DEVELOPMENT OF HUMAN AND SOCIAL DEVELOPMENT INDICATORS: HUMAN ASPIRATION AND SUSTAINABILITY

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Contents

1. Human Aspiration and Environmental Sustainability

Human and social development is assessed in terms of such parameters as education, health, equity, poverty, population, and social cohesion. The desire for improvement in such respects has provided the primary rationale for economic growth, and the prevailing attitude has generally been the more growth the better.

Despite progress, however, the world remains plagued by poverty, with serious consequences for health, education, and social cohesion. Current world governance is guided by the premise that reduction in poverty (and in income differentials, both within countries and globally), can be achieved through industrialization in less developed countries. The hope is for increased production to bring about higher levels of income, increased consumption, better access to medical and educational facilities, and improved quality of life.

After some 200 years of industrialization, however, we are now faced with pressing evidence that the planet can no longer carry the burden placed on it by human aspiration. The Earth is becoming more polluted as its resources are being depleted. It is also likely that the Earth's climate balance has been seriously upset. The future consequences are unknown.

1.1. Spaceship Earth and the System Boundary

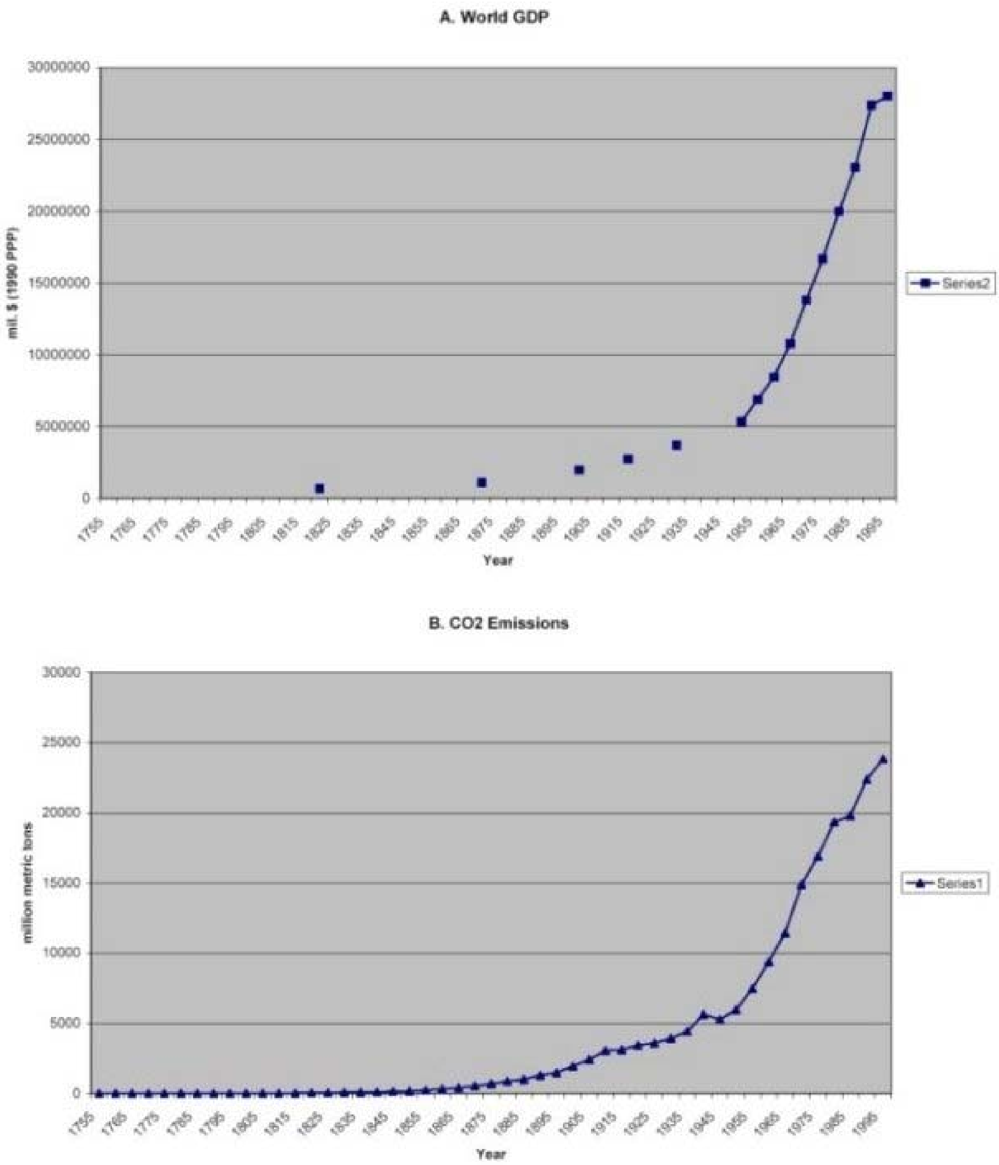

Figure 1.A. Historical Trends of World GDP and CO_2 Emissions

In 1968 Kenneth Boulding described the coming economics of Spaceship Earth. "System may be open or closed in respect to a number of classes of inputs and outputs.

Three important classes are matter, energy, and information. The present world economy is open in regard to all three.…from a material point of view, we see objects passing from the non-economic into the economic set in the process of production, and we similarly see products passing out of the economic set as their value becomes zero." Boulding called our present open economy a "cowboy economy," and called the closed economy of the future a "spaceman economy."

In the cowboy economy, consumption is regarded as a good thing and production likewise. If there are infinite reservoirs from which material can be obtained and into which effluvia can be deposited, then the throughput is at least a plausible measure of the success of the economy. The gross national product is a rough measure of this total throughput. By contrast, in the spaceman economy throughput is by no means a desideratum, and is indeed to be regarded as something to be minimized rather than maximized. In the spaceman economy, what we are primarily concerned with its stock maintenance, and any technological change which results in the maintenance of a given total stock with a lessened throughput (that is, less production and consumption) is clearly a gain. (Boulding 1968, pp. 275-287)

