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**REPORT OF THE WORKSHOP ON INTEGRATED ENVIRONMENTAL
AND ECONOMIC ACCOUNTING**

(Santiago, Chile, 20-24 April 1998)

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CONTENTS

	<u>Paragraph</u>	<u>Page</u>
I. ORGANIZATION OF THE WORKSHOP	1 - 15	1
Place and Date	1	1
Objectives	2	1
Attendance	3	1
Agenda	4 - 5	2
Opening Session	6 - 15	2
II. SUMMARY OF PRESENTATIONS	16 - 77	5
The System of National Accounts	16 - 17	5
Environmental Accounting and the System of Integrated Environmental and Economic Accounting	18 - 29	5
Environmental Protection Expenditure Accounts	30 - 40	8
Land Accounts	41 - 43	10
Subsoil Asset Accounts	44 - 47	11
Forest Accounts	48 - 53	13
Fishery Resource Accounts	54 - 55	15
Water Accounts	56 - 59	15
Environmental Degradation	60 - 64	16
Aggregation and Tabulation, Analysis and Interpretation of the Results	65	17
Institutionalization	66 - 74	18
Closing Session	75 - 77	20
ANNEX I - List of participants		22
ANNEX II - Workshop agenda		29
ANNEX III - Worksheets		32

I. ORGANIZATION OF THE WORKSHOP

Place and Date

1. The Workshop on Integrated Environmental and Economic Accounting was jointly organized by the United Nations Statistics Division (UNSD) and the Statistics and Economic Projections Division of the Economic Commission for Latin America and the Caribbean (ECLAC). Collaborators included representatives of the Environment Statistics Program of Statistics Canada, the Environmental Accounts Project of the Central Bank of Chile, the National Administrative Department of Statistics (DANE) of Colombia, and the National Institute of Statistics, Geography and Information (INEGI) of Mexico. The Workshop took place at ECLAC headquarters in Santiago, Chile, from 20 to 24 April 1998.

Objectives

2. The main objectives of the Workshop were to provide training in the compilation of satellite environmental accounts linked to national accounts, within the framework of the 1993 System of National Accounts and to provide a forum for the exchange of experience on the implementation of environmental accounting. To achieve the first objective, a description of the step-by-step guidelines on how to implement the System of integrated Environmental and Economic Accounting (SEEA) was given, and the use of the concepts, classifications and methods contained in the forthcoming publication, *Integrated Environmental and Economic Accounting - An Operational Manual*, were explained.

Attendance

3. The Workshop was attended by representatives of the following fifteen countries: Argentina, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Guatemala, Mexico, Panama, Peru and Venezuela. Also in attendance was one resource person from UNSD, and ECLAC representatives from the Statistics and Economic Projections Division. The list of participants is included in Annex I.

Agenda

4. The topics on the agenda to be discussed during the Workshop were as follows:
 1. The System of National Accounts (SNA)
 2. Environmental Accounting and the System of integrated Environmental and Economic Accounting (SEEA)
 3. Environmental Protection Expenditure Accounts
 4. Land Accounts
 5. Subsoil Asset Accounts
 6. Forest Accounts
 7. Fishery Resource Accounts
 8. Water Accounts
 9. Environmental Degradation
 10. Aggregation and Tabulation, Analysis and Interpretation of the Results
 11. Institutionalization.

5. The meeting did not formally elect officers. The representatives of ECLAC and UNSD shared the office of chairperson except when discussions of selected issues were headed by a moderator, who then assumed the role of chairperson. Each agenda topic was first introduced by the representative of UNSD who described the topic and presented the relevant worksheets from the *Operational Manual*, after which country presentations were made and a discussion followed. (See Annex II for the Workshop agenda and Annex III for the worksheets).

Opening Session

6. The Workshop was opened by the Director of the Statistics and Economic Projections Division of ECLAC, who welcomed the participants and explained that at the last Joint OAS/ECLAC Meeting on Statistical Matters, the Directors of Statistics of the Latin American and Caribbean countries had drawn attention to the demand, on the part of their governments as well as society, for environmental statistics and for the incorporation of the subject of environmental statistics into their work programmes. It was also pointed out that the present Workshop had been included in the work programme that was approved during that Joint Meeting.

7. He emphasized that a sharp contrast exists between the growing demand for information on the environment and the limited response in the countries of the region. In fact, the experience in the systematic compilation of environment statistics has been meager. It was for this reason, he noted, that it was especially important to tap and to transfer international and regional experience among the countries of the region.

8. He mentioned that he was pleased that the United Nations Statistical Division was co-sponsoring the Workshop, and expressed gratitude that experts from Canada and countries in the region that have initiated environmental accounting activities were present to share their concrete experience.
9. In closing, he reiterated the commitment of the Statistics and Economic Projections Division to contribute to the improvement of national capacities to develop programmes on environmental statistics, indicators, and accounting through the organization of workshops such as the current one as well as by continuing to facilitate the transfer of experience and information.
10. The representative of the United Nations Statistics Division welcomed the participants on behalf of the Director of UNSD, and expressed her pleasure to discuss the concepts and methods of integrated environmental and economic accounting with experts of the region and to collaborate with ECLAC in this relatively new area of statistics. She noted that it was in the ECLAC region that much of the discussion on sustainable development had begun and that one of the first workshops and the first UNSD project on environmental accounting were undertaken there as well, in Costa Rica and Mexico respectively.
11. She commented on the increased attention being paid by the international community to the question of socioeconomic and sustainable development since the 1992 United Nations Conference on Environment and Development in Rio de Janeiro, the changing perception of the environment with respect to its capacity to provide natural resource inputs to and absorb wastes from economic activity, and the fact that in order to be able to limit the negative impact of economic activity on the environment, economic and environmental problems must be analyzed together using a common approach.
12. She explained that in response to the proliferation of methodologies, some of which were inconsistent with the System of National Accounts (SNA), the United Nations published the handbook, *Integrated Environmental and Economic Accounting*, in 1993. The System of integrated Environmental and Economic Accounting (SEEA) is a satellite system of the SNA that extends the SNA with respect to the treatment of information on the environment, but does not replace it. One of the purposes of the SEEA, she continued, is to organize the information related to the environment using classifications and methods that are consistent with the SNA in order to evaluate the interrelationships between economic activities and the environment. Noting that policy-makers currently base many of their decisions on economic indicators such as Gross Domestic Product (GDP), she went on to mention some of the criticisms of the SNA from environmentalists, such as its failure to acknowledge the contribution of the environment to national wealth, its treatment of the receipts from the depletion of natural resources as income, and its inclusion of environmental protection expenditures as part of GDP. She explained that the 1993 SNA includes information on the environment in its balance sheets, thereby accounting for natural wealth. The emphasis on sustainable development has given increased importance to the contribution of natural wealth

to income. Sustainable development requires consideration of both produced and natural capital. There is a divergence of opinion on whether the two forms of capital can be substituted for one another or maintained intact independently. Two definitions of sustainability - weak sustainability and strong sustainability - have been developed. The SEEA embraces, in general, the concept of strong sustainability, in the sense that natural capital should be maintained intact, with the exception, however, of subsoil assets.

13. She indicated that the SEEA is a work in progress, which has been tested in several countries and which continues to be reviewed. Realizing that guidance was needed on implementing it, and taking into account experience gained by countries in environmental accounting, the United Nations, in collaboration with the Nairobi Group (composed of experts from international, national and non-governmental organizations) decided to prepare an operational manual to explain, step-by-step, the implementation of the SEEA.

14. The representative of UNSD concluded by describing the environmental accounting activities in which UNSD is involved, such as those of the London Group, which she pointed out, has made important contributions to the development of concepts and methods. Other joint activities being carried out, such as the Eurostat-FAO-World Bank-UNSD work on the preparation of a report on integrated environmental and economic accounting for forests, and the manual on integrated environmental and economic accounts for fisheries that UNSD is developing with FAO and the UN University, were mentioned. She described UNSD's work on environmental statistics and indicators, explaining that a pilot questionnaire is being sent to selected countries, and that future work will involve developing a joint UNSD-OECD questionnaire and preparing a compendium to include data received in the questionnaires and well as environmental data collected by other international organizations.

15. The representative of ECLAC then briefly described the work of the Statistics and Economic Projections Division with respect to the two areas of environmental statistics and indicators, and environmental accounting. She remarked that the Workshop was fortunate to have present experts from the national statistical offices of Canada, Colombia, and Mexico, as well as from the Central Bank of Chile, who had agreed to impart their knowledge and relate their experience in the development of environmental and natural resource accounts to the participants from the other countries. She noted that among the participants, there seemed to be a good mix of both representatives responsible for environmental statistics and indicators from national statistical offices and those from central banks who were in charge of national and/or environmental accounts, a fact that was likely to ensure an interesting and varied exchange of views during the Workshop.

II. SUMMARY OF PRESENTATIONS

The System of National Accounts (SNA)

16. The National Accounts expert from ECLAC introduced the topic by presenting the current version of the System of National Accounts (SNA), i.e. the 1993 SNA. His presentation was based on the description of the principal structural elements of the system, with emphasis on those which were most closely related to the System of integrated Environmental and Economic Accounting (SEEA). The description referred to: the agents of the system; the accounting framework (accounts and sub-accounts); the transactions (flows and stocks); the proposed classifications; and the valuation criteria.

17. After completing the presentation of the system, the most notable expansions of the central framework of the 1993 SNA which link the SEEA and the SNA were described. The representative of ECLAC concluded by mentioning the progress being made in Latin America and the Caribbean in applying the 1993 SNA and the growing interest that can be observed in the region in incorporating the environmental dimension in the economic accounts.

Environmental Accounting and the System of Integrated Environmental and Economic Accounting (SEEA)

18. The representative of UNSD described the objectives and framework of the SEEA and explained how to compile the accounts following the step-by-step guidelines presented in the draft *Operational Manual*. Reiterating that the SEEA complements the SNA, she explained that the conventional supply and use and asset accounts of the SNA are expanded in the SEEA to:

- (a) separately identify and measure all environment-related flows and stocks of the traditional accounts;
- (b) assess environmental costs caused by the production and consumption of industries and households, i.e., the depletion of non-produced assets and environmental degradation;
- (c) link physical resource accounts with monetary environmental accounts and balance sheets;
- (d) account for the maintenance of tangible wealth by including not only human-made capital but also natural capital;
- (e) compile environmentally-adjusted aggregates such as environmentally-adjusted net domestic product (EDP) and capital formation (ECF).

