

REVISION OF THE SYSTEM OF ENVIRONMENTAL - ECONOMIC ACCOUNTS (SEEA)

United Nations Committee of Experts on Environmental Economic Accounting (UNCEEA)

Statistics Division / Department of Economic and Social Affairs, United Nations

Draft Version for Second Round of Global Consultation, October 2011

Chapter 1: Introduction

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1.1 What is the System of Environmental - Economic Accounts?

1.1 The System of Environmental - Economic Accounts (SEEA) is a multi-purpose, conceptual framework that describes the interactions between the economy and the environment and the changes in the state of the environment over time.

1.2 The concepts and definitions that comprise the SEEA are designed to be applicable across all countries, regardless of their level of economic development, their economic structure, or the composition and state of their environment.

1.3 At the heart of the SEEA is an accounting approach that describes, as completely as possible, the stocks and flows that are relevant to the analysis of environmental and economic issues. The analysis may pertain to the assessment of the state of the environment in terms of trends in environmental assets, the environmental impacts of economic activity, the application of environmental policy instruments, the impact of the environment on human health, and the trends concerning the environment in an international context.

1.4 The accounting approach of the SEEA is based on the System of National Accounts (SNA), a conceptual framework that has developed over the second half of the 20th century to be the pre-eminent approach to the measurement of economic activity, economic wealth and the general state of the economy.

1.5 An accounting approach distinguishes the SEEA from general sets of statistics on environmental and economic issues because it demands coherence and consistency with a core set of concepts and definitions. Thus, using a wide range of source data, the SEEA provides a systematic approach to compare and contrast source data and presents aggregates, indicators and trends across a broad spectrum of environmental and economic issues.

1.6 A particular strength of the SEEA emerges from its basis in the SNA. Using common concepts and definitions, the SEEA extends the monetary focused recording in the SNA to incorporate many environmental statistics that are usually available in physical or quantitative terms. The power of the SEEA comes from its capacity to present information in both physical and monetary terms in a coherent manner.

1.7 The integration of information concerning the economy and the environment requires a multi-disciplinary approach. The SEEA brings together, in a single framework, information on water, minerals, energy, timber, fish, soil, land and ecosystems, pollution and waste, production, consumption and accumulation. Each of these areas has specific and detailed measurement approaches that are integrated in the SEEA to provide a comprehensive view.

1.8 At a practical level, each area is governed by disciplines that have their own language and terminology. Where possible the SEEA incorporates this language, but the SEEA retains at its core the language and terminology of the SNA. The explanation of the relevant accounting concepts within a variety of environmental contexts is a key role of the SEEA.

1.9 The SEEA is not designed to provide or replace the richness and depth that each of these disciplines bring to their own areas. Rather it is the linkages and connections developed in the

SEEA that provide an additional and broader perspective and hence add value to the detailed information already available.

1.2 Policy relevance and uses of the SEEA

- 1.10 The effect of human activity on the environment has emerged as one of the most significant policy issues. On the one hand, there has been growing concern about the impact of each country's economic activity upon the global and local environment. On the other hand, there has been increasing recognition that continuing economic growth and human welfare are dependent upon the benefits obtained from the environment. These benefits include the provision of raw materials, energy and other resources used to produce goods and services; the absorption of waste and pollution from human activities by the environment; the regulatory functions such as pollination and flood protection; and the provision of amenity services such as places for recreation.
- 1.11 The policy issues translate into questions regarding whether environmental endowments are being used responsibly. For example, is there a threat to economic development now, either by using up resources too quickly with no prospect of replacement, or by generating a level of pollution that exceeds the absorptive capacity of the environment and that affects human health and well-being? And, even if current activities do not pose a problem at present, could they do so if continued without change into the future?
- 1.12 Ultimately, the benefits from the SEEA are embodied in the ability of the information within the SEEA to positively benefit the creation and setting of policy and the process of decision making. As a multi-purpose system, the SEEA can provide these benefits in a number of ways. First, the summary information in the SEEA (provided in the form of indicators of progress towards policy objectives) can be used to give broad guidance on issues and areas of the state of the environment that should be the focus of decision makers. Second, the detailed information in the SEEA on the key drivers of change in the state of the environment can be used to provide a richer understanding of the policy issues. Third, the framework of the SEEA permits the development of models and scenarios that can be used to assess the national and international impact of different policy scenarios both within a country, between countries and at a global level.
- 1.13 The benefits of the SEEA to policy and decision making processes can be seen in specific areas such as energy and water resource management; patterns of consumption and production and their impact on the environment; the green economy and economic activity related to adoption of environmental policies; and the changing condition and health of ecosystems and their capacity to continue to deliver benefits to humanity. The benefits are most broadly captured in policies concerning sustainable development – one of the most pressing policy issues for current and future generations. The capacity to consider all of these different topics within a single, coherent framework is core to the value that the SEEA provides.