By the time Ayres and Simonis jointly edited a volume on industrial metabolism in 1994, the list of unsustainable environmental trends had grown even longer. The items listed by Ayres and Simonis included: the build-up of greenhouse gases in the atmosphere; the destruction of the ozone layer in the stratosphere; the acidification of soil and surface waters; the build-up of toxic metals in sediments and soil; the build-up of radioactive wastes; the accumulation of long-lived non-biodegradable chemicals in the environment; the contamination and exhaustion of groundwater; and the loss of tropical forests, wetlands, biodiversity, etc. "Industrial metabolism is the set of physico-chemical transformation that convert raw materials (biomass, fuels, minerals, metals) into manufactured products and structures (i.e. "goods") and waste. To an economist these processes, in the aggregate, are called 'production.' A further transformation of economic goods into services (and wastes) is also implied by the economic term "consumption." (Ayres and Simonis 1994, pp. xi-xii)

1.2. Pollution

Production, income, and consumption are positive outcomes of human activity. But the negative outcomes, among which environmental degradation is perhaps paramount, must also be acknowledged. Environmental concerns range from local to national and global levels, and extend over very diverse spheres of concern, including the quality of air and water, the disposal of waste, the alteration of land use and land cover, the depletion of energy and other resources, the threat to endangered species, and global warming.

One can analyze environmental issues in terms of the "pressure" (or "driving force") side of human activity, the "state" of the environment and of natural resources, and the "response" of economic and environmental agents such as households, enterprises, governments, and international institutions. Here we focus on industrial pollution in the form of sulfur dioxide (SO_2) concentrations. Ambient level is a location specific index, and care must be taken when using it to represent the spatial dimension of the state of the environment. Table 1 shows the levels of SO_2 concentration in representative cities of OECD countries. The data are indexed taking 1985 as 100. The 1985 base figures are also shown in physical terms. In many countries, a declining trend can be observed, indicating that the peak of industrial pollution, as measured by SO_2 concentration level, had passed before the observation period in the table. According to the same source (OECD), the concentration of nitrogen dioxide (NO_2) has peaked more recently, sometime between 1985 and 1990. In the case of particulates, the peak was typically reached before 1985, and the figures for 1990s tend indicate improvement.

