

RESOURCES FOR SUSTAINABLE DEVELOPMENT

Sylvie Faucheux and Martin O'Connor

Université de Versailles St-Quentin-en-Yvelines, France

Keywords: Complexity, deliberative democracy, diversity, ecodevelopment, environmental functions, future generations, globalization, governance, indicators, information society, integrated assessment, intergenerational equity, intrinsic value, knowledge, quality assurance, natural capital, post-normal science, property rights, reciprocity, stakeholders, uncertainty, valuation, WorldWideWeb.

Contents

1. Introduction
 2. From Environmental Concerns to the Sustainability of Development
 - 2.1 The Environmental “Crisis” since the 1970s
 - 2.2 The Social Supply and Demand for a Sustainable Development
 - 2.3 Distributional Justice and North-South Relations
 - 2.4 Ethics, Information and Governance Challenges
 3. Challenges for Resources Management
 - 3.1 The Economic Valuation of Natural Resources and the Environment
 - 3.2 The Time Dimension: Irreversibility, Uncertainty and the Long-Term
 - 3.3 Inter-Generational Equity and Ethical Concerns
 - 3.4 Institutional Barriers in the Way of Sustainable Development
 4. New Policy and Decision-Making Frameworks
 - 4.1 An Interdisciplinary Science and Research Base
 - 4.2 Multi-Stakeholder Management of Resources
 - 4.3 The Shift from Substantive to Procedural Rationality
 5. A New “Social Contract” for Science and Technology Development?
- Glossary
Bibliography
Biographical Sketches

Summary

This article focuses on the question of the resources of societies for the pursuit of a sustainable development. It offers a brief characterization of the challenge of sustainable development, as it has emerged from the environmental concerns of the 1960s and 1970s.

It then outlines several distinctive ways in which resources management for sustainable development constitutes a new challenge for decision-makers and economic analysis.

Finally, it explains how, in order to respond to these new challenges, it will be necessary to develop new analysis and decision-support tools based on a wider sharing of information, and efforts at reconciling different perspectives around the resources management involved in a sustainable development.

1. Introduction

All human activity brings about environmental changes, but the expansion of industrial economic activity over the past 200 years has brought the scale of actual and potential harmful impacts to unprecedented levels and intensity, now worldwide. Since the 1980s, growing attention has been given to the global and long-term dimensions of environmental problems, associated with irreversible risks. These are situations where, in the phrase of philosophers Funtowicz and Ravetz (1990), the facts are often uncertain, the decision stakes high, and decisions nonetheless urgent. Policymakers and decision-makers in democratic societies are obliged to act under conditions of very high uncertainty, sometimes virtual ignorance, to manage resources in the pursuit of public policy and development goals. In such circumstances, “soft” scientific information must serve as an input into “hard” decisions for many questions. In addition, sustainable development is a domain of manifest conflicts within and between democratic societies (for example: exposure to acid rain; burden of reduction to emissions damaging the ozone layer; greenhouse gas emissions; biodiversity losses; and access to water resources in quality and quantity).

In this context, it seems important to focus on the question of the resources of our societies for the pursuit of a sustainable development. Section 2 of this article offers a brief characterization of the challenge of sustainable development, as it has emerged from the environmental concerns of the 1960s and 1970s. Section 3 outlines several distinctive ways in which resources management for sustainable development constitutes a new challenge for decision-makers and economic analysis. Section 4 explains how in order to respond to these new challenges, it will be necessary to develop new analysis and decision-support tools based on a wider sharing of information, and efforts at reconciling different perspectives around resources management involved in sustainable development.

2. From Environmental Concerns to the Sustainability of Development

Environmentalists want environmental systems sustained. Subsistence farmers want their productive capacity sustained. Consumers want consumption sustained. Industrial production line workers want jobs sustained. The concern for sustainability thus betrays a general sense of threat—for everybody, there is something at risk, something that, under business-as-usual, probably will not be sustained.

All human societies have been preoccupied with their future. Human concern for degradation of the living environment is not a new phenomenon, nor is it peculiar to Western industrial economies. So the question arises, what are the specific preoccupations of modern society, underlying the concern for the (un)sustainability of “development”?