19. She described the difference between economic and environmental assets, noting that the former includes natural assets over which ownership rights are enforced and from which

economic benefits may be derived, and that the latter, implicitly, applies to all those non-produced assets that do not function as providers of natural resource inputs into production but rather as providers of "non-economic" (generating no profit) environmental services such as waste absorption, ecological functions such as habitat or flood and climate control, and other non-economic amenities.

20. It was noted that the compilation of the physical data constitutes the first step in the compilation of the accounts and that the data provides useful information for describing environment-economy relationships. Whenever feasible, physical accounts should be valued to obtain monetary accounts. The strength of the SEEA consists in the integrated database generated by the compilation of the accounts. Such an integrated database provides information for decision-making for improving or ensuring the sustainability of growth and development. It can also serve as an input into modeling and forecasting with different scenarios.

21. The following three valuation approaches that are presented in the SEEA were discussed: market valuation, maintenance costing, and contingent and related valuations. It was pointed out that only the first two approaches are consistent with the SNA and therefore recommended for recurrent implementation of the SEEA.

22. Environmentally-adjusted economic aggregates, for example, environmentally-adjusted value added (EVA), net domestic product (EDP) and capital formation (ECF), were described.

23. The representative of UNSD then presented the different worksheets of the SEEA *Operational Manual* to provide a general overview of the system, while describing the structure of the individual accounts and tables, the types of data and valuation/costing calculations that are required to fill them in, and reviewed the key environmental/national accounting concepts.

24. She summed up the sequence of steps set forth in the *Operational Manual*, as follows:

- Step 1: Compilation of the supply and use accounts
- Step 2: Identification and compilation of environmental protection expenditure accounts
- Step 3: Compilation of produced asset accounts
- Step 4: Compilation of physical economic asset accounts
- Step 5: Valuation of natural resources
- Step 6: Compilation of physical environmental asset accounts
- Step 7: Compilation of emissions by economic sector
- Step 8: Maintenance costing of environmental degradation
- Step 9: Aggregation and tabulation
- Step 10: Comparison of conventional and environmentally-adjusted indicators.

25. She also noted that the steps do not necessarily have to be followed in sequence and that not all the steps have to be implemented during the SEEA compilation. Each country should choose which steps, and hence which worksheets or parts of worksheets to compile, on the basis of its environmental concerns and priorities.

26. The participants were then reminded that the worksheets would be examined in greater details as the different agenda items were covered.

27. The representative of the Central Bank of Chile summarized the experience of her institution in the development of environmental accounts within the framework of the System of National Accounts, since 1993 when the Environmental Accounts Project began. The work undertaken included: the compilation of balance sheets (consisting of information in physical terms on opening stocks, flows or changes in stocks, and closing stocks) for the fishery, minerals and forestry sectors; the efforts to estimate mitigation costs to reflect the environmental damage caused by the production activities of the three sectors; the identification of environmental protection expenditures; and the review of methodologies for the eventual valuation of the natural resource assets. The various problems that had been encountered in the course of executing the project were mentioned, such as the lack of background data that would have been suited for direct incorporation into environmental accounts, the complexities of inter-institutional relations, as well as the difficulties associated with the different ways that the various experts involved in the project often interpreted concepts, depending upon their particular branch of learning.

28. The representative of the National Institute of Statistics, Geography and Information (INEGI) of Mexico began his presentation by giving a general description of the work being carried out by INEGI and then outlined the work it has been doing on environmental accounting. He spoke about the different phases of the development of the System of Economic and Ecological Accounts of Mexico (SEEAM), beginning with the case study carried out by INEGI with the technical assistance of the United Nations Statistical Office and the World Bank, followed by work to bring that information up to date. He discussed the work done to develop an environmentally-adjusted net domestic product for Mexico, and presented Mexico's results and compared them to those of a few other countries. He mentioned that currently work continues to be done on reviewing and updating the accounts, using the new 1993 base year of the System of National Accounts of Mexico. The latest series will cover 1988-1996, and include preliminary data for 1997. The following broad topics are covered in the SEEAM: water resources - depletion and degradation; land - changes in land use, soil contamination, soil erosion; forest resources; air pollution; and depletion of subsoil assets (petroleum and natural gas). He concluded by presenting various tables and briefly discussed some of the results contained in the SEEAM.

29. The representative of Statistics Canada provided an overview of the Canadian System of Environmental and Resource Accounts, which represents a comprehensive framework for linking the economy and the environment. Its objective is to organize physical and monetary

statistics related to the environment using classifications, concepts and methods that are compatible with the Canadian System of National Accounts. She described the three principal components of the System of Environmental and Resource Accounts. The Natural Resource Stock Accounts, she explained, measure the quantities of natural resource stocks and the annual changes in the stocks, in both physical and monetary terms, and form the basis of the estimates of Canada's natural resource wealth that are included in the Canadian National Balance Sheet Accounts. The Material and Energy Flow Accounts record, in physical units, the flows of materials and energy in the form of natural resources and wastes, between the Canadian economy and the environment. She concluded by describing the Environmental Protection Expenditure Accounts, which identify current and capital expenditures by businesses, the government and households for the purpose of protecting the environment.

Environmental Protection Expenditure Accounts

30. The series of presentations on environmental protection expenditures was begun by the representative of UNSD. Environmental protection expenditures are actual expenses incurred by industries, households, governments, and non-governmental organizations to avoid environmental degradation or to eliminate part or all of the effects after degradation has occurred. She explained that environmental protection expenditures are included in the SNA although they are not usually separately identified in the conventional production and use accounts. One of the objectives of the SEEA, therefore, is to make explicit the expenditures on environmental protection activities. In that way, a picture of the efforts that have been undertaken by the different sectors of the economy to protect the environment and maintain its natural capital can be provided.

31. The worksheets on environmental protection expenditures from the draft *Operational Manual* were presented and it was pointed out that environmental protection expenditures are separately identified as part of output, intermediate and final consumption, consumption of fixed capital, capital formation, imports and exports, and valued added and its components.

32. Reference was made to the draft Classification of Environmental Protection Activities (CEPA), and Eurostat's European System for the Collection of Economic Information on the Environment (SERIEE) was mentioned as containing more details on the definitions and classifications of environmental protection expenditures. The representative of UNSD concluded by listing some of the data sources for environmental protection expenditures, mentioning, for example, special surveys, governmental budgets or public accounts, and data from industries.

33. The representative of Statistics Canada described Canada's Environmental Protection Expenditure Accounts, explaining that accounts have already been developed for the business and government sectors, and that work is under way on the household account. The business account is currently restricted to direct expenditures made by firms in order to comply with or

anticipate environmental regulations or conventions (voluntary agreement). The categories of expenditures include: pollution abatement and control; restoration of wildlife and habitat; environmental monitoring; and site reclamation and decommissioning. The government account expenditures are classified into three categories: pollution abatement and control; natural resource conservation and industrial development; and expenditures on parks.

34. The methods and sources used to collect information on environmental protection expenditures for the accounts and the challenges involved in measuring the expenditures were described. The representative of Statistics Canada then responded to several questions and comments, one of which concerned the argument that expenditures on environmental protection should be excluded from the value of production measured in the national accounts. She explained that Statistics Canada does not currently intend to adjust Gross or Net Domestic Product.

35. The discussion on environmental protection expenditures continued with a presentation by the representative of Colombia, who explained that the Administrative Department of National Statistics (Departamento Administrativo Nacional de Estadística - DANE) of Colombia developed the pilot project on integrated economic and environmental accounting as part of the activities of the Inter-institutional Committee for Environmental Accounts. The objectives of the project in the area of environmental protection expenditures were the explicit identification and registering of the expenditures undertaken by the government, industries and households for the protection and recuperation of the environment and the design of a special module on environmental expenditures to be included in the Annual Manufacturing Survey in order to identify and register expenditures incurred by the industrial sector for environmental protection.

36. She explained that the Colombian system of integrated economic and environment accounting (COLSCEA) bases its classification of the environmental protection activities and products on the International Standard Industrial Classification (ISIC) and the Central Product Classification (CPC) and includes: reforestation; sewerage; transport and disposal of wastes; recycling; other environmental activities of the government; and ancillary environmental protection activities. The other environmental activities of the government are classified into: protection of the air, water, soil, groundwater and subsoil; protection against noise; ecosystems and landscape; research and development; and general environmental activities.

37. The representative of the National Institute of Statistics, Geography and Information (INEGI) of Mexico began his presentation on the environmental protection expenditures of the public sector by giving a brief description of the public sector and its different entities and then listed the sources of information used to collect the data included in the System of Economic and Ecological Accounts of Mexico (SEEAM). He mentioned the difficulties associated with defining environmental protection expenditures and described the methodology to calculate them that is applied in the SEEAM. He added that for the private sector, composed of households and industries, efforts to compile information on environmental protection

expenditures incurred by them involved adding a module in the household survey of income and expenses, and the design of a questionnaire to collect the information from industries. He concluded by presenting several tables containing information on environmental protection expenditures of the public sector and noted that the work in this area continues to be done to improve the results obtained to date and to incorporate additional relevant information.

38. The representative of Costa Rica informed the participants about a pilot project that was undertaken in 1996 to elucidate the expenditures made on environmental protection by the public sector of his country from 1991 to 1995. He explained that a request for data had been sent to more than one hundred government institutions by the Central Bank of Costa Rica and that the data received was combined with information from the Controller's Office on programmes related to the environment. Data broken down into current and capital expenditures on environmental protection were compiled according to the following categories: forest and non-forest ecosystems; water resources; protection of the air and climate; treatment of wastes; protection against noise; protection of soil; and other environment protection activities.

39. A discussion on environmental protection expenditures followed, moderated by the representative of Canada. She contrasted the purpose criterion used in Canada for defining environmental protection expenditures with the technological criterion, which is another main approach to classifying expenditures. She outlined the limitations of each, and pointed out that the purpose criterion is more practical by restricting the purposes that define environmental protection expenditures.

40. Some participants then mentioned those expenditures which are considered to be environmental protection expenditures in their countries, and several noted the difficulties involved in clearly defining them. Examples of the problems involved in unequivocally attributing an expenditure to environmental protection were brought up, such as in the case of the adoption of a cleaner technology which increases productivity, and in the case of the adoption of a technology in order to ensure that the exported product fulfills certain requirements imposed by purchasing countries. Canada's questionnaires on environmental protection expenditures were presented, after which a brief description was given of the environment industry in Canada.