Country	City or Area	1985 Base reference (g/m^3)	(Unit: Index, 1985=100)			
			1980	1985	1990	1995 or latest available
Canada	National	16.0	163	100	100	100
Mexico	Mexico, D.F.	162.8	…	…	95	45
United States	National	24.4	122	100	88	62
Japan	National	17.0	118	100	100	83
Korea	Seoul	146.7	168	100	91	30
Australia	Melbourne	10.5	…	100	325	…
New Zealand	Auckland	3.2	719	100	59	134
Austria	Wien	(1989) 23.0	…	…	87	61
Belgium	National	46.0	109	100	57	52
Czech	National	63.0	76	100	59	33
Denmark	Copenhagen	26.0	119	100	66	28
Finland	Helsinki	29.0	110	100	52	14
France	National	(1988) 27.0	…	…	93	74
Germany	National	118.0	110	100	46	15
Greece	Athens	26.5	…	100	149	147
Hungary	Budapest	42.0	149	100	34	92
Iceland	Reykjavik	(1990) 3.8	…	…	100	118
Ireland	Dublin	35.0	134	100	60	56
Italy	Milano	90.8	214	100	51	34
Luxembourg	National	(1988) 22.0	…	…	127	86
Netherlands	National	(1986) 29.4	110	…	58	…
Norway	National	15.1	139	100	60	43
Poland	National	(1990) 36.0	…	…	100	58
Portugal	Lisbon	28.0	121	100	71	29
Spain	Madrid	(1987) 87.0	…	…	64	41
Sweden	Stockholm	21.0	200	100	38	24
Switzerland	Zurich	50.0	…	100	36	22
Turkey	Ankara	132.0	158	100	129	42
United Kingdom	National	41.0	112	100	88	59
Slovakia	National	53.0	115	100	55	47

Source: OECD, *OECD Environmental Data, Compendium 1997*.

Table 1. Ambient Levels: The Case of Sulfur Dioxide

Since the "pressure" indicators generally show downward trends, the state described above can be interpreted as one of improvement. In the case of sulfur dioxide, pollution prevention efforts, including heavy oil desulfurization and flue gas desulfurization, proceeded from the mid-1960s, covering more or less the entire production process by early the 1980s in the case of the former, and by the mid-1980s in the case of the latter (Uno, 1995, pp. 178–179).

1.3. Material Flows

The linkage between economy and environment is often analyzed in terms of natural resource inputs (such as energy, various metals, and wood products) to Gross Domestic Product (GDP), or in terms of waste and pollution in relation to economic activity as reflected in GDP. A joint report by four leading research institutions, namely, the World Resource Institute (United States), the Wuppertal Institute (Germany), the Netherlands Ministry of Housing, Spatial Planning and Environment, and the National Institute for Environmental Studies (Japan), contends that "sustainable development will require a closer understanding of how the economic and environmental aspects of human activity interact," and proposes that study of this interaction be undertaken. (World Resource Institute, et al., 1997, pp. 1-2)

The authors of the report argue that GDP fails to include the movement of vast quantities of materials. They propose the Total Material Requirement (TMR) as a new summary measure representing the material requirement of an industrial economy. Their findings are summarized in Table 2. TMR is the total material requirement for a national economy, defined as the sum of commodities (domestic and foreign) and hidden material flows (domestic and foreign). Hidden, or indirect, material flows are associated with, for example, extractive activities, harvesting, and the building of infrastructure. Examples of hidden material flows include: the portion of ore processed and discarded in concentrating ore, plant and forest biomass removed from the land along with logs and grain, overburden removed to gain access to an ore body, soil erosion from agriculture, and material moved in the construction of highways and buildings, or in the dredging of harbors and canals (ibid., p. 8) Although this portion of the total material requirement never enters the economy, it can be very large. According to the table, the ratio of total hidden flows to total commodity flows typically amounts to between 2 and 3 in the industrial countries examined, which include the United States, Japan, Germany, and the Netherlands. Direct material input (DMI) ranges between 17 and 38 tons per person in the countries studied, whereas TMR is estimated to amount to about 45 to 85 tons per person.

	U.S.A.	Japan	Germany	Netherlands
Total Domestic Commodities	4581	1424	1367	271
Total Foreign Commodities	568	710	406	303
Grand Total Commodities	5149	2133	1773	574
Grand Total Commodity per Capita	20	17	22	38
Domestic Hidden Flows	15494	1143	2961	69
Foreign Hidden Flows	594	2439	2030	632
Total Hidden Flows	16088	3583	4991	701

Total Hidden Flows / Total Commodities	3	2	3	1
TMR (Commodities + Hidden Flows)	21237	5716	6764	1275
TMR per Capita	84	46	86	84

Source: World Resources Institute, et al. (1997).