The term sustainability evokes the image of an economic system able to evolve without deterioration from its current state into the long-term future, being “in balance with nature.” It evokes a broad and diffuse set of concerns to reconcile the tensions between (1) exploitation of the potentials of nature in the pursuit of human well-being, and (2) coexistence of diverse life forms, both human and nonhuman, on the planet. At heart

is the sense that current practices of resource exploitation, waste production and disposal and occupation of physical space are putting at risk not only the values of cultural and ecological diversity, but also the biophysical basis for the welfare human societies in the long term.

2.1 The Environmental “Crisis” since the 1970s

Since the 1960s, people within industrialized societies (of the “North”) have become increasingly preoccupied by a sense that environmental degradation may be outweighing benefits from economic and technological progress, and that furthermore, the damages are perhaps being imposed irreversibly on future generations.

The term environmental damage refers to harm inflicted, or potentially inflicted, on creatures whose interests, existence or livelihoods should be respected. These are, first of all, other humans—but not only humans. The term damage may also register a sense of grief or loss—as, for example, when it is learned that there are only a few hundred giraffes left living in the wild. The increased scale of human agricultural, fishing, forest exploitation, mining and industrial production activity, coupled with the increase in human numbers, is having increasingly visible effects on ecological systems all round the world. Jane Lubchenco, in her Presidential Address to the American Association for the Advancement of Science on February 15, 1997, synthesized the following indicator statement:

Between one-third and one-half of the land surface has been transformed by human action; the carbon dioxide concentration of the atmosphere has increased by nearly 30% since the beginning of the industrial revolution; more atmospheric nitrogen is fixed by humanity than by all natural terrestrial sources combined; more than half of all accessible surface fresh water is put to use by humanity; about one quarter of the bird species on earth have been driven to extinction; and approximately two thirds of major marine fisheries are fully exploited, overexploited or depleted.

Environmental changes are often unnoticed, or noticed only after some time, because they are gradual and deferred in their cumulative impact (for example degradation of land productivity through salinization, ozone layer depletion, climate change from enhanced carbon dioxide emissions, and deforestation on a continental scale). Moreover, damaging practices which affected those who lacked power and voice can often be ignored by the vociferous and powerful. Yet, many economic practices formerly perceived as innocent, constructive and benign—forest clearance, for example—are no longer as widely perceived as such. The environment is seen as intrinsically vulnerable. In the past, a ship wrecked in a storm at sea was primarily a human tragedy, a loss for the friends and family of the men at sea, and for the owner of the cargo. When it was learned, in late 1999, that yet another rusty oil tanker (the “Erika”) had foundered off the Bretagne coast of western France, the event was immediately defined as one more in a growing line of human-induced ecological disasters.

The sources of environmental concern are complex. It is useful to distinguish three main facets, which overlapping in various ways, are the object of learning, information and ignorance.

Economic livelihood interests. These concern the threats posed to human life, health, and continuing economic activity, by impairments to the functional, productive and assimilative capacities of ecological systems. The depletion of natural resources—of fishery stocks, energy and mineral reserves, and so on—has brought home the problem of environmental constraints on economic growth both to the general citizenry and to policymakers. Sustainable development policies must specifically address the trade-offs between present and future associated with the depletion of minerals and fossil energy sources, and of renewable resources such as forests, fisheries, water and productive land. Pollution of air, earth and water directly affects the health and life chances of citizens, and also has an indirect effect through its adverse impacts on the productivity of agriculture, forests, and fisheries. There is an increased alarm at possible perturbations to the biosphere equilibria upon which human life depends—the possible depletion to the stratospheric ozone layer, enhanced greenhouse gas concentrations in the atmosphere bringing global warming, changes in precipitation patterns, and extreme climatic events.