Land Accounts

41. The representative of UNSD observed that in the SNA, land accounts are already dealt with, but refer only to land over which ownership rights can be exercised and from which its owners may derive economic benefits. The SEEA, on the other hand, extends the SNA's classification of land to include forest land and all "non-economic" land. The SEEA's Classification of Non-Financial Assets thus includes the categories (a) soil; (b) cultivated (economically used) land areas with connected ecosystems, broken down into: land underlying buildings and works; agricultural land; forest and other wooded land; recreational land and

other open land for economic purposes; and areas of artificial watercourse or water impoundment; and (c) uncultivated land areas (with connected ecosystems), broken down into: wet open land; dry open land with vegetation cover; open land with or without insignificant vegetation cover; and water areas (except areas of artificial watercourse or water impoundment). The representative of UNSD then described the concepts and definitions of the SEEA's land and soil component of the physical and the monetary accounts for non-produced economic assets, and the physical account for the non-produced "environmental" assets, and specified the data that are necessary for compiling the accounts, as well as the sources of the data. She pointed out that the issue of soil erosion in the accounts is considered as a change in the quality (degradation) of the land, and briefly mentioned the valuation approaches that have been proposed to estimate the economic effects of soil loss.

42. The representative of Canada described the purposes and classifications of the five components of Canada's Land Account. The physical foundation component, she noted, delineates Canada's land and water. The land cover component, she continued, describes vegetation and other surface features (e.g., forests, tundra, urban built-up area, water, etc.) and provides information for determining land use and land value. The land use component consists of seven classes (urban, rural, agricultural land, forest land, transportation land, utilities land, other land) and provides information on land use trends, which is important for assessing, for example, environmental sustainability. The land potential component examines the biophysical properties of the land and supplies information that is useful for planning for the most efficient use of the land resources. She then explained that the purpose of the land value component is to provide estimates of the value of Canada's land for inclusion in the Canadian National Balance Sheet. She noted that the Balance Sheet currently includes land under residential and non-residential buildings and agricultural land, and mentioned that valuation methods are being developed in order to include land that is excluded.

43. The representative of Mexico began his presentation on land use by identifying several of the sources of information used to compile the data, such as land use inventories, population and housing censuses, Mexico's national accounts, and statistical yearbooks on agricultural production and livestock production. He explained that the land use classification used in the System of Economic and Ecological Accounts of Mexico (SEEAM) contained the following categories, according to the economic use of the land: forest, agriculture, livestock, mixed, urban, unproductive, and bodies of water. The representative of Mexico then spoke briefly about some of the methodologies applied in the SEEAM, and presented several tables which contained data on land use in both physical and monetary terms.

Subsoil Asset Accounts

44. The representative of UNSD presented the subsoil assets component of the physical and the monetary asset accounts for the non-produced economic assets and explained that subsoil assets are defined in the SNA and SEEA as proven reserves of mineral deposits located on or below the earth's surface, which are economically exploitable given current technology and

relative prices. She mentioned that some countries have extended this definition to include probable and possible reserves, i.e. reserves that can be extracted with high probability given the current technological conditions and prices. She then described the other key concepts and definitions pertaining to the stocks and changes in stocks of subsoil assets, and pointed out that depletion in the worksheets refers to extraction since subsoil assets are non-renewable resources. She concluded by specifying the data that are necessary for compiling the accounts and the sources of the data, and by discussing the valuation methods that can be applied in the accounts.

45. The representative of Canada explained that Canada's subsoil asset accounts record annual physical and monetary estimates for the stocks of economically recoverable reserves of various energy resources, metals and non-metallic minerals. She presented a classification of subsoil reserves and resources to illustrate how they are classified by the degree of economic viability and geological certainty with which they are known to exist, and explained the reserves terminology. The structure and components of the physical and the monetary subsoil asset accounts were described. The concepts and methods of valuation (net price and present value) that are used to estimate stock values in the monetary subsoil asset accounts were explained and it was pointed out that the principal function of the monetary accounts is to provide estimates of subsoil asset stock values for inclusion in the Canadian National Balance Sheet Accounts.

46. The representative of the Central Bank of Chile described the study that it undertook in collaboration with the National Geological and Mining Service (SERNAGEOMIN) as part of the Bank's project on environmental accounts. The objective of the study was the measurement of the stocks of copper, gold, coal, and calcium carbonate and their developments in Chile during the period 1985-1994. The specific work of the Central Bank entailed the measurement of the mineral resources for the environmental accounts. She presented a scheme of the reserves and resources classification used in the study and explained the relevant concepts, and then presented the balance sheet, pointing out its accounting structure and noting that it is the instrument used to order information on the stocks and flows of the natural resources for a series of years. She specified the various types of flows and explained how the final inventory in the balance sheet is calculated. She concluded by discussing some of the results of the study, and explained that although the measurement of the stocks of the mineral resources had been made in physical terms only, work was under way to eventually assign monetary values to them.

47. The representative of Mexico described INEGI's experience in accounting for the energy resources crude petroleum and natural gas in the System of Economic and Ecological Accounts of Mexico (SEEAM). He listed the various sources of information used to collect the data, and explained how the valuation of the resources was carried out in the SEEAM by presenting the methods they used. He concluded his presentation by showing and describing several of the tables from the SEEAM, and explained that to compile the balance sheet for oil, data on opening stocks, discoveries, extraction, oil spills, revaluation and closing stocks were collected.

Forest Accounts

48. The representative of UNSD began by describing the different categories of forests accounted for in the SEEA. Produced forests, she explained, are those which have come into existence as outputs of production processes and whose natural growth and/or regeneration is directly controlled or managed by an institutional unit. The non-produced forests can be considered as either economic or "environmental" (non-economic) assets, although the distinction may sometimes be difficult to make. Non-produced economic forests are defined as forests that are not the result of a production process but which nevertheless are likely to be exploited in the short term; this category includes all natural forests that can be exploited for timber production or for the production of non-wood products. The growth of non-produced forests is accounted for in other volume changes, as opposed to the growth of cultivated forests, which is considered a process of production and is therefore recorded in the capital account. All forests, she added, also provide environmental services which can be accounted for in physical terms. The non-produced "environmental" forests are those which are not likely to be exploited in an economic sense, such as protected forests and forests in the wilderness which are inaccessible and over which effective ownership rights cannot be enforced.

49. The representative of UNSD then presented the following four worksheets from the *Operational Manual*: the monetary asset accounts for produced assets, the physical and the monetary asset accounts for non-produced economic assets, and the physical asset accounts for the non-produced "environmental" assets. She explained the key concepts relating to the forest asset component of the worksheets, such as sustainable use and depletion, among others. She pointed out that since forests are renewable assets, depletion in the worksheets refers to exploitation of the forests at levels that exceed their natural capacity of renewal. She then specified the data on forests that are necessary for compiling the accounts, and listed the sources of the data, and concluded by describing the different valuation methods that are commonly applied to forests.

50. A representative of the National Forest Corporation (CONAF) of Chile described the land survey and evaluation of the native vegetation that had recently been undertaken in Chile in response to the need for up-to-date information on the state of the country's forest resources and ecosystems. It was carried out using a geographical information system, and cartographic images of the entire national territory's forest resources and ecosystems were obtained. The cost of this method, as well as its system for updating and monitoring, was much lower than that of a traditional forest inventory. He explained that the principal objective was to produce a national survey of the natural vegetal formations and to locate the plantations so that basic information could be geared to and provided for government policy purposes in environmental matters and for resource management and conservation policies. The characteristics of the vegetation were determined by means of collecting two types of information, geographic as well as alphanumeric. The following six attributes describe the state of the vegetation: current use of the land; vegetation formation; population structure; density; height; and dominant species. The current land use categories in Chile were determined as follows: urban

and industrial areas; agricultural land; pastures (covering 27.2% of the national territory); forests (covering 20.8% of the national territory, of which 17.8% represents native forests); wetlands; deserts (barren areas, covering 32.5% of the national territory); snow; water bodies; and areas not classified.

51. The representative of Canada explained that Canada's Timber Asset Accounts are made up of a physical and a monetary account, which focus on the timber supply from accessible and timber-productive forest land that is available for harvesting. She described the physical timber asset account, explaining that it provides annual opening and closing estimates of standing timber stocks and timber-productive land area, as well as the changes in the volume of these stocks due to natural growth, harvest, mortality, fire loss and loss due to logging roads. She noted that the account is based on data from forest resource inventories and data estimated from simulation models. It was explained that the monetary timber asset account provides annual value estimates, which are included in the National Balance Sheet Accounts, for the stock of standing timber. She discussed the calculation of timber rent as well as the present value method to value the total stock of timber.

52. The representative of the Central Bank of Chile described the work carried out by the Environmental Accounts Project together with sectoral institutions to determine the area of the native and the exotic forests (plantations) and the changes in their stocks over time, for the period from 1985 to 1994. She presented examples of the balance sheets that were designed for the analysis for registering information, in physical terms, on the stocks (area of the opening and closing assets) and the flows (forest land area affected by actions which cause it to increase or decrease). She described the practices which increase the area covered by forests (forestation and reforestation in the case of plantations), and the actions causing the area covered by forests to decrease (fires causing damage to the entire area and production for consumption in the case of plantations; and fires, clearing for agricultural use or for the raising of livestock, replacement by plantations, and illegal clear-cutting in the case of native forests). She pointed out that the balance sheet for the native forest contains additional information, i.e. a breakdown of the stocks of both the non-protected forests, according to their quality, and of national parks and reserves, as well as intra-area transfers (actions which do not affect the total area but which do affect the quality of the forests). She concluded by explaining that at the present time, the figures for the study were not available.

53. The representative of Mexico began his presentation by describing the various sources of information used in Mexico to compile the asset accounts for forest resources, such as forest inventories and inventories on land use, satellite images, censuses and maps. He explained that in the System of Economic and Ecological Accounts of Mexico (SEEAM), the annual balance sheets for forest resources contain information in area, volume, and monetary terms, on: opening and closing stocks; increases due to reforestation and growth; and decreases as a result of logging (or production), fires, deforestation (for the raising of livestock, agriculture or urbanization) and other losses. He then briefly discussed the valuation methods used in the SEEAM and presented various graphs, tables and forest resources balance sheets.