Table 2. The Material Basis of Industrial Economies

The comparative study covers the 20-year period from 1975 to 1994. According to the time-series data, TMR per unit of GDP has tended to decline in the countries under study. In the case of Germany, TMR has declined from 2.68 to 2.09 kilograms per DM over the period, while in the United States, TMR (index, 1985=100) has decreased from 138 to 86. Due to economic growth, however, TMR per capita shows mixed trends. The figure climbed from 64 to 76 tons in Germany over the period, while it declined from 99 to 84 tons in the United States.

As the Factor 10 Club has stated, “Environmental damage is caused not only by pollution but also by the process involved in extracting resources. Reducing the costs of environmental damage requires both bringing down emissions and reducing the flow of resources drawn from nature in the first place.” (Factor 10 Club, 1997, p. 8) The Club has advocated a tenfold efficiency increase in the use of energy, natural resources, and other materials. The aims are to halve the global use of natural resources and to ensure that they are distributed more equally over the world. For the industrial economies, these objectives would require an absolute reduction in the use of natural resources by factor of 10.

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Bibliography

Ahmad Y. J., El Serafy, S., and Lutz, E. eds.(1989). *Environmental Accounting for Sustainable Development.* A UNEP-World Bank Symposium. Washington, D.C. [Examines the linkage between national accounting and environmental accounting in order to develop alternative macro-indicators of ecologically adjusted income and products.]

Alcamo J. ed. (1994). *IMAGE 2.0: Integrated Modeling of Global Climate Change*. Dordrecht: Kluwer Academic Publishers. [An attempt at developing an empirically based global model with spatial dimensions.]

Alfieri A. and Bartelmus P. (1998). Implementation of Environmental Accounting: Towards an Operational Manual. *Environmental Accounting in Theory and Practice*. Ed. by K. Uno and P. Bartelmus. Dordrecht: Kluwer Academic Publishers. [Details practical methods of estimating in environmental accounting.]

Asia Pacific Energy Research Centre (1998). APEC Energy Demand and Supply Outlook. Tokyo. [A projection to 2010 for the Asia Pacific Economic Cooperation (APEC) region, including the United States, Canada, Mexico, China, Japan, Korea, Indonesia, Malaysia, Singapore, Thailand, Australia, New Zealand and other countries in the Pacific Rim.]

Bartelmus, P. (1994a). *Environment, Growth and Development: The Concepts and Strategies for Sustainability.* London and New York: Routledge. [The author of this book has been the mainspring of the Integrated Environmental and Economic Accounting framework developed by the United Nations. In this book, the author explores policy dimensions of the environmentally adjusted domestic product and national income indicators.]

Bartelmus, P. (1994b). Towards a Framework for Indicators of Sustainable Development. *Working Paper Series No.7*. ST/ESA/1994/WP.7. New York: United Nations. [An easy-to-read summary of the Integrated System of Environment and Economic Accounting (SEEA).]

Bartelmus, P. (1998). The Value of Nature–Valuation and Evaluation in Environmental Accounting. K. Uno and P. Bartelmus eds. *Environmental Accounting in Theory and Practice.* Dordrecht: Kluwer Academic Publishers. [A comprehensive review article on the valuation methodology used in the System of Environmental and Economic Accounting (SEEA).]

Boulding, K. E. (1968). *Beyond Economics. Essays on Society, Religion, and Ethics.* Ann Arbor: The University of Michigan Press. [A pioneering work that challenged previously unquestioned assumptions of economic thinking, in particular the unlimited availability of natural assets.]

Brown L. R. et al. (various years). *State of the World.* A Worldwatch Institute Report on Progress towards a Sustainable Society. London: Earthscan Publications Ltd. [An annual series examining environment-related topics, with chapters devoted to focal points of the period.]

Burniaux J-M, Nicoletti, G., and Oliveira-Martins, J. GREEN: A Global Model for Quantifying the Costs of Policies to Curb CO_2 Emissions. *OECD Economic Studies*, No.19, Winter. [Describes the model specification of the model GREEN. Parameters on inter-factor elasticities of substitution and inter-energy elasticities of sugstitution are discussed.]

Commission of the European Communities, International Monetary Fund, Organization for Economic Co-operation and Development, United Nations, and World Bank (1993). *System of National Accounts 1993.* Brussels/Luxembourg, New York, Paris, Washington, D.C. [This is referred to as the 1993 SNA, and provides the theoretical discussion of national accounting, including environmental accounting as a satellite to the core account.]