The natural world. The second kind of environmental concern, which has come from the life sciences, subsistence agricultural societies, and the nature conservation movements, is the loss of biodiversity—the disappearance of particular habitats, the extinction, local and global, of particular species of flora and fauna, and ecosystem change worldwide. These issues sometimes have economic and human health dimensions—for example, it may be that there are herbs and medicines that will be lost, or particular food resources that disappear. But narrow economic justifications for the concern are often unconvincing (it is doubtful that human life chances or economic productivity will really be much affected by the loss of some species of butterfly, or even the blue whale). So the concern is not only about the conservation of natural resources for utilitarian purposes, but about the natural world as a direct object of appreciation independent of any specific usefulness these objects (and living subjects) might have for human individuals. This concern has been discussed by some philosophers in terms of the “intrinsic value” of nature and by some economists in terms of “existence value.”

Cultural meanings. The third category of environmental concerns is rooted in social, aesthetic and cultural spheres of life. The environment is not just a physical precondition for human life and productive activity or a habitat for other species, it is the place and space of meanings where humans lead their lives. Some of this dimension comes under the heading of “recreation value” in economics texts: forests, beaches, mountains, and rivers are places of walking, fishing, climbing, swimming, of family picnics and play. Yet the natural environment is not, or is not for all people, merely a playground or spectacle which might have substitutes in a local gym or video gallery. Particular places can matter deeply to individuals and communities in virtue of embodying history and cultural identities. Thus, for example, the public significance attached to the damage to forests and lakes in Scandinavia and Germany due to acid atmospheric pollution, reflects their cultural as much as their economic importance.

Some people speak of the “intrinsic value” of nature and of ecosystems. This expresses the feeling, the affirmation, that the world is good the way nature (or the gods, or God) made it.

2.2 The Social Supply and Demand for a Sustainable Development

The sustainability objective is usually stated as an objective of ensuring that the needs or interests of “future generations” are, in some sense of the words, fairly and adequately provided for. The most widely referred to definition of “sustainable development” is the one given by the World Commission on Environment and Development (1987) in *Our Common Future (The Brundtland Report)*, as “paths of human progress which meet the needs and aspirations of the present generation without compromising the ability of future generations to meet their needs,” and as “a process of change in which exploitation of resources, the direction of investments, the orientation of technological development and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations.” Here, explicitly, is already a notion of intergenerational equity, and as such, a basic ethical precept for sustainable development.

The Brundtland definition expresses a wish, a hope, a desire for harmonization, but without having established the feasibility of achieving it. To what extent can the two goods—the needs of “present” and “future” generations—be satisfied simultaneously? Even if physical (economic and ecological) feasibility of a sustainable development comes to be demonstrated, it still remains to outline the societal (ethical, political, institutional) preconditions for attainment. For any good and service, economists will identify a “supply side” relating to technology of production, resource availability and transportation, etc., and a “demand side” relating to the way of life, political priorities expressed by citizens and collectivities, and preferences and incomes of consumers. This notion can be applied to sustainability.

The “supply side” issues can be addressed through a variety of systems representations and quantifications that build on biophysical, technological and economic data and understandings. What levels of economic production, of national income, of water and energy use, can be assured for the next decade, for the next generation, for the far future? This type of feasibility analysis is indeed the object of a great deal of work around the world.

The “demand side” factors are distinguished from purely scientific feasibility questions, by being partly subjective, and also by being strongly influenced by institutional, cultural, infrastructural and physical environment factors. The demand for sustainability relates to the meanings and significance attributed, by societies and their members, to the various aspects of ecological-economic activity including labor, consumption, other life forms, ecosystem variety, and human relationships themselves.

A view of sustainable development as a process based on cycles of renewal and regeneration, a symbiosis of ecological and economic reproduction, was expressed in the concept of ecodevelopment expounded in the early 1970s by some international agencies, at first with reference to rural development projects in developing countries.

At that time it joined a large array of concepts and terminology proposing an alternative development, whose common feature was rejection of the dominant views of development couched in terms of rapid GNP-growth, throughput of resources, and technological modernization.

For Sachs (1980): “Ecodevelopment is a development of peoples through themselves utilizing to the best the natural resources, adapting to an environment which they transform without destroying it. [...] Development in its entirety has to be impregnated, motivated, underpinned by the research of a dynamic equilibrium between the life process and the collective activities of human groups planted in their particular place and time.” Emphasis here is placed not only on a biophysical stability, but on “the cultural contributions of the peoples concerned” in the effort to “transform the various elements of their environment into useful resources.” Ecodevelopment aims at achieving a lasting symbiosis between humanity and the earth, and at the social level, the search is for a harmonization of relationships based on participatory decision-making and cooperation at local and international levels to achieve economic equity.