1.14 The relevance of the SEEA framework emerges in a number of ways.

- First, the basic intent of the SEEA is to provide the measurement framework for sustainable development by informing the policy framework on the state of the environment and by integrating information on the state of the economy.
- Second, the SEEA framework is broad thus supporting the ambitions of sustainable development to offer a holistic view of development alternatives. In particular, the SEEA extends the coverage of assets to encompass all types of environmental assets in physical terms.
- Third, sustainability cannot be dissociated from assets and their measurement in the economic, social and environmental domains. The SEEA is designed to systematically record the stock of assets and the flows that link them over time and so lends itself to constructing relevant indicators.
- Fourth, the SEEA contains physical and monetary flow accounts that can structure information relevant to resource management, sectoral and general economic policies. For example, in many countries water scarcity is a problem and water pricing is used as a partial solution to this scarcity. Environmental–economic accounts record who is using the water and who pays; the impact (burden) of water charges on profitability of various sectors of the economy; changes to the return on produced assets used for water supply and water treatment; and over time the resultant changes in water use by enterprises and households. Similar analyses can be undertaken for issues such as energy supply and demand; forestry and fisheries management; land use; and pollution abatement, including the management of greenhouse gas emissions.
- Fifth, the SEEA provides a framework within which the stocks and economic value of certain natural resources can be measured (for example, mineral and energy resources, timber resources and aquatic resources). Through the measurement of these resources it is possible to construct measures of the depletion of natural resources in physical and monetary terms. Further, in monetary terms adjustments can be made to measures of economic activity, for example Net National Income, so as to not only account for depreciation of produced assets but also to account for the depletion of natural resources. Such adjusted measures start to bring into stronger focus the relationship between the economy and the environment that is not taken into account in traditional measures of economic activity.
- Sixth, the SEEA provides the framework for the description of environmental activities, products and producers. Functional accounts cover the production of goods and services and the expenditures for purposes of environmental protection and resources management. These accounts allow for the analysis of the impacts of policy instruments to prevent and eliminate environmental pressures and preserve and maintain the stock of natural resources.
- Seventh, the SEEA framework can be used to monitor the extent to which patterns of production, consumption and accumulation are becoming more sustainable. The SEEA

also provides the tools to gauge the effects on economic growth and employment that are associated, for example, with the environmental goods and services sector.

- Eighth, the SEEA provides a catalyst and mechanism for the engagement of experts from across the multiplicity of fields that relate to sustainable development.

1.15 In an increasingly integrated and connected world the SEEA framework provides the conceptual framework and information source on which discussion, research and policy on environmental and economic issues can be based.

1.3 The SEEA as a system

1.16 The SEEA consists of a coherent, consistent and integrated set of tables and accounts which each focus on different aspects of the interaction between the economy and the environment or on the changing state of the environment. The tables and accounts are based on internationally agreed concepts, definitions, classifications and accounting rules.

1.3.1 Scope and coverage of the SEEA

1.17 Generally, the accounts are compiled in respect of a national economy and its environment and therefore present, in a condensed way, a great amount of information reflecting the different economic and environmental stocks and flows that take place within a country.

1.18 The national economy is defined in accordance with the SNA. In geographic terms, the economy is defined by the economic territory of a country (which generally aligns closely in physical terms with its national boundaries as commonly recognised). The economic units of interest are those enterprises, households and governments that have a centre of interest in the economic territory (a concept known as residence). The economy is defined by the production, consumption and accumulation activity undertaken within the economic territory by the relevant economic units.

1.19 The relevant scope of the environment is also bounded by these territorial considerations. Thus, all natural resources and terrestrial ecosystems within a country's economic territory are within scope of the SEEA framework. Within the SEEA the environment of a country is conceptualised as a single, physical entity that can be viewed from two primary perspectives. First, it can be viewed as a combination of individual components such as trees, animals, lakes, minerals, soil, land, etc. Many of these individual components may be regarded as environmental assets that provide materials and space to all economic activities.

1.20 Second, a country's environment can be viewed as a collection of ecosystems, each defined within a given area. Ecosystems provide not only materials and space but also non-material benefits to the economy through ecosystem services such as water purification and pollination. Ecosystems may be of many different types depending on the climate, topography, the degree of human intervention, and other factors. Ecosystems function through the interaction between the various individual components and hence, in concept, both perspectives are complementary rather than competing views of the same physical environment.

1.3.2 Types of SEEA accounts

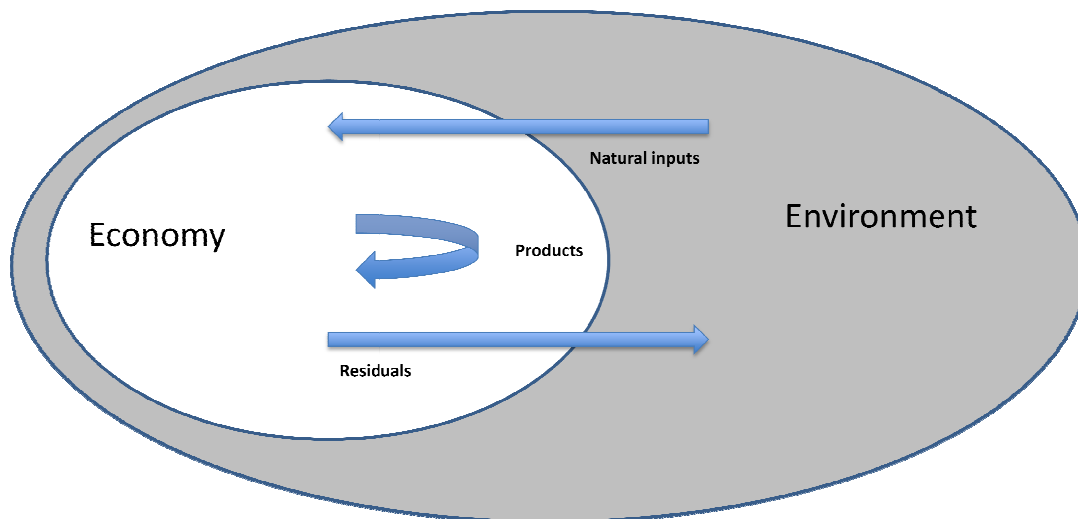
1.21 There are five main types of accounts and tables in the SEEA framework: (i) physical flow accounts presented in supply and use tables, (ii) asset accounts in physical and monetary terms, (iii) the sequence of economic accounts, (iv) functional accounts for environmental transactions, and (v) tables containing demographic and employment information. The description of these types of accounts and tables forms the core of the SEEA Central Framework that is contained in Chapters 2 – 6.