Fishery Resource Accounts

54. The representative of UNSD presented the worksheets for the monetary asset accounts for produced assets, and the physical and the monetary accounts for the non-produced economic assets from the *Operational Manual* and discussed the relevant concepts and definitions relating to fishery resources. She pointed out that economic assets, when referring to fish, cover fish and other aquatic animals that are being exploited for economic purposes or that are likely to be exploited for economic purposes. She described the distinction between fish as produced assets and as non-produced assets, explaining that growth, in the case of fish in the produced asset category, is organized, managed and controlled by institutional units (such as fish in aquaculture), whereas in the case of non-produced fish, growth is considered as a natural process. She then described the specific data required for compiling the accounts, as well as the sources of the data, and mentioned some of the difficulties involved in accounting for these resources. One problem cited had to do with defining the production boundary and distinguishing between non-produced and produced fishery resources, as it is difficult to define how much control has to be exercised in order for an asset to be considered produced. She concluded her presentation by mentioning some of the commonly applied valuation methods for fish.

55. The representative of Canada informed the participants about the preliminary work being done by Statistics Canada on developing fish accounts, and the pilot survey of the aquaculture industry. She referred to data availability problems especially with respect to fish and shellfish stocks, and mentioned that the current focus of the work is on developing physical accounts of important commercial species. She indicated that the aquaculture industry survey represents a potential source of data for stocks and rent calculations.

Water Accounts

56. The representative of UNSD stated that water accounts are difficult to compile due to the nature of the asset. She explained that the water accounts in the SEEA focus on such water bodies as aquifers and other groundwater sources, and other freshwater bodies. Emissions into water are dealt with in the degradation accounts. She presented the water component of the SEEA's physical and the monetary accounts for non-produced economic assets and described the relevant concepts and definitions, and specified the data that are necessary for compiling the accounts and the sources of the data. She concluded by mentioning the valuation approaches to measuring water depletion and degradation.

57. The representative of Statistics Canada described her country's water use account, which records gross water use, total discharge and consumption by industries, governments and households. She cited the various data sources and explained that the compilation of water stock accounts and monetary water accounts is not currently planned.

58. The representative of Mexico began his presentation on water resources by listing the sources used to compile the data. He explained that the water resources covered in the System of Economic and Ecological Accounts of Mexico (SEEAM) include only groundwater and its depletion, and presented various tables with data series on groundwater depletion, in physical units as well as in monetary terms. He concluded his presentation with a brief discussion on valuation and by presenting various formulas used in the SEEAM to determine the cost of groundwater depletion.

59. The representative of the National Commission for the Environment (CONAMA) of Chile informed the participants about a project that CONAMA is undertaking to develop environmental accounts on water resources for a selected water basin.

Environmental Degradation

60. In her discussion of environmental degradation, the representative of UNSD described the worksheet on the physical quantities of emissions into the different media of the natural environment (land, air and water) by polluting sectors, and the worksheet on the maintenance costing of emissions. She described the procedure for determining the maintenance cost, the calculations required to complete the worksheets, and the various sources of the data. She emphasized that in principle, only emissions that cannot be safely absorbed by environmental sinks should be costed, but that in practice it is assumed that the residual emissions after treatment are the only ones that are safely absorbed or alternatively, that the environment's capacity to absorb any emissions has been exceeded.

61. The representative of Statistics Canada first explained that the Greenhouse Gas Accounts in the Canadian System of Environmental and Resource Accounts provide estimates for emissions of carbon dioxide, methane, and nitrous oxide by industry, government and households, and then described the sources of each of the three greenhouse gases.

62. The representative of Colombia informed the participants about the work to compile information on the environmental quality of water and air carried out by the pilot project on economic and environmental accounting in Colombia. She explained that the account on water quality contained information on the initial water quality, the total volume of industrial discharges, the expenditures on environmental protection and the final quality of water bodies of the principal industrial areas of the country. With respect the air quality account, she explained that its structure was similar to that of the water quality account, and that it covered pollutants generated by industrial activity by fixed sources and included emissions of total suspended particulate matter, sulphur dioxide and nitrogen oxide.

63. The representative of Mexico informed the participants about the work that INEGI has been doing on the compilation of information on environmental degradation by listing the data sources, and describing the relevant concepts and methods used in the System of Economic

and Ecological Accounts of Mexico (SEEAM) to produce data on air and water pollution, and soil contamination and erosion. In his discussion of air pollution, he described the fixed and mobile sources of air pollution in Mexico and showed various statistical tables from the SEEAM on emissions of each of the main pollutants from industrial activity, the generation of electricity, oil refining, services and transport. He explained that the methodology used in the SEEAM for estimating emissions to air involved the application of emission factors to data on fuel consumption in the case of fixed sources, and to the kilometers traveled by type of vehicle, in the case of mobile sources, and then briefly described the calculations made to estimate air decontamination costs. He discussed water pollution next, and described the work done by INEGI with respect to the compilation and analysis of information on the generation of waste water by the industrial, agricultural and household sectors, and presented some results of the work done to calculate the costs of treating polluted water. He continued with a discussion of soil contamination by solid wastes, mentioning that solid wastes are classified in Mexico into the categories municipal, industrial and special, and according to whether they are biodegradable or not. He then briefly described the method applied in the SEEAM to estimate the volume of solid wastes produced. He ended his presentation by first describing the data required to compile balance sheets on soil erosion as well as the sources of this data, and then by describing the methodology applied in the SEEAM to calculate the value of soil erosion of agricultural land, land used for grazing of animals, forest land and unproductive land.

64. The representative of the Central Statistics and Information Office of Venezuela described the environment statistics programme being developed by his institution. The focus of the programme is basically the preparation of an environmental quality index whose purpose is to generate an information system capable of answering questions about the environmental condition of the geographic areas of the country and to support decision-making with respect to the planning of these areas. He continued by describing the components of the environmental quality index and the variables and method used to construct it.

Aggregation and Tabulation, Analysis and Interpretation of the Results

65. The representative of UNSD presented a diagram of the framework of the SEEA, which showed how each individual worksheet of the *Operational Manual* fits into the overall framework. She pointed out the components of the worksheets which already are included in the SNA and those additional ones relating to the environment whose inclusion ultimately permits the integration of economic and environmental information and the calculation of environmentally-adjusted aggregates. She explained that the SEEA does not propose that the countries compile all of the accounts that she had presented for each of the resources, but rather recommends that each country choose which particular accounts to compile according to its priorities, natural resources endowment and data availability. She briefly presented the analysis of the results obtained from the compilation of the SEEA in Korea and the Philippines, and described the indicators derived from the accounts that can be used in the analysis.

Institutionalization

66. In addition to discussing their institutional arrangements and problems with respect to integrated environmental and economic accounting, the participants were requested to inform the meeting about their future plans to compile the accounts and to advise UNSD and ECLAC on what they would like them to do in the future to contribute to the development and improvement of environmental accounting activities in Latin America and the Caribbean.

67. It was recognized that in order to compile integrated environmental and economic accounts, information is required from the Central Banks and/or the National Statistical Offices, depending upon which institution is responsible for compiling the national accounts, as well as from numerous other sources. This calls for much interaction to obtain the cooperation of many different institutions and to establish coordination among them. The representatives of Chile, Colombia and Mexico explained how the environmental accounting projects had been initiated in each of their countries, described the institutional arrangements, and stressed the importance of effective coordination and the challenges involved in establishing it. A few participants mentioned the slight advantage that some countries had when the same institution is in charge of producing the national accounts and the environmental statistics and accounts; others mentioned the problems that arise when the necessary data is dispersed over numerous institutions.

68. The participants agreed on the usefulness of the Workshop, and stated that they had benefited greatly from UNSD's explanation of the step-by-step guidelines on the compilation of integrated environmental and economic accounts, and from hearing about the experience, methods used and progress made in the compilation of the accounts in Canada, Chile, Colombia and Mexico. While it was agreed that the *Operational Manual's* guidelines provide a good basis for initiating environmental accounting activities, the need for additional future training and technical support from UNSD and ECLAC was stressed both by participants from countries which have not yet initiated activities, and by a few participants from countries with programmes under way who suspect that they are likely to encounter some potential difficulties in the future as they progress further. The participants requested UNSD and ECLAC to continue to facilitate the exchange of information and experience by organizing seminars and other workshops such as the present one, to provide them with conceptual and methodological material and other reports so that they could study the subject further and stay abreast of developments, and to facilitate the opening of channels of communication so that participants could informally seek advice and answers to their questions from experts.

69. Several participants from institutions which were not currently involved in environmental accounting activities stated that they felt they could now, as a result of having attended the Workshop, gradually begin to undertake some activities and described the ways in which they proposed to begin. Many others stated that they did not envisage that their institutions would be able to embark upon environmental accounting programmes in the near future, mainly because of the lack of financial resources, and other priorities and more

pressing needs. The importance of integrating the environmental dimension in the national accounts was acknowledged by all participants, and several expressed regret over the lack of awareness among many decision-makers with respect to the usefulness and importance of integrated environmental and economic accounts. They urged UNSD and ECLAC to work towards creating greater awareness and generating more interest in this regard, to encourage their countries to undertake programmes on environmental and economic accounting, and to identify funding and channel the resources in order to assist those countries that would otherwise be unable to initiate environmental accounting activities.

70. The representative of Statistics Canada referred to the participants' comments regarding institutional problems they face in their countries, and reminded them that the development of Canada's existing accounts has taken six years, and that work still remains to be done to complete the set. She remarked that this type of work often requires much patience and negotiation, since it involves obtaining the cooperation of different departments to share their data. She stressed the importance of going to other sources for data, and mentioned that Statistics Canada does not collect all the physical data it needs for the accounts, but rather must obtain it from other departments and then integrate the economic and environment data.

71. The representative of Statistics Canada then described the uses of the Environmental and Resource Accounts in Canada, mentioning that the natural resource stock accounts serve as a basis for various environment-economy indicators, such as the amount of rural land that has been converted to urban land and the amount of urban land that occupies the best agricultural land. Noting that Canada's prime agricultural land is scarce, she pointed out that such information can provide an indication of long-term agricultural sustainability. Referring to wealth indicators, she pointed out that information on the monetary value of natural resource stocks indicates the contribution of the resources to national wealth and permits the estimation of the flow of income from the extraction and harvesting of natural resources. Information provided by the physical accounts, she continued, helps to identify the rate of depletion of natural resources and to assess whether they are being exploited in a sustainable manner. She illustrated the importance of measuring resource flows by citing the example of the excessive resource use and resulting depletion of Canada's cod fishery.