Sustainability studies have, since the 1970s, often been developed with a heavy emphasis on the “supply side”—that is, prospects of technological improvements that can reduce environmental pressures, relative to the biophysical constraints on present and future economic activity. Established economic analysis has, in this perspective, represented economic welfare as a function of levels of produced goods and services as a stock (capital, property holdings), or as a flow level (rates of consumption of produced goods and services). Ecological scarcity then means trade-offs between present and future welfare levels.

There exist considerable scientific difficulties in trying to give reliable quantitative estimates of the “trade-offs.” But in addition, it becomes quickly evident that such changes in patterns of resource use activity are unlikely to occur unless there occur changes in social values—the greatest challenges are thus posed at the level of political process, decision-making, and institutions for conflict resolution. This means turning attention to the psychological and cultural dimensions of goods and services consumption, human relationships, lifestyles, and political and community processes.

In particular, the question arises of the extent to which collective social objectives of equity and environmental sustainability can be reconciled with the notions of freedom and “self-interest” widely valorized in the West. Here, a return is made to old questions of individual rights and duties, virtue and vice, license and public order, that have preoccupied centuries of political philosophy.

2.3 Distributional Justice and North-South Relations

The contemporary environmental crisis is recognized as “global” in character and as distinctively associated with the dynamism of the West. Today’s “problems of the environment” arise primarily in the context of the expansion, on a world scale, of industrial production, mass-commodity-consumption, and various forms of rapid transport and telecommunication. The 1960s saw a growing agitation across the affluent North concerning the poisoning of urban and rural habitats occasioned by economic growth and consumerism. This quality of habitat and quality-of-life concern was

overtaken in the 1970s by the oil-supply “energy crisis,” and related preoccupations with natural resource depletion. People of the South, meanwhile, were mounting wide-ranging protests at the depredation of their natural resource base (including renewable sources such as fisheries and forests as well as mineral wealth)—due, in part, to a sort of “ecological unequal exchange” that has helped fuel economic growth in the North without distributing very fairly the gains-from-trade. This places focus on instances of “international externalities” and cases of alleged cost-shifting by powerful economic players onto weaker ones, separated by large distances.

Ecologically unequal exchange between North and South, means that poor countries are bearing more than their fair share of the burdens of natural resource depletion, ecosystem damage and pollution, without necessarily getting much of the economic benefits in exchange. (The terms North and South are used here in their symbolic sense; the South and “Third World” may be regarded as approximately synonymous).

The opportunity costs of the depletion of forests and fisheries are, henceforth, being discussed in terms of intertemporal and intersocietal injustice. Now that the fragility of the “sink” capacity of the planet’s atmosphere for carbon dioxide emissions (and other greenhouse gases) has become the object of an international debate, it has been argued that the already industrialized countries have appropriated the natural resource “services” in a historically unequal way, in this sense imposing a cost on future generations.

The 1990s has thus emerged as the decade of “global ecology” issues, partly because of the planetary proportions of some of the ecological impacts (climate change, ozone layer depletion, accumulation of metal toxins, nuclear waste disposal, etc.), and also because of the internationalization of the politics of the environment as epitomized by the UNCED Rio de Janeiro Conference in 1992, and the wrangles over the World Trade Organization and the (non)greening of the GATT.

The twenty-first century is likely to unfold as an epoch of intensifying conflicts over access to ecological resources, including water, agricultural production land, fisheries, and other food sources. With ecological globalization, natural resources degradation has become a phenomenon capable of accentuating not only the sources of spatial and temporal conflicts, but also inter- and intra-generational inequities. Present decisions and actions in the economic and environmental fields can profoundly influence, both negatively and positively, the welfare prospects of future (as well as present) generations.