Dean A. and Hoeller P. (1992). Costs of Reducing CO_2 Emissions: Evidence from Six Global Models. *OECD Economic Studies.* No.19 Winter. [Analyzes the reduction scenarios taking up global cost curves, different regional results, substitution effect, and stabilization of emissions.]

Dixon J. A., Scura L. F., Carpenter R. A., and Sherman P. B. (1986). *Economic Analysis of Environmental Impacts.* Manila: The Asian Development Bank. London: Earthscan. [Includes theoretical discussion of the measurement of environmental impact as well as project-based case studies in Asia and Africa.]

EUROSTAT (1994). *European System for the Collection of Economic Data on Environment SERIEE.* Luxembourg: Office for Publication of the European Communities. [EUROSTAT's report on the conceptual development of environmental statistics; compares its characteristics to the UN's SEEA.]

EUROSTAT (1997). *Material flow Accounting, Experience of Statistical Institutes in Europe.* Luxembourg: Quarterly Accounts and Environmental Accounts, EUROSTAT. [Physical environmental accounting and indicators derived from such data are crucial in integration of the environment into the national accounts. This survey covers cases from European countries.]

Factor 10 Club (1997). The International Factor 10 Club's Statement to Government and Business Leaders. Wuppertal: Wuppertal Institute for Climate, Environment and Energy. [Pamphlet advocating a ten-fold increase in the efficiency of energy and resource use.]

Fankhauser S. (1995). *Valuing Climate Change. The Economics of the Greenhouse.* London: Earthscan Publications Limited. [Provides comprehensive coverage of the climate change issue, from the prevailing situation to policy actions intended to counteract global change; introduces various models and their predictions.]

Fei, J. C. H. and Ranis G. (1964). *Development of the Labor Surplus Economy, Theory and Policy.* Homewood, Illinois: Richard D. Irwin, Inc. [Contemporary mainstream economics lacks the insight into developing economies. This book provides insight into the development of a dualistic economy consisting of labor surplus agriculture and emerging industrial sector, with particular focus on the generation of savings based on agricultural surplus.]

Franz A. and Stahmer C. eds. (1993) *Approaches to Environmental Accounting.* Heidelberg: Physica-Verlag. [A conference volume on environmental accounting organized by the International Association for Research in Income and Wealth; lead to compilation of the SEEA manual.]

Goodland, R., Daly H., El Serafy S., and von Droste B. eds. (1992). *Environmentally Sustainable Economic Development: Building on Brundtland.* Paris: UNESCO. [Transition to sustainability is discussed in this UNESCO publication prepared prior to the UNCED held in 1992.]

Hammond A., Adriaanse A., Rodenburg, E., Bryant D., and Woodward, R. (1995). *Environmental Indicators: A Systematic Approach to Measuring and Reporting on Environmental Policy Performance in the Context of Sustainable Development.* Washington, D.C.: World Resources Institute.

Hufschmidt M. M., James, D. E., Meister A. D., Bower B. T., and Dixon J. A. (1983). Environment, Natural Systems, and Development. An Economic Valuation Guide. Baltimore and London: The Johns Hopkins University Press. [Shows how techniques of economic valuation can be used is actual planning situations.]

Intergovernmental Panel on Climate Change (1994). *IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations.* Special Report to the First Session of the Conference of the Parties to the UN Framework Convention on Climate Change. World Meteorological Organization and the United Nations Environment Programme. [Result of Working Group II of IPCC efforts to make comparable assessment of the impact of potential climate change in different geographical areas and economic sectors.]

Intergovernmental Panel on Climate Change (1996). *Climate Change 1995. Economic and Social Dimensions of Climate Change.* Contribution of Working Group III to the Second Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press.

International Energy Agency, Organization for Economic Co-operation and Development (1989). *Energy and the Environment: Policy Overview.* Paris: OECD. [Provides a comprehensive description of environmental concerns and a typology of environmental policy tools.]

International Institute for Applied Systems Analysis (1992). *Science and Sustainability.* Laxenburg, Austria: IIASA. [Outcome of a conference on the challenges to systems analysis covering the role of technology, decarbonization, science and politics, and international environmental governance.]