72. She explained that the material and energy flow accounts are useful in identifying the types, quantities and sources of wastes that are being produced by economic activity, that they provide information about whether the carrying capacity of the environment is being exceeded, and are critical for establishing the intensity of resource use, for example, how much raw material and energy is needed to produce one unit of economic output.

73. The use of the environmental protection expenditure accounts as a means of measuring the financial cost associated with complying with environmental regulations and conventions in Canada was mentioned, and she added that future work on environment protection expenditures will involve trying to relate the impact of the expenditures in reducing waste output and environmental damage.

74. The representative of UNSD briefly described the development and outcomes of projects on integrated environmental and economic accounting which have been undertaken with the assistance of UNSD in Korea, the Philippines and Ghana. She stressed to the participants that although in many cases existing data might have been incomplete and less than ideal, the countries nevertheless used what data was available, and often supplemented it by making estimates, so that some selected accounts could be compiled. As more experience was gradually gained, it was possible to improve the quality of the accounts and to increase the coverage. She noted that once the countries had results that they could make known to policy-makers, such as in the case of the Philippines, interest was generated and greater support was then given to the work. She concluded by encouraging those participants interested in following the examples of countries in the region such as Chile, Colombia and Mexico, as well as Canada and the other countries that she had spoken about, to consider attempting to compile some accounts now that they had the basic tools with which to begin, and added that UNSD would be willing to provide guidance and assist them to the extent possible. She then mentioned that after the Workshop ended, she would briefly demonstrate the preliminary SEEA software to any of the participants who were interested in it.

Closing Session

75. The Director of the Statistics and Economic Projections Division of ECLAC referred to the role that ECLAC and the international organizations could play in the area of environment. He explained that ECLAC, and the Statistics and Economic Projections Division in particular, are subject to demands of the countries, which implies assisting them in the design of programmes and the development of policies. Faced with a new subject area, he continued, international organizations and the countries tend to set very ambitious goals that normally cannot be attained, and this causes frustration among the Member States. ECLAC, being more cautious, sets goals and deadlines for the execution of programmes that are more realistic. A subject of public concern is transformed into one with political status when there are statistics and information that back up the importance of such a subject area and which permit the formulation and evaluation of policies. It is at this stage that the ministries concerned with the problem contribute the resources that are required to develop the project, he noted.

76. He then suggested that the countries concentrate their efforts on a few activities with regard to environment statistics, so that they could obtain concrete results which, at the same time would serve as a basis upon which to obtain the necessary resources for future work. He expressed his willingness to request the assistance from the directors of the national statistical offices and the Executive Secretary of ECLAC when concrete projects were proposed. In addition, he mentioned that by using connections with the ministries of some countries, it would be possible for ECLAC to obtain the necessary assistance in order for the countries to be able to undertake those projects that end up being feasible to carry out.

77. The representative of ECLAC thanked the representatives of Statistics Canada, the Central Bank of Chile, the National Administrative Department of Statistics of Colombia, the National Institute of Statistics, Geography and Information of Mexico, and the United Nations Statistics Division for their collaboration and for having shared their valuable experience with the representatives of the other countries. She also thanked the rest of the participants for having attended the Workshop and for the interest they showed in the subject. The Workshop was then closed.

ANNEX I**LIST OF PARTICIPANTS****COUNTRIES****ARGENTINA**

Liliana Moyano
Economista - Analista Económica Sectorial
Dirección Nacional de Accounts
Ministerio de Economía, Obras y Servicios Públicos
Hipólito Yrigoyen 250, 8° piso, Oficina 801
Buenos Aires
Tel: (54-1) 349-5512 / 5606
Fax: (54-1) 349-5693 / 5663
E-mail: lmoyan@meyosp.mecon.ar

BOLIVIA

Bladimir Velásquez
Técnico Sectores Institucionales
Accounts Nacionales
Instituto Nacional de Estadística (INE)
Plaza del Periodista N° 1
La Paz
Tel: (591-02) 367286 / 367445
Fax: (591-02) 354230

BRAZIL

Sandra De Carlo
Economista-Núcleo de Meio Ambiente do
Departamento de Contas Nacionais
Instituto Brasileiro de Geografia e Estatística (IBGE)
Av. Chile 500, 9° piso
Rio de Janeiro, R. J. 20.000
Tel: (55-21) 5140433
Fax: (55-21) 5144782
E-mail: decarlo@ibge.gov.br

CANADA

Alice Born, Chief
 Environment Statistics Program
 Statistics Canada
 7th Floor, RH Coats Building, Tunney's Pasture
 Ottawa, Ontario K1 A, OT 6
Tel: (613) 951-3728
Fax: (613) 951-0634
E-mail: bornali@statcan.ca

CHILE

Ximena Aguilar
 Jefe de Proyecto de Accounts Ambientales
 Banco Central de Chile
 Agustinas 1180
 Santiago
Tel: (56-2) 670-2244
Fax: (56-2) 670-2419
E-mail: xaguilar@condor.bcentral.cl

Leonardo Araya Valdebenito
 Jefe del Departamento de Accounts Forestales
 Corporación Nacional Forestal (CONAF)
 Avenida Presidente Bulnes 285
 Santiago
Tel: (56-2) 696-6677 Anexo 266
Fax: (56-2) 671-5881

Enrique Calfucura
 Analista Económico
 Banco Central de Chile
 Agustinas 1180
 Santiago
Tel: (56-2) 670-2909
Fax: (56-2) 670-2419
E-mail: ecalfucu@condor.bcentral.cl

María Paz Collinao
 Estadístico
 Banco Central de Chile
 Agustinas 1180
 Santiago
Tel: (56-2) 670-2909
Fax: (56-2) 670-2419
E-mail: mpcollin@condor.bcentral.cl

CHILE

Paula Andrea Jara Echegoyen
Investigador, Ingeniero en Adm. de Agronegocios
Instituto Nacional de Estadística (INE)
Avenida Bulnes 418
Santiago
Tel: (56-2) 366-7682
Fax: (56-2) 639-0058
E-mail: inestus@ctcreuna.cl

Soledad Larenas
Consultora
Comisión Nacional del Medio Ambiente (CONAMA)
Obispo Donoso 6, Providencia
Santiago
Tel: (56-2) 240-5600
Fax: (56-2) 244-1262

Dharmo Rojas D.
Jefe Subdepartamento Energía y Medio Ambiente
Instituto Nacional de Estadística (INE)
Avenida Bulnes 418
Santiago
Tel: (56-2) 222-9088
Fax: (56-2) 222-6545

Cristina Silva Carrasco
Jefe Estadísticas Manufactureras
Instituto Nacional de Estadística (INE)
Avenida Bulnes 418
Santiago
Tel: (56-2) 366-7578
Fax: (56-2) 639-0071
E-mail: ineindus@ctcreuna.cl

Ana Zuñiga
Profesional Unidad Economía Ambiental
Comisión Nacional del Medio Ambiente (CONAMA)
Obispo Donoso 6, Providencia
Santiago
Tel: (56-2) 240-5600
Fax: (56-2) 244-1262
E-mail: azuniga@conama.cl

COLOMBIA

María Carmenza González Ramírez
Sectorialista Accounts Nacionales, Estadísticas
Económicas del Sector Agropecuario y Ambiental
Departamento Administrativo Nacional de Estadística (DANE)
Avenida Dorado - CAN, 3er piso
Bogotá
Tel: (57-1) 222-4417
Fax: (57-1) 222-2107
E-mail: dane1@impsat.net.co

COSTA RICA

Carlos Enrique Carrillo Chaves
Economista, Sección Accounts Nacionales
Banco Central de Costa Rica
Avenida 4-6, Calle 1
San José
Tel: (506) 243-3255
Fax: (506) 243-3246
E-mail: carrillocc@bccr.fi.cr

CUBA

Gloria Quevedo Quintián
Economista
Oficina Nacional de Estadística (ONE)
Paseo esquina 5ta. Vedado
La Habana
Tel: (53-7) 300054
Fax: (53-7) 333083
E-mail: gloria@onered.one.gov.cu

DOMINICAN REPUBLIC

Rosa Maribel Oviedo Rodríguez
Economista
Banco Central de la República Dominicana
Pedro Henríquez Ureña esq. Leopoldo Navarro
Santo Domingo
Tel: (809) 221-9111-685-0783
Fax: (809) 682-7666

ECUADOR

Galo Arias Veloz
 Subdirector General Técnico
 Instituto Nacional de Estadística y Censos (INEC)
 Juan Larrea 534 y Riofrio
 Quito

Tel: (593-2) 231602

Fax: (593-2) 509836

E-mail: inec1@ecnet.ec

GUATEMALA

Sandra América López Arango
 Jefe Unidad de Estadísticas Ambientales
 Instituto Nacional de Estadística (INE)
 8a. calle 9-55, Zona 1
 Guatemala, C. A.

Tel: (502) 232-2873 / 232-7241 / 238-2749, ext. 314

Fax: (502) 232-4790

MEXICO

Francisco Guillén-Martín
 Coordinador de Accounts Ambientales,
 Estudios Regionales e Insumo-Producto
 Instituto Nacional de Estadística, Geografía e Informática
 (INEGI)
 Avenida Baja California N° 272, 9° piso, Col. Hipódromo
 Condesa
 06100 México D.F.