-
-
-

TO ACCESS ALL THE 33 PAGES OF THIS CHAPTER,
Visit: <http://www.eolss.net/Eolss-sampleAllChapter.aspx>

Bibliography

Brodhag C. (1999). From Rationality to Governance: The decision process of sustainable development. *International Journal of Sustainable Development* 2(3), 388–396. [Article insisting on the importance of developing human and electronic networks for the sharing of experience at local and global levels.]

Carson R. (1960). *Silent Spring*, reprinted 1965. London: Penguin Books. [Recognized as a classic, a lucid exposition by a biologist of the prospects of large-scale species extinction through indiscriminate use of chemical pesticides.]

Daly H. E., ed. (1973). *Toward a Steady-State Economy*. San Francisco: W.H. Freeman. [A now classic collection, including Kenneth Boulding's classic paper "The economics of spaceship Earth" and Daly's own influential essay "The steady-state economy: toward a political economy of biophysical equilibrium and moral growth."]

Dryzek J. (1990). *Discursive Democracy*. Cambridge: Cambridge University Press. [Exposition of notions, drawing on Habermas, of deliberative processes as a basis for open and just society.]

Ekins P. and Simon S. (1999). The sustainability gap: a practical indicator of sustainability in the framework of the national accounts. *International Journal of Sustainable Development* 2(1), 32–58. [Methodological discussion, with examples from the UK, of the use of "strong sustainability" standards for formulating resource management policies.]

Faucheux S., Pearce D., and Proops J., eds. (1996). *Models of Sustainable Development*. Cheltenham: Edward Elgar. [A collection presenting a spectrum of modeling approaches in neoclassical, eco-energetic, evolutionary, and neo-Ricardian traditions, showing how mathematical modeling can be exploited to explore and to convey insights for sustainability.]

Faucheux S. and O'Connor M., eds. (1998). *Valuation for Sustainable Development: Methods and Policy Indicators*. Cheltenham: Edward Elgar. [A book that presents a variety of conceptual frameworks and applications—including "weak" and "strong" sustainability concepts, energy-based systems analysis, multicriteria methods and multisector scenario modeling—for policy-oriented analyses of economy-environmental interfaces.]

Faucheux S., O'Connor M., and Straaten, J. van der, eds. (1998). *Sustainable Development: Concepts, Rationalities, Strategies*. Dordrecht: Kluwer. [Collection of essays in and around economics that explore guiding ideas for sustainability such as justice, valuation, biophysical dynamics, decision-making, uncertainty and responsibility towards future generations.]

Funtowicz S. O. and Ravetz J. R. (1990). *Uncertainty and Quality in Science for Policy*. Dordrecht: Kluwer. [The now-classic work that introduces the concept of Post Normal Science as a reflexive practice that incorporates wide stakeholder deliberation as a means of assuring knowledge quality and pertinence in high stakes contexts.]

Funtowicz S. O., Ravetz J. R., and O'Connor M. (1998). Challenges in the utilisation of science for sustainable development. *International Journal of Sustainable Development* 1(1), 99–108. [A short discussion paper, initially prepared for a session of the 6th United Nations Commission for sustainable Development, New York, April 1998.]

Funtowicz S. and O'Connor M. (1999). The Passage from Entropy to Thermodynamic Indeterminacy: Long-term Principles for Sustainability. In Mayumi K. and Gowdy J. M., eds. (1999). *Bioeconomics and Sustainability, Essays in Honour of Nicholas Georgescu-Roegen*. Cheltenham: Edward Elgar, pp. 257–286. [Arguments bridging from thermodynamics of open systems to the challenges of indeterminacies in human societies seeking tolerance and sustainability.]

Gallopin G., O'Connor M., Funtowicz S. and Ravetz J. (2001). Science for the 21st Century: From social contract to the scientific core. *International Journal of Social Science* 168, (June) 219–229. [Argument for the necessary reframing of priorities and conventions in scientific methodology, to confront the problems

of complexity in contemporary applied science. Traduction française: « La Science pour le XXI^{ème} siècle : du contrat social aux fondements scientifiques », *Revue Internationale des Sciences Sociales*, **168**, June 1991, pp. 239-250.]