Physical flow accounts

1.22 The first type of account is the physical flow accounts. Three sub-systems of physical flows are considered: flows relating to energy, flows relating to water and flows relating to materials. Flows for each sub-system are recorded in different physical units (joules, cubic metres and tonnes as appropriate) and, aim to account for all flows from the environment into the economy, within the economy, from the economy to the environment.

1.23 In broad terms, the flows from the environment to the economy are recorded as natural inputs. Flows within the economy are recorded as product flows and flows from the economy to the environment are recorded as residuals. Figure 1.3.1 presents these flows.

Figure 1.3.1 Physical flows between the economy and the environment



1.24 Accounting for these various physical flows applies basic laws concerning the conservation of mass and energy. Thus the supply of natural inputs by the environment must be matched by the use of those inputs by the economy or the immediate return of those inputs to the environment (e.g. discarded catch in fishing or felling residues in timber operations). Also, the supply of products (i.e. goods and services) within the

economy must equal the use of products within the economy (with relevant adjustments for the trade in goods and services between countries). Finally, the generation of residuals by the economy must be matched by either the collection of these residuals by other economic units (for example solid waste collected by landfill sites) or the release of the residuals to the environment.

- 1.25 As a result of accounting for the various physical flows in this way, a framework, known as a physical supply and use table (PSUT), can be constructed in which each of the various types of physical flows is recorded. The PSUT in the SEEA is based on supply and use tables that have been developed for economic analysis (which has a focus on products) and is extended to include consideration of flows between the environment and the economy.
- 1.26 Conceptually, the PSUT framework allows all physical flows to be recorded and presented in one account. However, not only is this very data demanding, it may be difficult to interpret information on all physical flows at the same time. Consequently, sub-systems for flows of energy, water and materials are introduced that focus on recording flows related to each sub-system. Further within the materials sub-system more restricted sets of flows may be targeted. For example, accounts may be compiled for flows of forest products or nutrients, or for specific types of flows (e.g. air emissions, solid waste or emissions to water).

Asset accounts in physical and monetary terms

- 1.27 Measuring the state of the environment and changes in it is a central feature of the SEEA. Asset accounts focus on the key individual components of the environment namely mineral and energy resources, timber resources, aquatic resources, other biological resources, soil resources, water resources, and land. They include measures of the stock of each environmental asset at the beginning and end of an accounting period and record the various changes in the stock due to extraction, natural growth, discovery, catastrophic loss or other factors.
- 1.28 The compilation of asset accounts in physical terms can provide valuable information on resource availability and may help in the assessment of sustainability. A particular feature of the SEEA asset accounts is the estimation of depletion of natural resources in physical terms. For non-renewable resources the quantity of depletion is equal to the quantity of resource extracted but for renewable resources the quantity of depletion must take into account the underlying population, its size, rate of growth and associated sustainable yield.
- 1.29 The compilation of asset accounts in monetary terms can also provide valuable information to assist in the understanding of the relationship between rates of extraction and current economic activity and in understanding the economic costs of extraction on future incomes. In particular it is possible to place a value in monetary terms on depletion and hence derive depletion adjusted measures of income and saving.

- 1.30 The valuation of environmental assets may be used to compile estimates of national economic wealth and hence provide a more complete picture of a country's economic structure and the way in which a country's natural endowments are being used in comparison to the use of other types of assets.
- 1.31 Because there is no market for many environmental assets (i.e. the environmental assets in situ are rarely bought and sold), alternative valuation methods often need to be used to compile asset accounts in monetary terms. The method described in the SEEA is the net present value (NPV) method which calculates the value of an asset based on the future income streams that are expected to accrue from the use of the asset.
- 1.32 The underlying basis for valuation in the SEEA is market prices, the same basis as used in the SNA. The use of this valuation basis allows environmental assets to be readily compared to produced and financial assets. At the same time, this valuation basis does not take into account all of the benefits that may arise from environmental assets - for example, timber resources are valued for the wood that can be extracted and not for the recreational benefits provided by the forests in which timber resources are found. The measurement and valuation of the full range of environmental benefits is incorporated in ecosystem accounts.

The sequence of economic accounts

- 1.33 In monetary terms, monetary supply and use tables and asset accounts record much of the information of interest in the assessment of the interactions between the economy and the environment. However, there are a range of other monetary transactions and flows that are of interest in environmental-economic accounting such as payments of rent for the extraction of natural resources, payments of environmental taxes, and payments of environmental subsidies and grants from government units to other economic units to support environmental protection activity.
- 1.34 These flows are presented in the sequence of economic accounts. It is compiled only in monetary terms because these accounts record transactions that do not have an underlying physical base, for example interest payments. The sequence of economic accounts follows the structure of the sequence of accounts in the SNA. Of particular importance is the derivation of measures of depletion adjusted income and saving within the sequence of economic accounts. The entries in the sequence of economic accounts also provide the information required for an assessment of the full economic costs and benefits of environmental activity.