Tel: (52-5) 722-55-80

Fax: (52-5) 722-55-85

E-mail: fguillen@dgcni.inegi.gob.mx

PANAMA

Luis Enrique Quesada
 Subdirector General de Estadística y Censo
 Contraloría General de la República
 Dirección de Estadística y Censos (DEC)
 Apartado 5213
 Panamá 5

Tel: (507) 2646731 / 2640777 # 381-388

Fax: (507) 2697294

E-mail: cgrdec@keops.utp.ac.pa

PERU

Arturo Rubén Camarena Chuquipoma
 Instituto Nacional de Estadística e Informática (INEI)
 Avenida General Garzón 658
 Jesús María
 Lima
Tel: (51-14) 433-4223 anexo 146 y 147
Fax: (51-14) 433-4223 anexo 148
E-mail: mortiz@inei.gob.pe

VENEZUELA

Pascual Curcio Morrone
 Jefe del Programa de Estadísticas Ambientales
 Oficina Central de Estadística e Informática (OCEI)
 Dirección de Estadísticas Sociales y Demográficas
 Avenida Boyacá con Avenida Principal de Maripérez
 Edificio Fundación La Salle 1er. piso
 Caracas
Tel: (58-2) 793-05-80
Fax: (58-2) 793-05-80
E-mail: ocei@true.net

INTERNATIONAL ORGANIZATIONS**UNITED NATIONS**

Alessandra Alfieri
 Statistician
 United Nations Statistics Division
 United Nations Headquarters, Room DC2-1658
 New York, N. Y. 10017
Tel: (212) 963-4590
Fax: (212) 963-0623
E-mail: alfieri@un.org

**ECONOMIC COMMISSION FOR LATIN AMERICA
AND THE CARIBBEAN (ECLAC)**

Pedro Sáinz
Director
Statistics and Economic Projections Division
Casilla 179-D
Santiago, Chile
Tel: (56-2) 210-2643
Fax: (56-2) 210-2472
E-mail: psainz@eclac.cl

Mary Jane Holupka
Statistician
Statistics and Economic Projections Division
Casilla 179-D
Santiago, Chile
Tel: (56-2) 210-2414
Fax: (56-2) 210-2472
E-mail: mholupka@eclac.cl

Farid Isa
Statistician
Statistics and Economic Projections Division
Casilla 179-D
Santiago, Chile
Tel: (56-2) 210-2177
Fax: (56-2) 210-2472
E-mail: fisa@eclac.cl

Marcelo Ortúzar
Statistician
Statistics and Economic Projections Division
Casilla 179-D
Santiago, Chile
Tel: (56-2) 210-2659
Fax: (56-2) 210-2472
E-mail: mortuzar@eclac.cl

Helga Hoffmann, Director
Environment and Development Division
Casilla 179-D
Santiago, Chile

ANNEX II**AGENDA****WORKSHOP ON INTEGRATED ENVIRONMENTAL AND ECONOMIC ACCOUNTING****Santiago, Chile, 20 - 24 April 1998****DAY 1: MONDAY, 20 APRIL**

- | | |
|---------------|---|
| 09:30 - 10:00 | Participant registration |
| 10:00 - 10:30 | Welcoming remarks, Pedro Sáinz, ECLAC |
| 10:30 - 11:00 | Description of UNSD activities, Alessandra Alfieri, UNSD |
| 11:00 - 11:30 | Description of the activities of the Statistics and Economic Projections Division of ECLAC; Description of the workshop objectives; Introduction of the speakers and participants, Mary Jane Holupka, ECLAC |
| 11:30 - 12:00 | Break |

THE SYSTEM OF NATIONAL ACCOUNTS (SNA)

- | | |
|--------------|--|
| 12:00 - 1:00 | Introduction - The SNA Framework, Marcelo Ortúzar, ECLAC |
| 1:00 - 2:30 | Lunch |

ENVIRONMENTAL ACCOUNTING AND THE SYSTEM OF INTEGRATED ENVIRONMENTAL AND ECONOMIC ACCOUNTING (SEEA)

- | | |
|-------------|--|
| 2:30 - 3:45 | Introduction, Alessandra Alfieri, UNSD |
| 3:45 - 4:15 | Break |
| 4:15 - 4:45 | Continuation of the presentation, Alessandra Alfieri, UNSD |
| 4:45 - 5:30 | Discussion |

DAY 2: TUESDAY, 21 APRIL**ENVIRONMENTAL ACCOUNTING AND THE SYSTEM OF INTEGRATED ENVIRONMENTAL AND ECONOMIC ACCOUNTING (SEEA) - (continued)**

- | | |
|---------------|--|
| 09:30 - 10:00 | Experience of Chile in the implementation of environmental accounting in the national accounts of Chile, Ximena Aguilar, Central Bank of Chile |
| 10:00 - 11:00 | Experience of Mexico in integrating environmental accounting in the national accounts of Mexico, Francisco Guillén Martín, INEGI |
| 11:00 - 11:30 | Break |
| 11:30 - 12:00 | The Canadian System of Environmental and Resource Accounts, Alice Born, Statistics Canada |

ENVIRONMENTAL PROTECTION EXPENDITURE ACCOUNTS

12:00 - 12:15	Introduction, Alessandra Alfieri, UNSD
12:15 - 1:00	Experience of Canada, Alice Born, Statistics Canada
1:00 - 1:30	Experience of Colombia, María Carmenza González R., DANE
1:30 - 2:45	Lunch
2:45 - 3:30	Experience of Mexico, Francisco Guillén Martín, INEGI
3:30 - 4:00	Experience of Costa Rica and other countries
4:00 - 4:30	Break
4:30 - 5:30	Discussion - (Moderator - Alice Born, Statistics Canada)

DAY 3: WEDNESDAY, 22 APRIL**LAND ACCOUNTS**

09:30 - 10:00	Introduction, Alessandra Alfieri, UNSD
10:00 - 10:30	Experience of Canada, Alice Born, Statistics Canada
10:30 - 11:00	Break
11:00 - 11:30	Experience of Mexico, Francisco Guillén Martín, INEGI
11:30 - 12:00	Discussion

SUBSOIL ASSET ACCOUNTS

12:00 - 12:15	Introduction, Alessandra Alfieri, UNSD
12:15 - 1:00	Experience of Canada, Alice Born, Statistics Canada
1:00 - 2:30	Lunch
2:30 - 3:00	Experience of Chile in the compilation of mineral accounts, Ximena Aguilar, Central Bank of Chile
3:00 - 3:30	Experience of Mexico in compiling petroleum and natural gas reserves accounts, Francisco Guillén Martín, INEGI
3:30 - 4:00	Experience of other countries and Discussion
4:00 - 4:30	Break

FOREST ACCOUNTS

4:30 - 4:45	Introduction, Alessandra Alfieri, UNSD
4:45 - 5:45	The national survey and evaluation of the native vegetation in Chile, Leonardo Araya Valdebenito, National Forest Corporation of Chile (CONAF)

DAY 4: THURSDAY, 23 APRIL**FOREST ACCOUNTS (continued)**

09:30 - 10:15	Experience of Canada, Alice Born, Statistics Canada
10:15 - 10:30	Break
10:30 - 11:30	Experience of Mexico, Francisco Guillén Martín, INEGI
11:30 - 12:00	Experience of Chile in compiling accounts for plantations and native forests, Ximena Aguilar, Central Bank of Chile
12:00 - 1:00	Experience of other countries and Discussion
1:00 - 2:30	Lunch

FISHERY RESOURCE ACCOUNTS

- 2:30 - 2:45 Introduction, Alessandra Alfieri, UNSD
 2:45 - 3:00 The pilot survey on the aquaculture industry of Canada, Alice Born, Statistics Canada
 3:00 - 3:15 Experience of other countries and Discussion

WATER ACCOUNTS

- 3:15 - 3:30 Introduction, Alessandra Alfieri, UNSD
 3:30 - 3:45 Experience of Canada, Alice Born, Statistics Canada
 3:45 - 4:00 Experience of Mexico, Francisco Guillén Martín, INEGI
 4:00 - 4:30 Experience of the National Environment Commission (CONAMA) of Chile and other countries and Discussion
 4:30 - 4:45 Break

ENVIRONMENTAL DEGRADATION: AIR, WATER, SOIL

- 4:45 - 5:00 Introduction, Alessandra Alfieri, UNSD
 5:00 - 5:15 Experience of Canada in compiling greenhouse gas accounts, Alice Born, Statistics Canada
 5:15 - 5:45 Experience of Colombia in compiling air and water quality accounts, María Carmenza González R., DANE
 5:45 - 6:15 Experience of Mexico, Francisco Guillén Martín, INEGI

DAY 5: FRIDAY, 24 APRIL**ENVIRONMENTAL DEGRADATION (continued)**

- 09:15 - 10:00 Continuation - Experience of Mexico, Francisco Guillén Martín, INEGI
 10:00 - 11:15 Experience of Venezuela and other countries and Discussion