Jensen P. R. and Møllgaard E. (1995). *On the Measurement of a Welfare Indicator for Denmark 1970-1990.* Copenhagen: The Rockwool Foundation Research Unit. [Following Nordhaus and Tobin's theoretical work and empirical application in Japan by Uno, this Danish study examines trends in the quality of life in contrast to the GNP trends.]

Kneese, A. V. and Sweeney J. L. eds. (1985). *Handbook of Natural Resource and Energy Economics.* Vol. I, II, III. Amsterdam: Elsevier Science Publishers B.V. [A major source of information on resources and energy.]

London Group (1994). *National Accounts and the Environment.* Papers and Proceedings from a Conference, London, England, March 16-18, 1994. Ottawa: Statistics Canada. [Brought together by the EUROSTAT, BEA of the Untied States, and Statistics Canada, and named after the location their first meeting, the London Group are experts in environmental accounting. This and the following publications by the Group provide up to date information in the field.]

London Group (1995). *Second Meeting of the London Group on Natural Resource and Environmental Accounting.* Conference Papers. Washington, D.C. March 15-17, 1995. Washington, DC: US Department of Commerce, Bureau of Economic Analysis. [See above.]

London Group (1996). *Third Meeting of the London Group on Natural Resource and Environmental Accounting.* Proceedings Volume. Stockholm, Sweden, May 28-31, 1996. Stockholm: Statistics Sweden. [See above.]

London Group (1997). *National Accounts and the Environment,* Papers and Proceedings from a Conference, Ottawa, Canada, June 17-20, 1997. Ottawa: Statistics Canada. [See above.]

Lutz E. ed. (1993). *Toward Improved Accounting for the Environment.* An UNSTAT-World Bank Symposium. Washington, D.C.: The World Bank. [Provides extensive discussion of the accounting framework, country case studies, and selected theoretical topics.]

Lynch O. J. and Talbott K. (1995). *Balancing Acts: Community-Based Forest Management and National Law in Asia and the Pacific.* Washington, D.C.: World Resources Institute. [Discusses deforestation and community-based forest management in the Asia Pacific context.]

Meadows D. H. et al. (1972). The Limits to Growth. New York: Universe Books. [Warned, on the basis of system dynamics, of impending catastrophe due to population explosion, inadequate food production, industrial pollution, and depletion of resources.]

Meadows D. H., Meadows D. L., and Randers J. (1992*). Beyond the Limits: Confronting Global Collapse, Envisioning a Sustainable Future.* White River Junction, Vt.: Chelsea Green Publishing Company. [20 years after *The Limits to Growth,* the authors expand on the sustainability issue on the basis of modeling and scenarios up to the year 2100. Considers the possibility of converting a constantly expanding society into a sustainable one by revising policies and practices and through drastic increase in energy and material efficiency.]

Meyer B. and Uno K. (1999). Global Econometric 3E-Modeling: The System COMPASS. *1999 International Conference on Mission Earth.* The Society for Computer Simulation International. [An exposition of an multi-country, multi-sector global model encompassing economy-energy-environment.]

Nakicenovic N., Grueber A., and McDonald A. eds. (1998). *Global Energy Perspectives.* Cambridge: Cambridge University Press. [Examines six scenarios for future energy development, focusing on the period 2020 to 2050. Population growth, economic growth, energy intensity, technological change, the resource base, and environmental concern are the key parameters. The result of a project study by the International Institute for Applied Systems Analysis (IIASA) and the World Energy Council (WEC).]

Nordhaus W. D. and Tobin J. (1972). Is Growth Obsolete? *Economic Growth,* National Bureau of Economic Research.. New York: Columbia University Press. Also appeared in Moss, Milton, ed. *The Measurement of Economic and Social Performance.* New York: Columbia University Press. [Proposed the Measure of Economic Welfare (MEW), which adds to and subtracts from GNP items left out of the conventional measure, including pollution, urban disamenity, leisure, non-market activity, and services of public and private capital.]

Nordhaus W. D. (1992). Economic Approaches to Greenhouse Warming. *Global Warming: Economic Policy Responses*, ed. by R. Dornbuschr and J. Poterba, Mass.: The MIT Press. [Provides theoretical and empirical analysis of the global warming issue.]

Organization for Economic Co-operation and Development (various years). *OECD Environmental Data, Compendium.* Paris: OECD. [Provides original statistical information on the state of the environment, pressures on the environment, and policy management in the member countries.]