Functional accounts for environmental transactions

- 1.35 There are many transactions between different economic units (i.e. enterprises, households, governments) that concern the environment. All transactions between economic units are recorded in the SNA. One part of the SEEA framework is targeted at

identifying and collating separately the sub-set of transactions that can be considered environmental.

- 1.36 Environmental transactions are identified by first defining the set of environmental activities – i.e. those activities that reduce or eliminate pressures on the environment and that aim at making more efficient use of natural resources. Examples include investing in technologies designed to prevent or reduce pollution; restoring the environment after it has been polluted; and recycling, conservation and resource management. Environmental activities are classified as being either environmental protection activities or resource management activities.
- 1.37 Since the information is sourced from the standard structures and definitions of the SNA, the information can be organised along similar lines. Thus, in effect, an alternative or satellite presentation of the SNA is developed. Because the logic behind the selection of transactions is on the basis of the function or purpose of the transactions, these accounts are commonly referred to as functional accounts.
- 1.38 The most developed functional accounts for environmental transactions concern activities for environmental protection - Environmental Protection Expenditure Accounts (EPEA). Another particular area of focus may be on flows to and from government for environmental purposes and in this context the measurement of environmental taxes and environmental subsidies and similar flows (such as investment grants) is appropriate.
- 1.39 Although not considered environmental activities, there are other economic activities related to the environment, in particular natural resource use activities and activities aimed at minimising the impact of natural hazards, that may be of interest. As for environmental activities, different accounts can be developed for these activities depending on the transactions of interest.
- 1.40 For natural resource use activities information on extraction and exploration activity including measures of value added, and payments of rent for access to resources may be particularly relevant. There may also be a focus on the level of investment in extraction equipment and the state of the associated produced assets (for example concerning the condition of a country's fishing fleet). All of this information can be organised into relevant functional accounts following the structures and definitions of the SNA.

Demographic and employment information

- 1.41 The usefulness of information within the SEEA can be enhanced by relating different environmental and economic data to estimates of population and various demographic breakdowns such as by household income levels and other detailed information by household characteristics related to material well-being. This information may be useful in assessing issues such as resource availability, changes in energy use and sources of emissions. Accounting for differences in population size and structure is also important for international comparisons of environmental and economic data.
- 1.42 Employment information such as the number of people employed, the number of jobs and the number of hours worked may be of particular interest in the assessment of environmental activity from an industry perspective. In particular, there is likely to be interest in employment indicators related to the production of environmental goods and services.

Accounting for Ecosystems

- 1.43 Ecosystems are areas containing a dynamic complex of biotic communities (for example, plants, animals and micro-organisms) and their non-living environment interacting as a functional unit to provide environmental structures, processes and functions. The environmental structure is the organisation in which the living and non-living components interact. Ecosystems provide benefits to humanity known as ecosystem services through environmental processes and functions. The benefits are supplied in many ways and vary from ecosystem to ecosystem. Ecosystem services are generally grouped into four main types – provisioning services (such as the provision of timber from forests), regulatory services (such as when forests act as a sink for carbon), supporting services (such as in the formation of soils), and cultural services (such as the enjoyment provided to visitors to a national park).
- 1.44 The objective of ecosystem accounting is to record the provision of all types of ecosystem services from the different types of ecosystems in a systematic manner. A related measurement issue is the assessment of the capacity of ecosystems to continue to produce ecosystem services into the future. The extent to which this capacity is reduced as a result of human activity is considered to be degradation.
- 1.45 A particular aspect of ecosystem accounting is that data are often compiled at finer levels of geographic detail since it is the delivery of services by a specific area that is of particular interest.
- 1.46 It is possible to place monetary values on flows of ecosystem services and the changing capacity of ecosystems to provide these services. However, there is no clear agreement on the valuation approach that should be used. SEEA Experimental Ecosystem Accounts describes the main valuation approaches and their advantages and disadvantages.

1.47 In broad terms the accounting structures of physical supply and use tables and asset accounts are also applied in ecosystem accounting. However, the structures are applied somewhat differently because the focus of measurement is on specific areas within the environment, the ecosystems, and hence the environment has a central and active focus rather than having a more passive role alongside the main economic units as it does in the accounts of the Central Framework.

The relationships between the accounts

1.48 Each of these different accounts is connected to the other within the SEEA framework but each one focuses on a different part of the interaction between the economy and the environment. Examples of the relationships between the different accounts include:

- Asset accounts describe the stock and changes in the stock of environmental assets. Asset accounts in the Central Framework focus on the individual components and can be extended to describe the interactions between the economy and the environment and the capacity of ecosystems to provide ecosystem services.
- Changes in the stock are most often the result of economic activity, which in turn is the focus of physical flow accounts. Measurement of flows of natural inputs in the PSUT is consistent with the measurement of extraction in the asset accounts and the interaction with ecosystems.
- Measurement of flows of residuals to the environment as recorded in PSUT is an important consideration in the measurement of the capacity to produce ecosystem services.
- Measures of the flows of natural inputs and residuals can also be related to transactions recorded in functional accounts for environmental protection and resource management, including investment in cleaner technologies and flows of environmental taxes and subsidies. For example, payments for emission permits recorded in functional accounts can be related to the flows of emissions recorded in the PSUT.
- The effectiveness of the expenditure for environmental purposes may, ultimately, be assessed by changes in the capacity of ecosystems to continue their delivery of ecosystem services as recorded in ecosystem accounts.

1.49 These examples serve to highlight the many and varied relationships between the accounts, each taking a different perspective. Throughout the SEEA these relationships are supported by the use of common concepts, definitions and classifications as described and explained in this book.