AGGREGATION AND TABULATION, ANALYSIS AND INTERPRETATION OF THE RESULTS

- 11:15 - 11:30 Introduction, Alessandra Alfieri, UNSD

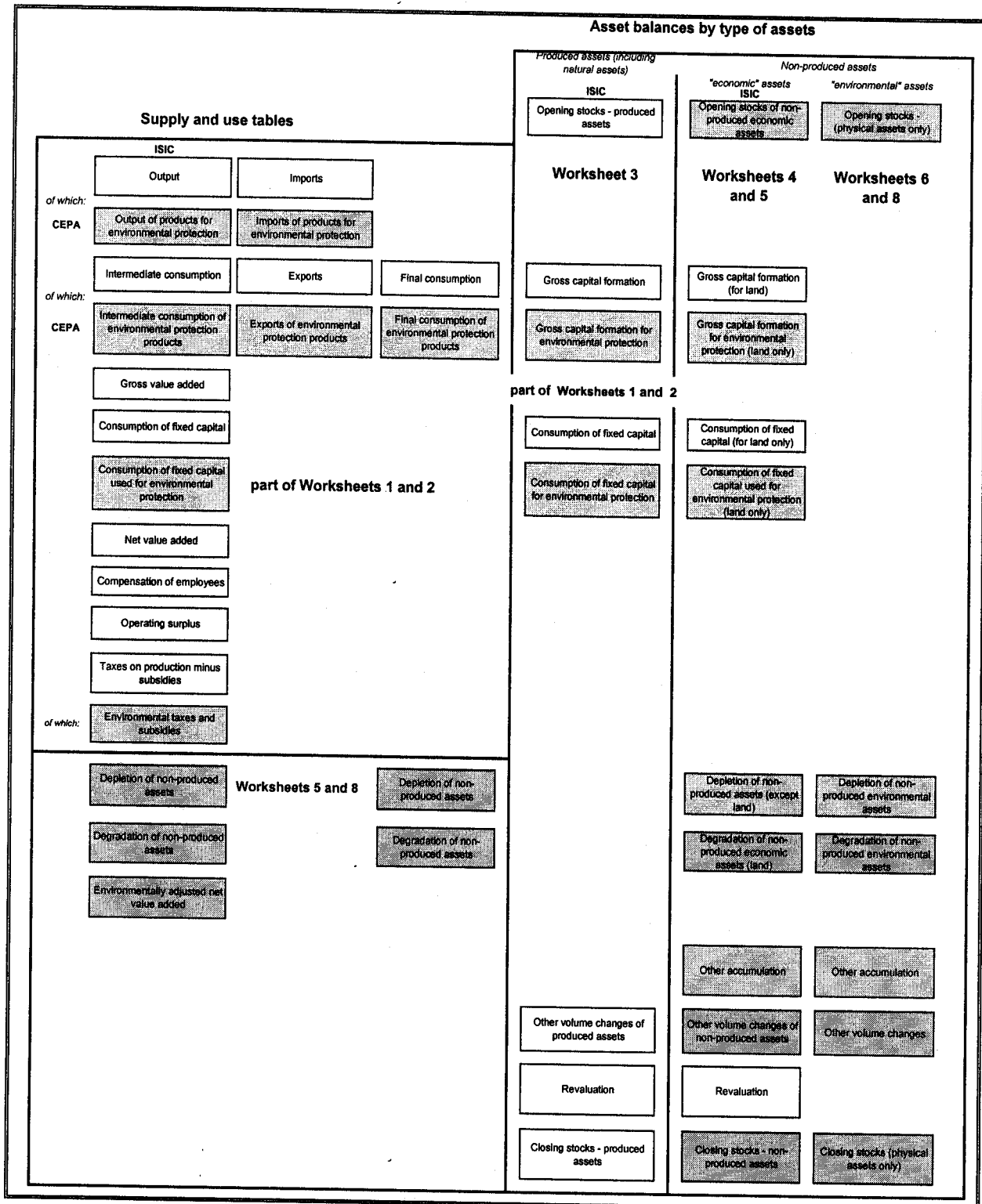
INSTITUTIONALIZATION

- 11:30 - 1:30 Country presentations
 1:30 - 2:30 Lunch
 2:30 - 4:00 Continuation of the country presentations
 4:00 - 4:30 Uses of the environmental and resource accounts in Canada, Alice Born, Statistics Canada
 4:30 - 4:45 Experience of UNSD in other countries, Alessandra Alfieri, UNSD
 4:45 - 5:15 Closing session, Pedro Sáinz, ECLAC

ANNEX III

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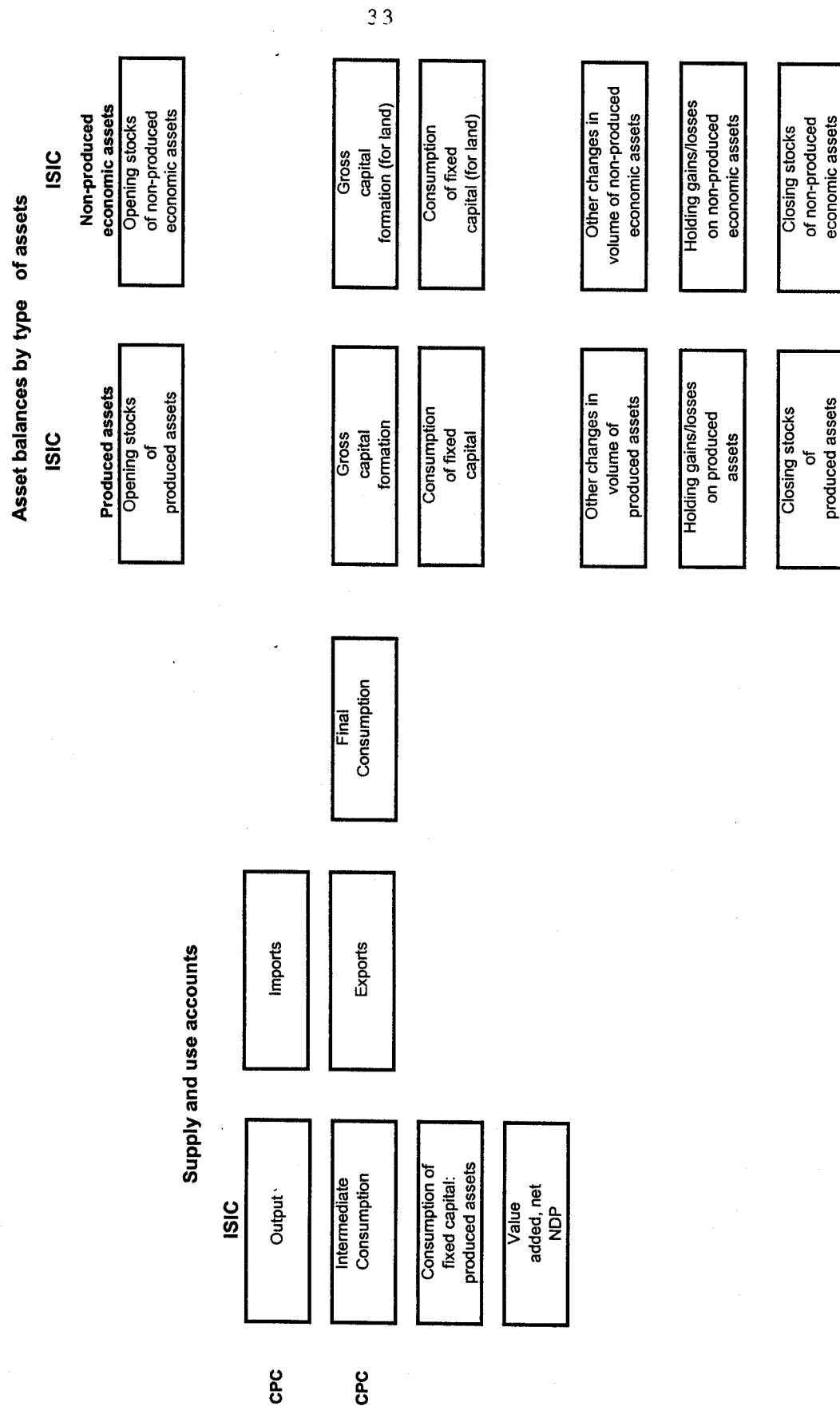
Figure 1. Framework for integrated environmental and economic accounting



Source: *Integrated Environmental and Economic Accounting - an Operational Manual* (draft), UNSD.

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Worksheet 1. SNA 1993: Supply and use and asset accounts



Source: Integrated Environmental and Economic Accounting - an Operational Manual (draft), UNSD.

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Worksheet 1A. Supply and Use Table

(monetary units)

	Agriculture	Forestry	Fishing	Mining	Manufacturing	Electricity, Gas and Water	Construction	Public Administration and defense	Other Industries	Total Industries	Imports	Exports	Final consumption (govt, households & NPISHs)	Gross Capital Formation	TOTAL
Output															
Intermediate consumption															
Gross value added															
Consumption of fixed capital															
Net value added															
Compensation of employees															
Taxes less subsidies															
Operating surplus															

Source: Integrated Environmental and Economic Accounting - an Operational Manual (draft), UNSD

Worksheet 2. Environmental protection expenditures

[illegible]

Source: Integrated Environmental and Economic Accounting - an Operational Manual (draft), UNSD.

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Worksheet 2A. Environmental Protection Expenditures

(monetary units)					
		OUTPUT OF INDUSTRIES			
		Manufacturing	Construction	Sewage and refuse disposal, sanitation and similar activities	Other industries
		Total	Total	Total	Total
Total value of products					
of which:					
Environmental Protection products	For internal use				
	For sale				
		INTERMEDIATE CONSUMPTION IN INDUSTRIES			
		Manufacturing	Construction	Sewage and refuse disposal, sanitation and similar activities	Other industries
		Total	Total	Total	Total
Total value of products					
of which:					
Environmental protection products	Protection of ambient air and climate				
	Protection of ambient water, excluding groundwater				
	Prevention, collection, transport, treatment and disposal of waste				
	Recycling of wastes and other residuals				
	Protection of soil and groundwater				
	Noise abatement				
	Protection of landscape and nature				
	Other environmental protection measures				
	Research and development on the environment				
	forest products				
	fish				
minerals					
Consumption of fixed capital					
of which:					
Environmental protection products	Consumption of fixed capital for environmental protection				
NET VALUE ADDED / NDP					
Compensation of employees					
Taxes on production less subsidies					
Operating surplus					
of which:					
Environmental taxes	Environmental taxes				
	Environmental subsidies				

Source: *Integrated Environmental and Economic Accounting - an Operational Manual* (draft), UNSD.

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Worksheet 3. Monetary asset accounts - tangible fixed assets, including produced natural assets

	ISIC	ISIC
	Produced natural assets	Other produced assets
Opening stock	Value of the stock of livestock, fish, fowl, orchards, plantations, timber tracts and other vegetation (AN.1114, 1221)	(AN.1, except AN.1114, 1221)
Capital formation		
Gross fixed capital formation (P.51)	- Value of acquisitions less disposals of fixed assets, i.e. livestock, fish, plantations, orchards, etc. - Value of unfinished assets produced on own account	
Changes in inventories and acquisitions less disposals of valuables (P.52, 53)	Inventories of plants, trees, livestock and fish: (a) single-use plants, trees (to be cut), livestock (to be slaughtered), and fish (to be caught) (b) fixed natural assets produced by specialized producers (breeders, tree nurseries)	
Consumption of fixed capital (K.1)	Decline in the value of fixed natural assets (normal wear and tear)	
Other volume changes - Economic appearance of other produced assets (K.4) - Catastrophic losses (K.7) - Other (K.8, 9, 12)	Value of positive or negative changes due to natural disasters, political events, or change in use of assets	
Revaluation (K.11)	Holding gains and losses	
Closing stock	Value of the stock of livestock, fish, fowl, orchards, plantations, timber tracts and other vegetation (AN.1114, 1221)	(AN.1, except AN.1114, 1221)

Source: *Integrated Environmental and Economic Accounting - an Operational Manual* (draft), UNSD.

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Worksheet 3A. Monetary asset accounts - selected produced natural assets

	(monetary units)				
	Agriculture		Forestry		Total
	Cultivated assets	Other	Cultivated forest	Other	
Opening stock					
Capital formation					
Gross fixed capital formation					
Changes in inventories					
Consumption of fixed capital					
Other volume changes					
Revaluation					
Closing Stock					

Source: *Integrated Environmental and Economic Accounting - an Operational Manual* (draft), UNSD.