Organization for Economic Co-operation and Development (1985). *The Economics of the Nuclear Fuel Cycle.* Paris: OECD. [Compiled by the Working Group on the Economics of the Nuclear Fuel Cycle under the OECD. The focus is on the costs of fuel cycle stages.]

Organization for Economic Co-operation and Development (1986). *Decommissioining of Nuclear Facilities: Feasibility, Needs and Costs.* Paris: OECD. [Describes decomissioning stages, technological factors, radioactive waste, and the costs of decomissioning.]

Organization for Economic Co-operation and Development (1993). The Costs of Cutting Carbon Emissions: Results from Global Models. Paris: OECD.

Organization for Economic Co-operation and Development (1995). Global Warming, Economic Dimensions and Policy Responses. Paris: OECD. [Reports on policy responses, including taxes, joint implementation, and energy-related R&D in relation to the commitments undertaken by the signatory parties to the Framework Convention on Climate Change.]

Organization for Economic Co-operation and Development (1996a). *Pollution Abatement and Control Expenditure in OECD Countries.* OECD/GD(96)50. Paris: OECD. [Introduces the OECD's effort to compile a standardized reporting system on pollution abatement and control (PAC) expenditure.]

Organization for Economic Co-operation and (1996b). *The Environmental Industry, The Washington Meeting.* Paris: OECD. [Experts representing various countries and international organizations discuss the characteristics of the environmental industry.]

Parikh J. K. and Parikh K. S. (1998). Valuing Environment in Developing Countries: A Challenge. *Environmental Accounting in Theory and Practice,* ed. by K. Uno and P. Bartelmus, Dordrecht: Kluwer Academic Publishers. [Introduces cases of contingent valuation.]

Redclift M. and Benton T. eds. (1994). *Social Theory and the Global Environment.* London: Routledge. [Discusses the gap between perceptions of environmental crisis and official technical and policy discourses from sociological and cultural viewpoints.]

Samuelson P. A. and Nordhaus W. D. (1992). *Economics*. Fourteenth Edition. New York: McGraw-Hill, Inc. [A standard elementary text.]

Sand P. H. ed. (1992). *The Effectiveness of International Environmental Agreements. A Survey of Existing Legal Instruments.* Cambridge: Grotius Publications Limited. [In the course of UNCED preparation leading to the Agenda 21, the UNCED itself took the initiative in examining existing legal framework. This publication is the outcome.]

Society of Environmental Toxicology and Chemistry (SETAC) and SETAC Foundation for Environmental Education (1991). *A Technical Framework for Life-Cycle Assessment.* Pensacola, FL. [The most comprehensive of the many publications on life-cycle assessment, this volume provides a picture not only of the framework itself but gives specifics on various topics including raw materials and energy, manufacturing, transportation, use-reuse, recycling, waste management.]

Solorzano R. et al. (1991). *Accounts Overdue: Natural Resource Depreciation in Costa Rica.* Washington, D.C.: World Resources Institute. [One of the earliest attempts to show empirically that apparent economic growth is being achieved by transferring natural assets to current income flows.]

Spector B. I., Sjoestedt G., and Zartman I. W. eds. (1994). *Negotiating International Regimes: Lessons Learned from the United Nations Conference on Environment and Development (UNCED).* A Publication of the Processes of International Negotiations (PIN) Project, International Institute for Applied Systems Analysis. London: Graham & Trotman Limited. [A collection of papers examining the dynamic processes of intergovernmental coordination initiated by the UNCED and its effectiveness for governance.]

Steurer A. and Caralp B. (1998). Results of SERIEE Pilot Exercises. *Proceedings of the 5th Annual meeting on Environmental Accounting, Fontevraud, 25-29 May 1998,* London Group (forthcoming). Institut Français de l'Environment (IFEN). [Compares environmental protection expenditures in European countries.]

United Nations (1977). *The Feasibility of Welfare-Oriented Measures to Supplement the National Accounts and Balances: A Technical Report.* ST/ESA/STAT/SER.F/22. New York. [In the 1970s research interest in measuring the well-being of populations gathered momentum. This publication provides brief surveys of household economy, government expenditures, measures of environmental conditions, and the measurement of assets.]

United Nations (1992). *Agenda 21: The United Nations Programme of Action from Rio.* New York: United Nations Department of Public Information. [Compilation document from the 1992 Rio Earth Summit, which provided the springboard for the concerted global action which followed.]