1.3.3 Combining information in physical and monetary terms

1.50 One of the most powerful features of the SEEA is its organisation of information in both physical and monetary terms following the same scope, definitions and

classifications. This feature is often utilised in the compilation of accounts and tables that combine information in physical and monetary terms. The structure of combined presentations depends on the topic of measurement (e.g. water, energy, air emissions, forest products), the questions of interest and the availability of data. Nonetheless there are certain common features and benefits.

- 1.51 First, combined presentations allow users to find relevant information in a single location with statistical coherence and consistency already completed through the confrontation of the source data in the SEEA framework.
- 1.52 Second, combined presentations promote a discussion between those familiar with data organised following economic accounting structures and those familiar with information organised with reference to specific physical flows.
- 1.53 Third, combined presentations structure information in a manner that supports the derivation of combined indicators – for example, decoupling indicators that track the link between the use of resources and growth in production and consumption.
- 1.54 Fourth, combined presentations provide an information base for the development of models and detailed analysis of interactions between the economy and the environment.
- 1.55 Overall, the power of the SEEA and its standard concepts and definitions is best exploited in the development of presentations that combine physical and monetary data.

1.3.4 SEEA as a co-ordinating framework for environmental-economic statistics

- 1.56 As an integrated accounting system, the SEEA stands apart from individual sets of environmental statistics. While sets of environmental statistics are usually internally consistent, there is, for good reason, often no strict consistency between one set of statistics and another. Environmental statistics are often collected with a particular regulatory or administrative purpose in mind and the way in which they are structured is specific to this need.
- 1.57 In contrast, the SEEA is an integrated system of accounts which, to the fullest extent possible, provides consistency between one account and another in terms of concepts, definitions and classifications. In addition, implementation of such an integrated system aims for consistency over time. This is of the utmost importance in developing the comparable time-series estimates that are necessary in the policy process.
- 1.58 A final important difference between environmental statistics and the SEEA is the latter's explicit goal of achieving compatibility with the economic information of the SNA. This adds considerable value to both the environmental and the economic information, as it facilitates their analysis within a common framework.
- 1.59 The SEEA may stand apart from sets of environmental statistics in important ways, but it also relies upon them for the basic statistics required in its implementation. Ideally, these statistics would be readily available in a format that allowed their direct

incorporation into the system. For example, data on air emissions from industrial sources would ideally be classified according to the industrial classification used in the SEEA. This would allow their simple incorporation into physical flow accounts and combined accounts.

- 1.60 It is reasonable to expect that over time the implementation of the SEEA will result in changes to the way in which environmental statistics are collected and structured in a given country. For this to happen there must exist (or be established) a spirit of collaboration and respect between environmental accountants and statisticians. The former group must understand that collecting data for environmental accounts may be a secondary concern for statisticians responsible for providing information to, for example, a regulatory programme. The latter group must be convinced of the importance of having highly structured and consistent data within an accounting framework. The SEEA can serve as a guiding framework for the development of environmental information systems that are more compatible with economic statistics.

1.3.5 Flexibility in implementation

- 1.61 Although the SEEA is conceived as a complete system which is internally consistent, its design is such that it can be implemented equally well in part or in whole. Depending upon the specific environmental issues faced, a country may choose to implement only a selection of the accounts included in the SEEA. Even if a country desires eventually to implement the full system, it may decide to focus its initial efforts on those accounts that are most relevant to the issues that it wishes to address.
- 1.62 For example, a country with few natural resources may not wish to pursue questions related to resource depletion and therefore would not undertake to compile asset accounts. Even those countries that are resource-rich may wish to concentrate first on those resources that are perceived to represent a risk to sustainability or that are the subject of discussion regarding the way in which government appropriates revenue from their extraction.
- 1.63 Countries with high levels of material throughput may find it useful to build physical flow accounts for materials but, again, this may be done on a selective basis, for example, by working first on accounts for specific materials.
- 1.64 If a country imposes strict environmental standards, with significant cost to producers and consumers, then environmental protection expenditure accounts may be an early priority. Those where there is as yet little active environmental protection may prefer instead to concentrate on the measurement of flows of residuals and their impact in order to determine how urgent the problem of introducing environmental protection is.
- 1.65 These examples illustrate the flexibility of application of the SEEA, which its structure is intended to permit. It is important to bear in mind, however, that no matter which parts of the system are implemented, these parts should be implemented in such a way as to be internally consistent and complementary.

1.66 While there is flexibility in the implementation of the system, much benefit from the SEEA comes from it being an internationally agreed statistical framework. Consequently, the ability to compare and contrast relevant information from a range of countries is a significant advantage supported by the wide-spread adoption of the SEEA for specific modules, particularly with regard to environmental issues that are multi-national or global in nature.