Worksheet 4. Physical asset accounts - non-produced "economic" assets

	Non-renewable resources		Renewable resources		
	Land/Soil (km ²)	Subsoil assets (tons)	Forests (economic functions) (m ³ , tons)	Fishery resources (tons)	Water resources (m ³)
Opening stocks	Area of land underlying buildings, agricultural land, recreational land	Proven reserves	Volume of standing timber	Biomass	Volume
Economic use (depletion, sustainable use)		Extraction of minerals (measured in ore or processed form)	- Logging - Clearing of forests (loss of timber)	Total catch	Water abstraction
Other accumulation	- Changes in land use - Transfers of land from the environment to economic use - Land reclamation (asset increase)	- Discoveries - Reassessment of reserves due to changes in technology and relative prices	- Net natural growth - Transfers from the environment to economic use	Net natural growth	- Transfers (discovery) from the environment to economic use - Replenishment
Other volume changes	- Changes in land use and land area due to natural, political or other non-economic causes - Transfer of land from economic use to the environment	Reduction in volume due to natural disasters or other non-economic factors	- Reduction in volume due to natural disasters or other non-economic factors (fires, floods, earthquakes) - Transfer of forest from economic use to the environment	Reduction in volume caused by natural disasters or other non-economic factors	Changes due to natural disasters (floods, droughts, etc.)
Closing stocks	Area of land underlying buildings, agricultural land, recreational land	Proven reserves	Volume of standing timber	Biomass	Volume
Memorandum item: changes in quality*	- Soil erosion (km ² or tons) or nutrient loss (tons) - Land/soil contamination including salinization and other changes in soil quality (km ² , ambient concentration)		Quality effects of forest disease, acid precipitation, etc.	Quality effects of acidification and other environmental impacts on aquatic animals	Water quality change (index value)

* Quality measures are not part of the asset accounts, but are used in assessing the cost of productivity losses.

Source: *Integrated Environmental and Economic Accounting - an Operational Manual* (draft), UNSD.

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Worksheet 4A. Asset accounts for non-produced economic assets

	LAND				SOIL (economic use) (km ²)	MINERAL RESOURCES				
	Agricultural land (km ²)	Forest land (km ²)	Land under- lying buildings (km ²)	Recreational land (km ²)	Other land (km ²)	Oil (million tonnes)	Gas (million m ³)	Coal (thousand tonnes)	Gold (tonnes)	Copper (thousand tonnes)
Opening stocks										
Sustainable use										
Depletion										
Other accumulation										
Other volume changes										
Closing stocks										
Change in quality										

	FORESTS (economic uses)			FISHERY		RESOURCES/OTHER BIOTA		WATER RESOURCES		
	Coniferous (thousand m ³)	Deciduous (thousand m ³)	Mixed (thousand m ³)	Marine water species #1 (tonnes)	Freshwater species #1 (tonnes)	Species #1 (tonnes)	Aquifers (million m ³)	Other groundwater (million m ³)	Other freshwater (million m ³)	
Opening stocks										
Sustainable use										
Depletion										
Other accumulation										
Other volume changes										
Closing stocks										

Source: *Integrated Environmental and Economic Accounting - an Operational Manual (draft)*, UNSD.

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Worksheet 5. Monetary asset accounts - non-produced "economic" assets

	Land/soil	Subsoil assets	Forests (economic functions)	Fishery resources	Water resources
Opening stock	Area of land underlying buildings, agricultural land, recreational land	Proven reserves	Volume of standing timber	Biomass	(Use value of selected water bodies)
Acquisitions less disposals of non-produced assets	Acquisitions less disposals of land	Acquisitions less disposals of subsoil assets	(not applicable)	(not applicable)	(not applicable)
Gross fixed capital formation	Expenditures on land improvement, including: - land reclamation - clearance of forest land - drainage of wetlands - prevention of flooding or erosion	not applicable	not applicable	not applicable	not applicable
Depletion	Capital consumption: decline in the value of land improvement	Value of extraction	Value of non-sustainable cut	Value of non-sustainable catch	Value of non-sustainable abstraction
Degradation	Change in market value due to contamination and erosion	(not applicable)	(not applicable)	(not applicable)	(not applicable)
Other accumulation	- Changes in land use - Transfers of land from the environment to economic use - Land reclamation (asset increase)	- Discoveries - Reassessment of reserves due to changes in technology and relative prices	- Net natural growth - Transfers from the environment to economic use	- Net natural growth	- Transfers (discoveries) from the environment to economic use - Replenishment
Other volume changes	- Changes in land use and land area due to natural, political or other non-economic causes - Transfer of land from economic use to the environment	Reduction in volume due to natural disasters or other non-economic factors	Reduction in volume due to natural disasters or other non-economic factors (fires, floods, earthquakes) - Transfer of forest from economic use to the environment	Reduction in volume due to natural disasters or other non-economic factors	Changes due to natural disasters (floods, droughts, etc.)
Revaluation	Holding gains and losses	Holding gains & losses	Holding gains and losses	Holding gains and losses	Holding gains & losses
Closing stock	Area of land underlying buildings, agricultural land, recreational land	Proven reserves	Volume of standing timber	Biomass	(Use value of selected water bodies)

Source: *Integrated Environmental and Economic Accounting - an Operational Manual* (draft), UNSD

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42

Worksheet 5A. Market valuation of depletion

	LAND			SOIL (economic use)	MINERAL RESOURCES				FORESTS (economic uses)			FISHERY Marine species #1	RESOURCES Freshwater Species #1	OTHER BIOTA Species #1	WATER RESOURCES		
	Agri-cultural land	Forest land	Land underlying buildings		Recreational land	Other land	Oil	Gas	Coal	Gold	Copper				Coniferous	Deciduous	Mixed
A. Net-price estimation																	
(1) Market price																	
- at beginning of accounting period																	
- at end of accounting period																	
- average during accounting period																	
(2) Factor cost per unit of resource (including normal return to capital)																	
- at beginning of accounting period																	
- at end of accounting period																	
- average during accounting period																	
(3) Net price = (1) - (2):																	
- at beginning of accounting period																	
- at end of accounting period																	
- average during accounting period																	
B. User cost calculation																	
(4) n = estimated life span of resource																	
(5) r = discount rate																	
(6) Unit user cost = (3)/(1+r) ⁿ +1																	

Source: *Integrated Environmental and Economic Accounting - an Operational Manual* (draft), UNSD.

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Worksheet 5B. Monetary asset accounts for non-produced economic assets

	LAND				SOIL (economic use)	MINERAL RESOURCES			
	Agricultural land	Forest land	Land underlying buildings	Recreational land	Other land	Oil	Gas	Coal	Gold Copper
Opening stocks									
Acquisitions less disposals									
Gross fixed capital formation									
Sustainable use									
Depletion*									
Degradation									
Other accumulation									
Other volume changes									
Revaluation									
Closing stocks									

(*) For land = consumption of fixed capital

	FORESTS (economic uses)		FISHERY RESOURCES		OTHER BIOTA Species #1	WATER	
	Coniferous	Deciduous	Marine water species #1	Freshwater species #1		Aquifers	Other groundwater Other freshwater
Opening stocks							
Acquisitions less disposals							
Gross fixed capital formation							
Sustainable use							
Depletion							
Other accumulation							
Other volume changes							
Revaluation							
Closing stocks							

Source: *Integrated Environmental and Economic Accounting - an Operational Manual* (draft), UNSD.

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44

Worksheet 6. Physical asset accounts - non-produced "environmental" assets

	Land & terrestrial ecosystems (excluding forests) (km ²)	Forests and forest land in the wilderness (km ²)	Rare and endangered species of fauna and flora (number)	Water and aquatic ecosystems (km ²)	Air
Opening stocks	Area of land not covered in the "economic" asset accounts (WS4)	Area	Population	Area, excluding aquifers and groundwater	not applicable
Economic use	not applicable	Clearing of environmental forests	- Number captured or killed	not applicable	not applicable
Other accumulation	- Transfer of land from "environmental" to economic land, including drainage of wetlands	- Net natural growth - Transfers from environmental to economic forests	- Net natural growth - Status change (classification) of species (from environmental to economic) - Number of species introduced	not applicable	not applicable
Other volume changes	- Transfer of land from economic to environmental use - Changes in ecosystem boundaries (classification) - Changes in area due to natural, political or other non- economic causes	- Transfer of economic forest to environmental (protected) status - Area change due to natural disasters (fires, floods, earthquakes)	- Status change of species (from economic to environmental) - Changes in number due to natural disasters	- Changes in ecosystem boundaries (classification) - Area change due to natural disasters or other non-economic causes	not applicable
Closing stocks	Area not covered in the "economic" asset accounts (WS4)	Area	Population	Area, excluding aquifers and groundwater	not applicable
Changes in quality*	- Soil erosion (tons) - Land contamination (loading and ambient concentration)	Forests affected by disease and acid precipitation (change in area or volume)	Species affected by disease (change in numbers)	Change in water quality (index)	Change in air quality (index)

* Quality measures are not part of the asset accounts, but are relevant for estimating environmental degradation costs, either for tracing the cost caused by economic activity or for applying damage valuations.

Source: *Integrated Environmental and Economic Accounting - an Operational Manual* (draft), UNSD.

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Worksheet 7. Emissions by industries

	Manufacturing	Electricity, gas and water	Government	Households	From Rest of the World	To Rest of the World
Air						
SO ₂ (Sulphur dioxide)						
NO _x (Nitrogen oxide)						
TSP (Total suspended particulates)						
CO ₂ (Carbon dioxide)						
Water						
BOD (Biochemical Oxygen Demand)						
Land						
Wastes						

('000 tons)

Source: *Integrated Environmental and Economic Accounting - an Operational Manual* (draft), UNSD.

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Worksheet 7A. Cost of unit of emission by industries
(with best available technology)

(monetary units)

	Manufacturing	Electricity, gas and water	Government	Households
Air SO ₂ NO _x TSP				
Water BOD				
Land Wastes				

Worksheet 7B. Total cost of emissions by industries
(best available technology)

(monetary units)

	Manufacturing	Electricity, gas and water	Government	Households
Air SO ₂ NO _x TSP				
Water BOD				
Land Wastes				

Source: *Integrated Environmental and Economic Accounting - an Operational Manual* (draft), UNSD

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Worksheet 8. Maintenance cost of emissions by industries

		A. Cost per million tonnes				B. Total cost				(monetary units)
		Manufacturing	Electricity, gas and water	Government	Households	Manufacturing	Electricity, gas and water	Government	Households	
AIR	SO ₂									
	NO _x									
	TSP									
WATER	BOD									
LAND	Wastes									
TOTAL										

Source: *Integrated Environmental and Economic Accounting - an Operational Manual* (draft), UNSD.