing the literature, it is evident that there are many conceptual approaches in the field of the environment and sustainability in general and also related specifically to the environment statistics domain, ranging from the most simple to the most complex. Two of the most recurrent approaches potentially useful in the revision of the FDES are the **ecosystem approach** and the **natural capital approach**.

21. The **ecosystem approach** has been used mostly for management (i.e. of natural resources) and also in assessment, particularly in the MEA effort. Although ecosystem management is by definition an open and timely invitation to move from species and area protection to a more integrated and participatory approach to resource and area management, the concept itself and its implementation are still limited. The ecosystem approach was originated and designed for resource and area management in the 1990s. Aided by frontrunner countries it became politically preeminent since the Convention on Biological Diversity (CBD) was agreed in 1992. It can be said that this ecosystem approach constitutes a true new paradigm in resource management, but the questions should be raised of whether it can be, and whether it is fair to try to apply it, to other realms such as official statistics?

22. “Without a strong base of scientific knowledge and manageable indicators, implementation of the **ecosystem approach** will fall short of its promise, largely because decision-makers will not be able to judge possible losses of ecosystems’ functions and services and long-term consequences of management decisions (WRI, 2000). However, the complexity of ecosystems’ structure and functioning is far from being fully explored. Not much is known about the changes in ecosystems’ functions and services that have taken or will take place on different scales due to human interference. Lack of reliable data is one reason for this. Another is the difficulty of distinguishing between natural variations (e.g. climate change or biodiversity change) and trends which can be traced back to human threats. Further, the interdependencies of the different global stresses to the environment are not fully understood”. [Hartje et al, 2003, p.13-14]

23. In reviewing the uses of the **ecosystem approach**, it is noted that this approach has mainly been applied to two realms (and to specific themes):

- (a) General positioning of the ecosystems as providers of human benefits: the Ecosystem approach to management (of forest, fisheries, watershed, basins, etc.). This use is more potent at the local level, for specific ecosystems whose parts and interrelations are adequately captured; and
- (b) Ecosystem approach to assessment, ranging over specific biomes or themes, and throughout many scales. The most well-known global application of the ecosystem approach is the Millennium Ecosystem Assessment produced in 2005.

24. The **ecosystem approach** has been considered as a conceptual foundation for the revised FDES. It has the potential to enable the environment to be captured and described as a system (biosphere), composed of subsystems (ecosystems) that are

functional units of biological organisms interacting with inert entities and exchanging matter and energy. Ecosystems are open systems that interchange this matter and energy with the “outside” that is, with other ecosystems. However, the biosphere only interchanges energy with outer space. In any given ecosystem, everything is related to everything else, although we may or may not see it or understand it all. Nevertheless, the systemic view underpinning the ecosystem approach allows us to understand that the ecosystem as a whole is greater and more complex than its parts, and the interrelations among components are as equally important as the functioning of each individual part. As humans, we are part of the ecosystems and constantly interact with other components, thus impacting them, benefiting from them, and ultimately depending on them. This approach is evidently closer to the complex reality in which we live than any partial and static ways of thinking about the environment. However, it is also more complex and more difficult to measure.

25. The **natural capital approach** has been used to derive strong global indicators, such as genuine savings and real wealth (World Bank) and also recent initiatives towards sustainable development indicators are being developed through this approach by the most developed countries (UNECE/Eurostat/OECD). The natural capital approach constitutes the conceptual basis for the SEEA.

26. **Natural capital** is a means of identifying and quantifying natural resources and ecosystem goods and services. The approach follows the economic notion of capital, which is a stock of assets used to produce goods and services. Natural capital consists of the stock of natural resources, land and ecosystems upon which the economy depends. The framework defines the environment largely in terms of its ability to provide goods and services to people. As such, it is well placed to provide the linkage between environment and economic statistics. The UN System of integrated Environment and Economic Accounts (SEEA) provides a useful statistical framework to measure natural capital.

27. 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 for 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.

V. Final thoughts for the revision of the FDES

28. By reviewing the main policy- and assessment-driven initiatives pertaining to the environment, it can be said that scientific knowledge, concepts, frameworks and data are very much interdependent and that their development worldwide is heterogeneous and in general much slower than what is to be desired.