1.4 History of environmental - economic accounting

1.4.1 Precursors to the SEEA

- 1.67 The recognition of environmental assets as essential components in the generation of economic income and wealth has been appreciated for centuries. In particular the writings of Smith, Ricardo, Mills and others recognised the role of land and land owners as distinct from labour and produced assets. The separation of total income between wages, profits and rent as returns to the various factors of production was well established at that time.
- 1.68 These writers also recognised that varying qualities of land (including variation introduced as a result of economic activity) and the overall supply of land were important considerations in determining the functioning of an economy. And it was recognised that those countries with particular endowments of natural resources had distinct advantages in earning incomes. One reason for the recognition of land in particular was that an observable market existed and areas of land could be bought and sold with prices fluctuating over time.
- 1.69 Early work on national accounting in the 20th century, largely ignored the significance of non-produced assets. Focus instead was placed on the measurement of economic growth which required the measurement of production, consumption and the accumulation of produced assets. These activities drove the growth in income that could facilitate higher standards of living.
- 1.70 From a measurement perspective one factor in the lack of focus on non-produced assets was that no monetary transactions were made with the environment for the resources extracted or for the use of the environment as a sink. The resulting conceptualisation is that the depletion and degradation of natural resources does not represent a cost of production.
- 1.71 While the SNA did not recognise these costs the broader economics profession did. The concept of externalities as the unpriced impacts of economic activity became well established in the economic literature. Related work on the setting of appropriate taxes and subsidies was also prevalent.
- 1.72 Thus, accounting for the environment at an aggregate, national economy level become an active consideration of many researchers. A particular focus was the confrontation of physical, environmental data and monetary, economic data within extended input-output frameworks. The basic principles behind this work were developed in the late 1960s by Leontief (1970) and others¹. It was these researchers who introduced the analysis of the “physical economy” by way of input-output modelling. They represented residuals as a by-product of regular production activities and showed how this

¹ See, for example, Cumberland (1966); Daly (1968); Isard (1969); Ayres and Kneese (1969); and Victor (1972).

could be incorporated in the conventional, monetary input-output framework. These data systems could be regarded as forerunners of PSUT and combined accounts in the SEEA.

- 1.73 Around the same time there was increasing recognition that natural resources themselves may not last forever, especially in the wake of the first oil crisis. Although early work on this topic, especially by Hotelling, had occurred some time before, in the 1970s increasingly, attention turned to the measurement of natural resources in both physical and monetary terms. Despite the difficulties in valuation, efforts were made to account for the cost of depletion as an adjustment to the core national accounts measures such as GDP.
- 1.74 Also in response to the impact of economic activity on the environment, a number of countries commenced the collection and publication of data on environmental protection expenditures thus recognising the increasing importance of these expenditures as part of government and business operations.
- 1.75 All of these and many other efforts, as indicated in the list of references at the end of this book, provided the theoretical foundation for the SEEA framework.

1.4.2 History of the SEEA

- 1.76 In 1987 the report of the Brundtland Commission, *Our Common Future*, made clear the links between economic and social development and the environment's capacity. Shortly afterwards, in 1992, the recommendations of the UN Conference on Environment and Development "Earth Summit" contained in Agenda 21 (UN 1992) recommended that countries implement environmental-economic accounts at the earliest date.
- 1.77 In response, the United Nations Statistical Division (UNSD) published the handbook of national accounting – *Integrated Environmental and Economic Accounting* (UN 1993) and commonly referred to as SEEA. This handbook was issued as an "interim" version of work in progress since the discussion of concepts and methods had not come to a final conclusion.
- 1.78 As a result of the publication of the SEEA handbook, several developing and developed countries started experimenting on the compilation of SEEA. 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 accounts. Increased discussion on concepts and methods of environmental accounting, accompanied with country experiences led to an increasing convergence of compilation methods for selected modules of the SEEA.
- 1.79 The publication – *Integrated Environmental and Economic Accounting – An Operational Manual* (UN 2000), was published by UNSD and the United Nations Environment Programme (UNEP) based on material prepared by the Nairobi group (a group of experts from national and international agencies and non-governmental

organisations established in 1995). This publication reflected the on-going discussion since 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.

- 1.80 In parallel with the work of the Nairobi Group, the international agencies in co-operation 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 and harmonisation of concepts, definitions and methods in environmental and economic accounting.
- 1.81 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.
- 1.82 Recognising the ever increasing importance of information on the environment and the need to place this information in an economic context understood by central policy makers, the UNSC agreed at its meeting in 2007 to start a second revision process with the aim of adopting the SEEA as an internationally agreed statistical framework for environmental and economic accounting within five years.
- 1.83 This process was to be managed under the auspices of the newly formed UN Committee of Experts in Environmental and economic Accounting (UNCEE). 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 carriage 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.
- 1.84 It became clear that there remained certain aspects of the SEEA-2003 on which it was unlikely that agreement could be found, in particular the measurement of degradation and its valuation. In large part this reflected the lack of broad national statistical efforts at assessing degradation and the existence of a range of different approaches to measurement and valuation. Consequently, the UNSC determined that the revision of the SEEA should proceed in two related but distinct areas. The first area was the development of a central framework which would cover the bulk of the SEEA-2003 concerning primarily the measurement of natural resources, the recording of physical flows and the accounting for environmental expenditure and other related transactions. This material was to become an internationally agreed conceptual framework.

1.85 The second area was 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. Over time, this second area of focus has become focused on accounting for the environment from the perspective of ecosystems. Ecosystem accounting is becoming an increasingly important perspective but it is also clear that further research and practical implementation is required before the relevant techniques and methods can be considered for adoption as international standards. Thus, SEEA Experimental Ecosystem Accounts will describe the current state of the art in ecosystem accounts and provide a basis for the integration of work on ecosystems with the core accounting approach that underpins the SEEA Central Framework.

1.86 A third area for the revision of the SEEA was also included to cover potential extensions and applications of SEEA based datasets with the aim of promoting and supporting the widespread adoption of the SEEA among both official statisticians, researchers and policy makers.