United Nations (1993). *Integrated Environmental and Economic Accounting.* New York: United Nations Statistical Division. [Describes the System of Integrated Environmental and Economic Accounting (SEEA), which was developed as a satellite account the 1993 SNA.]

United Nations (1994). *World Comparisons of Real Gross Domestic Product and Purchasing Power 1985.* New York. [Compilation of PPP-adjusted GDP for various countries of the world.]

United Nations Department for Policy Coordination and Sustainable Development (1996). *Indicators of Sustainable Development: Methodology Sheets.* Background paper #15, Fourth Session, 18 April – 3 May, 1996. New York : United Nations. [A methodological paper containing a list of indicators corresponding to Agenda 21.]

United Nations Framework Convention on Climate Change (1997). "Implementation of the Berlin Mandate, Additional Proposals from Parties." New York: United Nations.

United Nations Framework Convention on Climate Change (1998). "Report of the Conference of the Parties on Its Third Session, Held at Kyoto from 1 to 11 December 1997. Addendum: Action Taken by the Conference of the Parties at Its Third Session." New York: United Nations. [Progress report of the Conference of the Parties (COP3), where agreement was reached on the target reduction of CO_2.]

Uno K. (1995). *Environmental Options: Accounting for Sustainability.* Dordrecht: Kluwer Academic Publishers. [An effort to focus attention on environmental issues such as energy, pollution, and technology. Includes construction of composite measures of quality of life and linkage with the input-output framework. Empirical data are taken from Japan, covering 1970 to 1990.]

Uno K. and Bartelmus P. eds. (1998). *Environmental Accounting in Theory and Practice.* Dordrecht: Kluwer Academic Publishers. [A collection of contributions on implementation and improvements to environmental accounting based on experience in various countries and international organizations.]

Van Dieren W. ed. (1995). *Taking Nature into Account, A Report to the Club of Rome.* New York: Springer-Verlag New York, Inc. [Contributions by experts with a common focus on the "paradox growth" that progress measured in the existing framework fails to reflect the state of the environment and the quality of life. A report to the Club of Rome.]

The World Bank (various years). *World Development Indicators.* Washington, D.C. [Annual publication that includes detailed indicators for individual countries on people, environment, economy and the market, and global links.]

The World Bank (various years). *World Development Report.* New York: Oxford University Press. [Provides important material relating to the assessment of development records and potentials.]

World Commission on Environment and Development (1987). *Our Common Future.* Oxford and New York: Oxford University Press. [The so-called Brundtland Report. Examines population, food security, the ecosystem, energy, industrial technology, and urban issues as common challenges and proposes institutional and other changes through international collaboration.]

World Resources Institute, Wuppertal Institute, Netherlands Ministry of Housing, Spatial Planning, and Environment, and National Institute for Environmental Studies (1997). *Resource Flows: The Material Basis of Industrial Economies.* Washington, D.C.: World Resources Institute. [Puts forward physical accounts that can be related to national economic accounts and proposes a new measure of material flow called the Total Material Requirement (TMR). The report finds that 55 to 75% of the TMR are hidden flows, such as those associated with extractive activities.]

The World Resources Institute, The United Nations Environment Program, The United Nations Development Programme, and The World Bank (various years). *World Resources.* New York and Oxford: Oxford University Press. [This series is a collaborative product of four international organizations in the environmental field, and is available in several languages. It includes analysis of environmental issues and detailed indicator tables for more than 150 countries.]

World Wide Fund for Nature (1995). *Real Value for Nature: An Overview of Global Efforts to Achieve True Measures of Economic Progress*. Gland, Switzerland: WWF. [Points out the defects of SNA as a measure of social development, particularly with regard to environmental issues, and introduces various attempts to modify the framework. Also closely examines country cases and initiatives by international organizations in relevant fields.]

Biographical Sketch

Kimio Uno is professor of Policy Management and Dean of the Faculty of Policy Management at Keio University in Japan. He is the co-editor (with Peter Bartelmus) of *Environmental Accounting in Theory and Practice* (Kluwer Academic Publishers, 1998) which resulted from a conference organized by the

United Nations University Institute of Advanced Studies in 1995. Prof. Uno has written extensively on Policy Analysis, Environmental Science, International Relations, Models/Simulations, and environmental effects of trade liberalization agreements. He has constructed econometric models and worked on trade analysis, and is interested in database systems and interactive WWW applications.