29. The limited availability of scientific knowledge and the insufficient data on key components and relations within ecosystems pose serious restrictions on the advancement of definition (and on the development of ideal overarching theories), classifications, the designation of strict boundaries and the corresponding derivation of required data sets. Unfortunately, these limiting factors also feed back into each other. Thus, the evolution of the original 1984 FDES is affected by the current state of the art in knowledge. It is also affected by the common characteristics of the statistical systems in the different nations.

30. Most policy driven frameworks used in monitoring and assessment of the environment and sustainable development were evidently developed in a tailor-made manner, responding to specific purposes, according to given technical capacities and resources, and they are not supported by a single, overarching theory. They were designed to serve the monitoring purposes of the specific policy maker.

31. The implicit and explicit frameworks used everywhere for statistical purposes (to organize the production of environment statistics and indicators) also seem to have been tailor-made, in order to accommodate the country- or agency-specific relevant interests and themes, and/or to respond to specific national or institutional environmental goals. But at the same time, these frameworks were enabled by data availability. This is very evident when examining different sets of environmental and sustainable development indicators, that have been developed and structured for particular monitoring and assessment needs.

32. The different approaches which have been reviewed intended at creating new ways of understanding and measuring the concepts of well being and even of sustainability, extend over a heterogeneous panorama ranging from the narrowest to the most complex conceptualizations. Notably, the ecosystem and capital approaches provide valuable conceptual inputs and structure when thinking about the components of the environment and how to measure and report their most important dynamics over time and space. At the same time, policy and monitoring initiatives require increasingly more comprehensive and robust environmental statistics as well as other types of data.

33. Unfortunately, when matching complex thinking and monitoring necessities to the available statistical data set and taking into account the institutional and resource difficulties of most countries in the world, an evident gap can be observed. It must be kept in mind that the statistical capabilities created by the functioning and development of the national statistical systems and national statistical offices, the allocated human and

other resources and the availability of current datasets all make determinations about what is feasible for the resulting frameworks and the contents of their datasets.

34. From the **ecosystem approach**, it is important to analyze the potential of the MEA and State of Ecosystems and other relevant ecosystem-based frameworks and their reporting categories and topics as potential inputs for the structure and dimensions of a revised FDES.

35. From the **natural capital approach**, and specifically with regard to system accounting, the SEEA 2012 classifications that are being developed for assets and physical flows are to be considered as potential inputs for the corresponding environmental components of the revised FDES.

ANNEX I.

Initiatives and frameworks reviewed

1. Global Policy Initiatives, its frameworks and derived statistical topics and indicators

- 1.1 The Earth Summit – Rio, 1992
- 1.2 The Commission of Sustainable Development Indicators (1997 – present).....
- 1.3 Rio+10. The World Summit on Sustainable Development in Johannesburg.....
- 1.4 The 2000 MDG framework and its environmental targets and indicators.....
- 1.5 Green Economy and Green Growth 2010-
- 1.6 The road for the 2012 UNCSD (RIO+20)

2. Global and Regional Environmental Assessments and its Frameworks

- 2.1 The Millennium Ecosystem Assessment, 2005
- 2.2 The GEOs Assessment of Environment Framework – DPSIR for assessment.....
- 2.3 Structure of the State and Outlook (SOER) of the European Environment 2010.....

3. Relevant Global and Regional Statistic Initiatives related to environmental statistics

- 3.1 Latin American work on environmental policy and statistics 2000 - present.....
- 3.2. Asian Development Bank work on Environmental statistics and indicators.....
- 3.3 Commission of the European Communities: “GDP and beyond: Measuring progress in a changing world”, 2009.
- 3.4 The ECE/OCDE/EUROSTAT work on a sustainable development framework and indicators 2005- 2012
- 3.5 The Stiglitz Commission, 2010.....
- 3.6 The OECD “indicators for the green growth strategy”, 2010.....
- 3.7 The SEEA 2003 and SEEA 2012 Volume 1 revision

4. Related conceptual approaches

- 4.1 Ecosystem approach
- 4.2 Natural capital approach

ANNEX 1. OECD Environmental Data Compendium.....

ANNEX 2. The US State of the Nations’s Ecosystems 2008.