Glacken C. J. (1967). *Traces on the Rhodian Shore: Nature and Culture in Western Thought from Ancient Times to the end of the 18th Century*. Berkeley, California: University of California Press. [Comprehensive and scholarly treatise on culture and nature across more than 2000 years of Mediterranean/European societies.]

Hobbes T. (1651). *Leviathan*, Fontana Edition (1962), edited and abridged by J. Plamenatz. London: Fontana Books. [Classic work in Western political tradition on the problems of power and the governance of relations between individuals in a civilized society.]

Holland A. (1997). The foundations of environmental decisionmaking. *International Journal of Environment and Pollution* **7**(4), 483–496. [Argument for the pertinence of principled deliberation by members of human communities as a basis for just and reasonable decisions.]

Huetting R. (1980). *New Scarcity and Economic Growth: More Welfare through Less Production?* Amsterdam: North-Holland. [The English translation of one of the pioneers of methods for integrated analysis of environmental impacts of economic activity and policy responses for sustainability.]

IUCN (International Union for the Conservation of Nature and Natural Resources) (1980). *World Conservation Strategy: Living Resource Conservation for Sustainable Development*. Gland, Switzerland: IUCN/UNEP/WWF. [Introduction of the notion of « sustainability » as a strategy for reconciling resource exploitation with nature conservation objectives.]

Jansson A.-M., Hammer M., Folke C., and Costanza R., eds. (1994). *Investing in Natural Capital: The Ecological Economics Approach to Sustainability*. Washington, DC: Island Press. [Contributions by leaders in ecological economics, on the importance of natural capital for sustainability policy.]

Leopold A. (1949). *A Sand County Almanac*, reprinted 1970, New York: Ballantyne Books. [A classic North American contribution to environmental ethics, inspired by intimate attentiveness to nature as a living community.]

Martinez-Alier J. (1987). *Ecological Economics*. London: Basil Blackwell. [Comprehensive history of ways that heterodox economic thinking since the nineteenth century has sought to exploit physical and biological sciences knowledge for understanding “biophysical foundations” of society.]

Martinez-Alier J. and O'Connor M. (1996). Distributional issues in ecological economics. In: *Getting Down to Earth: Practical Applications of Ecological Economics*, eds. R. Costanza, O. Segura, and J. Martinez-Alier, pp. 153-184. Washington, DC: Island Press. [A theoretical discussion, with examples, of distributional conflicts and of “endowment effects” in valuation of environmental externalities and of natural capital.]

Mayumi K. and Gowdy J. M., eds. (1999). *Bioeconomics and Sustainability, Essays in Honour of Nicholas Georgescu-Roegen*. Cheltenham: Edward Elgar. [Collection of papers exploring the cross-fertilizations between thermodynamic analysis, ecological-economic systems analysis, and the ethical and existential challenges of a sustainable development.]

Mill J. S. (1848). *Principles of Political Economy, with some of their Applications to Social Philosophy*, 7th Edition (1871), edited with an introduction by W. J. Ashley (1909). London: Longmans, Green and Co. (reprinted 1976. New York: A. M. Kelly). [Classic treatise that deals with all topics in political economy—including land reform, externalities, public goods, etc.—in a remarkably “contemporary” way.]

Norgaard R. (1988). Sustainable development: a co-evolutionary view. *Futures* **20**, 606–620. [Short lucid exposition of sustainability as a process of cultural and institutional as well as ecological economic co-evolution.]

Norgaard R. (1994). *Development Betrayed: the End of Progress and a Co-evolutionary Revisioning of the Future*. London: Routledge. [Full exposition of “coevolution” as a framework of understanding of social and ecological change, intertwining values, epistemology, technology, institutions and economics.]

O'Connor M., ed. (1994). *Is Capitalism Sustainable? Political Economy and the Politics of Ecology*. New York: Guilford Publications. [Collection of essays exploring the contradictions of modern capitalism from a variety of left critical, Marxist, ecofeminist and democratic theory perspectives.]