1.5 The SEEA in the context of other international statistical standards

1.87 The breadth of the SEEA and in particular its coverage of data in both physical and monetary terms means that it has many relationships to other international statistical standards and frameworks. These relationships are of four main types: relationships to the SNA and related economic accounts standards; relationships to sub-systems of the SEEA and other manuals on environmental-economic accounts; relationships to standards for environmental statistics; and relationships to standard international classifications. Each of these is described in turn.

1.5.1 SEEA and the 2008 SNA

1.88 The relationship between SEEA and the SNA is fundamental. The SNA is the primary source for many of the concepts, definitions and accounting rules on which the SEEA is based. Indeed while the SEEA itself is conceived as an independent accounting system and framework, in many respects it is, at the same time, an extension of the SNA.

1.89 The SEEA follows very closely the accounting concepts and definitions outlined in the SNA and users of the SEEA may be required to consult the 2008 SNA for more detailed guidance on particular accounting issues. The two primary areas of distinction between the systems concern the scope of the recording of physical flows compared to monetary flows (which is somewhat broader in the SEEA) and the incorporation in the SEEA of depletion as a cost against the income earned from the extraction of natural resources rather than as only a reduction in the value of natural resources.

1.90 The relationship between the SEEA and the SNA extends to the other statistical standards that form the broader set of standards for economic accounting. These are the 6th Edition of the Balance of Payments and International Investment Position Manual (BPM6) and the 2001 Government Finance Statistics Manual (2001 GFSM). Other relevant materials and references concerning economic accounting are listed at the back of this book.

1.5.2 SEEA and other environmental accounts manuals

1.91 Since the release of the SEEA-2003 a number of manuals have been developed or are under development that focus on particular topics within scope of the SEEA framework. They are the Integrated Environmental and Economic Accounting for Fisheries (SEEA-F) – final draft circulated in 2004; the System of Environmental-Economic Accounting for Water (SEEA Water) – released as an interim standard in 2007; and the System of Environmental and Economic Accounting for Energy (SEEA Energy) - released in 2012. The development of other sub-systems of the SEEA is also under consideration including a SEEA for land and ecosystems and a SEEA for agriculture.

1.92 It is intended that the SEEA Central Framework will provide the overarching framework within which all thematic SEEA frameworks should be aligned. Inevitably, the

SEEA sub-systems will contain more detailed structures and explanations. Nonetheless, in all cases the starting point for the development of the accounting approaches will be the SEEA Central Framework and any changes and extensions to suit specific and targeted purposes will be fully explained.

1.93 In addition to environmental accounting publications within the SEEA “family”, there is a range of other handbooks and manuals on environmental accounting and related topics that are of importance in considering the practice of environmental and economic accounting. Since these handbooks and manuals have been developed before the finalisation of the SEEA Central Framework there will be differences between some of the definitions, structures and accounting treatments that are presented in this book and those presented in these other publications. Nonetheless, these other publications may provide useful guidance for compilers since they are focused on particular environmental accounting topics rather than competing with the breadth of the SEEA. Future releases of specialised handbooks and manuals will be based on the definitions, structures and accounting treatments outlined in the SEEA.

1.94 Examples of the handbooks include the SERIEE – European system for the collection of economic information on the environment (Eurostat, 1994) and the Manual for Air Emission Accounts (Eurostat, 2009). Other relevant materials and references concerning environmental accounting are listed at the back of this book.

1.5.3 SEEA and other standards for environmental statistics

1.95 The compilation of accounts within the SEEA framework requires the use of information from a wide variety of data sources. Of particular relevance is information on various aspects of the environment, generically referred to as environmental statistics. Increasingly, standards are being developed for various areas within environmental statistics and wherever possible alignment is being incorporated between the specific requirements for data in these areas and the general framework requirements of the SEEA.

1.96 Two examples of environmental statistical standards are the International Recommendations for Water Statistics (IRWS) released in 2010 and the International Recommendations for Energy Statistics (IRES) released in 2011. In both cases the recommendations describe the requirements for the compilation of data on water and energy for a range of purposes including the compilation of data to suit the preparation of physical flow accounts for water and energy within the SEEA framework. Other relevant materials and references concerning environmental statistics are listed at the back of this book.

1.5.4 SEEA and standard international classifications

1.97 The consistent use of classifications in the compilation of data in physical and monetary terms is a central feature of the SEEA. Further, international comparability of

data is enhanced through the collective use of standard international classifications wherever they are available.

- 1.98 Of particular importance are the classifications that are central to economic analysis – the classification of economic production units to industries, the International Standard Industrial Classification for All Economic Activities Revision 4 (ISIC Rev 4), and the classification of goods and services, the Central Product Classification Version 2 (CPC Ver 2.). In addition, the SEEA follows the SNA definitions of institutional sectors of the economy, for example Households, Government and Non-financial and Financial corporations. These three classifications are used throughout the SEEA.
- 1.99 Additional classification exist in relation to specific topics within the SEEA. For example, in the measurement of environmental protection and resource management activities the Classification of Environmental Activities (CEA) is relevant. In the measurement of energy products the Standard International Energy Product Classification (SIEC) is used. In the assessment of the status of different mineral and energy resources, the UN Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009) is the relevant international standard. The underlying basis for the organisation of information on land cover is the Land Cover Classification System Version 3 (LCCS3) developed by the UN Food and Agriculture Organisation.
- 1.100 In addition, in the SEEA there are a range of other lists and sets of classes on different topics that are aimed at providing support for the compilation of data in a similar way. Examples include the classification of environmental assets, the classes of natural inputs, the classification of land use and land cover types, the list of solid waste categories and various classes for different natural resources. These are not standard statistical classifications but do provide a structure for compilation and international comparison.
- 1.101 The organisation of data following standard classifications is an important step that facilitates the development of accounts that are as coherent, consistent and comparable over time and across countries.