O'Connor M. (1995). La réciprocité introuvable: l'utilitarisme de John Stuart Mill et la recherche d'une éthique pour la soutenabilité. *Economie Appliquée* XLVIII (2), 271–304. [Exposition of Mill's thinking as a precursor to contemporary sustainable development debates; English version: J.S. Mill's Utilitarianism and the Social Ethics of Sustainable Development, *European Journal of the History of Economic Thought* 4(3), 478-506.]

O'Connor M. (1997). Environmental Valuation: From the Point of View of Sustainability. Ch.8 in Dragun A.K. and Jakobsson K.M., eds., *Sustainability and Global Environmental Policy, New Perspectives*, pp. 149–179. Cheltenham: Edward Elgar. [Resource management and environmental valuation viewed as a social process of arbitrating over “sustainability of what and for whom”.]

O'Connor M. and Meité, V., eds. (2002). *Environmental Evaluation*, CIEE Series (Current Issues in Ecological Economics). Cheltenham, Northampton, Massachusetts: Edward Elgar Publishing. [Selection of essays exploring ethical, institutional and scientific challenges of taking “environment” into account in societal evaluation processes.]

O'Connor M. and Arnoux R. (1992). Ecologie, échange inéluctable, et éthique de l'engagement (Sur le don et le développement durable). *Revue du MAUSS*, No. 15-16, 288–309. [Links anthropological writings on social reciprocity to preoccupations with sustainability and coexistence in (post)industrial societies.]

O'Connor M. and Martinez-Alier J. (1998). Ecological Distribution and Distributed Sustainability. Chapter 3 in Faucheux S., O'Connor M., and Straaten, J. van der, eds. (1998). *Sustainable Development: Concepts, Rationalities, Strategies*. Dordrecht: Kluwer, pp.33–56. [Argues that valuation for sustainability must first of all define justice, durability and coexistence goals, then assess the resource requirements for realizing these goals.]

O'Connor M. and Spash C., eds. (1999). *Valuation and the Environment: Theory, Methods and Practice*. Cheltenham: Edward Elgar. [Collection of essays on methodological issues and empirical studies using monetary valuation techniques and a variety of nonmonetary information and appraisal techniques.]

Passet R. (1979). *L'Economie et le Vivant*,. 2nd Edition (1996). Paris: Economica. [An excellent exposition, in French, of the application of open systems concepts for understanding challenges of economic analysis and policy in their institutional and wider ecological contexts.]

Pearce D., Barbier E. and Markandya A. (1990). *Sustainable Development and Cost-benefit Analysis*. London: Earthscan. [Arguments for the extension of economic cost-benefit analysis to include depreciation of and investments in ‘natural capital’ in the context of development project evaluation.]

Peet J. (1992). *Energy and the Ecological Economics of Sustainability*. Washington DC: Island Press. [Exposition of the insights from thermodynamics and energy analysis for framing the technological, political and ethical challenges of sustainable development.]

Rawls J. (1971). *A Theory of Justice*. Cambridge: Harvard University Press. [Classic work of political philosophy arguing for a criterion of justice in favour of improving the status of the least well off in society.]

Ricardo D. (1817). *On the Principles of Political Economy and Taxation*, ed. P. Sraffa (1951). Cambridge: Cambridge University Press. [One of the classics of political economy, which (apart from a

lot of other interest) makes explicit the simple premises of an “invariant” physical environment underlying established schools of thinking in economics.]

Sachs I. (1980). *Stratégies de l'écodéveloppement*. Paris: Les Editions Ouvrières. [Succinct statement in French of the concept and practice of ecodesign, integrating economic justice, political self-determination and environmental sustainability, as formulated during the 1970s.]

Samuels W. J. (1992). *Essays on the Economic Role of Government* (2 volumes). London: Macmillan. [Exposition of the institutional and political dimensions inherent in the resolution of conflicts over rights and duties in economic activities, including access to natural resources and the benefits of environmental services.]

Solow R. (1992). An Almost Practical Step towards Sustainability. 40th Anniversary Lecture, Resources for the Future, Washington D.C. [Retrospective by a noted economist on the roles for economic analysis in furnishing guidance in pursuit of sustainable development.]

Victor P. (1972). *Pollution, Economy and Environment*. London: Allen and Unwin. [An early investigation of possibilities of analyzing economy-environment interdependence and for organizing environmental information using extensions of economic sectoral analysis concepts for representation of ecological processes.]

Victor P. (1991). Indicators of Sustainable Development: Some lessons from capital theory. *Ecological Economics* 4, 191–213. [Discussion of the challenges of making measurements and aggregate indicators of 'natural capital' from physical and economic sciences perspectives.]

World Commission on Environment and Development (1987). *Our Common Future (The Brundtland Report)*. Oxford: Oxford University Press. [The original exposition of the notion of sustainable development as providing for present needs without compromising future needs.]

Biographical Sketches

Sylvie Faucheux is currently Professor in Economic Science at the University of Versailles-St Quentin-en-Yvelines (UVSQ) in Paris, France, and Director of the research institute C3ED (Centre d'Economie et d'Éthique pour l'Environnement et le Développement) based at the UVSQ. Since 1992, in addition to teaching, research supervision and other duties as a university professor, Faucheux has been responsible for the leadership and management of contract research at C3ED in the fields of sustainability, ecological economics, environmental policy and scenarios. She has published a large number of scientific papers in French and English, and is associated with several collective publishing ventures. These include: the role of coeditor for the International Journal of Sustainable Development which was established in 1998 and publishes a lot of ecological economics contributions; cooperation in the establishment of the International Library of Ecological Economics (a new monograph series published by Edward Elgar); and a new series in ecological economics based in Switzerland, to be published in French with translation agreements for English and German. Recently, she has especially concentrated on problems of governance, risks and technological change, and systems of “vigilance-foresight,” with stakeholder-based approaches to the analysis of transitions towards sustainability in European countries. She has worked with several Ministries of the French state, with firms and with the European Commission on these topics, including recently climate policy, nuclear reactor waste management, and futures studies for technological innovation and the environment. As a member of the ISEE Board, Sylvie Faucheux brings a long experience in leadership, organization and resource management for ecological economics activities on an international and multilanguage level. In 1994, she led the organization of a major international conference in Paris on models for sustainable development (participation of 400), and in 1996 she played a central role in organizing the inaugural conference of the European Society for Ecological Economics (ESEE), the European branch of ISEE. She was elected the ESEE's first President in 1996, until stepping down from this position at the end of 1999. Under her leadership, the C3ED research institute has acted as host for the ESEE Secretariat since 1996, and has provided the support needed to establish a regular ESEE Newsletter, to maintain the membership list, and other activities. Sylvie Faucheux has also led initiatives to establish partnerships with universities, ministries and industry in the Middle East and parts of Africa (especially French-speaking North and West Africa), in this way broadening the base of

ecological economics networking. She is a member of the European Consultative Forum on the Environment and Sustainable Development as well as reporter of the Climate Change Working Group of the former forum.

Martin O'Connor is from Christchurch, New Zealand, and studied physics and humanities in his native country and in Paris. After completing his Ph.D. in economics (*Time and Environment*) at the University of Auckland in New Zealand, he was for several years a Lecturer in Economics at the University of Auckland before taking up a professorial position at the University of Versailles St-Quentin-en-Yvelines (UVSQ) in Paris, in 1995. He has research degrees in physics, sociology and economics, and specializes in interdisciplinary work in ecological economics theory, development theory, environmental policy and social sciences epistemology. In New Zealand during the 1980s he was active in a range of critical and consulting studies including public policy, environmental and social impact assessments, energy and banking sector studies, in parallel to academic teaching and writing. Since 1995, as Project Manager at the C3ED (Centre d'Économie et d'Éthique pour l'Environnement et le Développement) research institute, he has participated in numerous French and European studies in the environmental valuation, green accounting, scenario studies, integrated assessment, risk and water governance fields. He is a member of the editorial advisory boards for the journals *Capitalism Nature Socialism (CNS)* and *Environmental Values*, and currently edits the interdisciplinary *International Journal of Water (IJW)*, published by Inderscience. With colleagues he is active in the development of international teaching networks, notably through the 3^E-SDP (European Ecological Economics and Sustainable Development Policy) program including North-South cooperation.