1.6 Overview of the SEEA

1.6.1 Introduction

- 1.102 The SEEA is described in the SEEA Central Framework, the SEEA Experimental Ecosystem Accounts, and the SEEA Extensions and Applications. The material in the SEEA Central Framework reflects the internationally agreed conceptual framework relating to environmental-economic accounting and is considered a statistical standard. Based on the accounting concepts, definitions and principles of the SNA, the SEEA Central Framework describes the relevant accounting concepts and structures that are needed for to present a variety of environmental-economic accounts including physical supply and use tables, functional accounts like the environmental protection expenditure account and asset accounts for natural resources.
- 1.103 The SEEA Experimental Ecosystem Accounts is not a statistical standard but rather describes a range of best practice approaches to the measurement of the condition and health of ecosystems through the changes in the capacity of ecosystems to deliver ecosystem services and the flows of material and non-material benefits between ecosystems and the economy. It describes both the measurement of ecosystems in physical terms and the broader valuation of ecosystems and the environmental assets within them. In accounting terms, many of the components within ecosystem accounts are drawn from the SEEA Central Framework but they are applied with a focus on ecosystems and their interaction with the economy rather than starting from the perspective of economic units and their interaction with the environment.
- 1.104 The SEEA Extensions and Applications is also not a statistical standard. It aims to build a bridge between those people conducting specific research on environmental-economic topics who may be able to use SEEA based data sets, and those people compiling and building the data sets themselves. The material aims to introduce various extensions and techniques that can be based on information from the SEEA Central Framework or the SEEA Experimental Ecosystem Accounts. Examples include the development of extended input-output and trade models; the measurement of geospatial data for detailed geographic areas; and the measurement of the interaction of specific economic sectors with the environment (e.g. the household sector).

1.6.2 Reader's guide to SEEA Central Framework

- 1.105 The SEEA Central Framework comprises six chapters. The first chapter introduces the SEEA providing an indication of the policy relevance of the SEEA and the general structure, purpose and context of environmental and economic accounting. The content and style is intended to suit a non-statistical audience and thus explain to those not intimately involved in the compilation or analysis of SEEA type data the rationale for undertaking this type of statistical work. The chapter provides a brief outlines of the

components of the SEEA framework, its historical background and its place in the broader suite of statistical information and conceptual frameworks on environmental and economic measurement.

- 1.106 The second chapter, “Accounting framework”, outlines in some depth the key parts of the Central Framework and the accounting approach that is used. It uses as its base the accounting approach of the SNA and hence in many ways is likely to be more accessible for those familiar with national accounts concepts and terms. Nonetheless, it aims to explain in a clear fashion the types of accounts and tables that are contained in the Central Framework and the basic principles of accounting for stocks, flows, the definition of economic units and the principles of recording and valuation.
- 1.107 An important aspect of the SEEA that Chapter 2 aims to highlight is the integrated nature of the SEEA with all of the different parts being founded within a common accounting structure.
- 1.108 The third chapter, “Physical flow accounts”, explains in detail the recording of physical flows in the SEEA. The different physical flows, natural inputs, products and residual, are placed in the construct of a physical supply and use table and this framework can be expanded and reduced to focus on a range of different materials or on specific flows.
- 1.109 The second half of chapter 3 describes in detail the structure of physical supply and use tables for energy (Section 3.4), water (Section 3.5) and various materials including tables for air emissions, water emissions and solid waste (Section 3.6).
- 1.110 The fourth chapter, “Monetary flow accounts” focuses on the identification of economic transactions within the core SNA that may be considered environmental. Of particular interest are those transactions that relate to environmental activities, i.e. those economic activities whose primary purpose is to reduce or eliminate pressures on the environment or to make more efficient use of natural resources. These types of transactions are summarised in Environmental Protection Expenditure Accounts (EPEA) and in statistics on the Environmental Goods and Services Sector (EGSS).
- 1.111 The fourth chapter also covers the topics of environmental taxes, environmental subsidies and similar transfers and a range of other payments and transactions related to the environment that are all recorded in the SNA framework but are often not explicitly identified as related to the environment.
- 1.112 The fifth chapter, “Asset accounts”, focuses completely on the recording of stocks and flows associated with environmental assets. The environmental assets within scope are referred to as individual environmental assets, i.e. mineral and energy resources, land, soil resources, timber resources, aquatic resources, other biological resources and water resources. The chapter commences with a discussion of asset accounting in general terms with a particular focus on the measurement of the depletion of natural resources and the valuation of environmental assets.

- 1.113 Sections 5.5 – 5.11 of the chapter describing the measurement of stocks and flows for each of the individual environmental assets. For each asset type the measurement scope is defined and accounting in physical and monetary terms is described.
- 1.114 There are a number of annexes to Chapter 5 including a detailed explanation of the net present value (NPV) approach to the valuation of environmental assets and a discussion on discount rates which are an important component of the NPV formulation.
- 1.115 The sixth chapter, “Integrating and presenting the accounts”, highlights the integrated nature of the SEEA framework and links the detailed measurement guidelines of chapters 3-5 with the presentation of information for users. Of particular focus in chapter 6 is the explanation of combined presentation of physical and monetary data and a range of examples of such presentations are described. The chapter also introduces the range of indicators that may be compiled from the SEEA dataset.