ECONOMIC MANAGEMENT PRINCIPLES FOR SUSTAINABLE DEVELOPMENT

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Summary

As human numbers increase and economic activity expands, demands on the natural environment grow more intense and varied. Using any single resource for a particular purpose at a given date invariably involves trade-offs. These can easily be cross-sectoral or international. Likewise, the opportunity costs associated with resource use are often intertemporal, as opposed to occurring within a single time period. Economics provides a conceptual framework for assessing all these trade-offs. Capital theory furnishes guidance for allocating resources between present and future use. Also, the literature on market failure addresses the reasons for inadequate internalization of environmental values, the inefficiencies that result when firms and households do not consider all the benefits and costs of resource use, as well as remedial public policies. Finally, economists emphasize that the debate over sustainability revolves largely around substitution issues. Can consumers, for example, maintain constant levels of satisfaction or enjoyment if reduced availability of environmental goods and services is compensated for by increased supplies of other things? Can firms maintain output in the face of resource depletion through investment in human capital and other kinds of productive wealth? Concerns about sustainability are directly related to the conviction that opportunities for substitution are limited in one way or another.

1. Introduction

For most of the time since the last Ice Age ended and agriculture began, approximately 10 000 years ago, natural resource management was, at most, a local concern.

Expressions of concern about resource exhaustion date back several centuries. But as long as the global population did not exceed a few hundred million and the vast majority of people farmed, relying almost entirely on muscle power provided by themselves and draft animals, the human footprint on the environment—to apply a modern idea—was transitory and light.

Things started to change 500 years ago. Sometimes involving trade and sometimes based on exploitation, international economic exchange grew. Human numbers did so as well. But even in 1798, when the first edition of Malthus's *magnum opus* was published, the global population had not yet reached one billion.

Malthus's model of population dynamics described human existence reasonably well—existence through the 1700s, that is. Positing that human numbers increase exponentially whenever average living standards are above bare subsistence, while agricultural output only exhibits a linear growth trend, Malthus concluded that there is a stable demographic equilibrium in which everyone is minimally fed, clothed, and housed, nothing more and nothing less.

When these observations were first offered, the historical basis for them was sound. Indeed, they were applicable in many parts of the world throughout the nineteenth century and into the twentieth. Even while Malthus was alive, though, population trends were starting to be driven by something other than heedless procreation during times of abundance and illness and starvation whenever food supplies came up short. As Malthus acknowledged in the second edition of his book, published in 1803, people can be motivated by a desire for self-improvement, acquiring skills, finding ways around environmental impediments to material progress, and limiting their fertility.

In modern times, more and more people have enjoyed the opportunities for self-improvement that markets provide. As a result, something inconceivable to Malthusians (past and present) has occurred. Human numbers have increased, from approximately 800 million in 1800 to six billion at the beginning of the twenty-first century, while the real value of global output has gone up forty-fold. Moreover, as Johnson (2000), an agricultural economist, explains, the benefits of this expansion—in terms of longer lives, better diets, and all other measures—have spread around the world. To be sure, simultaneous growth in the population and average living standards has made environmental management more of a challenge. The real question to be addressed is whether this challenge will continue to be overcome, as it has been consistently during the past two centuries. The prospects for doing this will be enhanced if management guidelines suggested by economic analysis are applied. Whether or not this occurs, of course, depends on the outcome of political interchange, which certainly is not driven exclusively, or even primarily, by efficiency and other criteria that economists use to assess management and policy choices.

2. Environmental Trade-Offs

A suitable point of departure for a discussion of economic principles for the sustainable management of natural resources is an assessment of the various linkages that exist

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between an economy and the natural environment. These linkages are expressed in Figure 1.

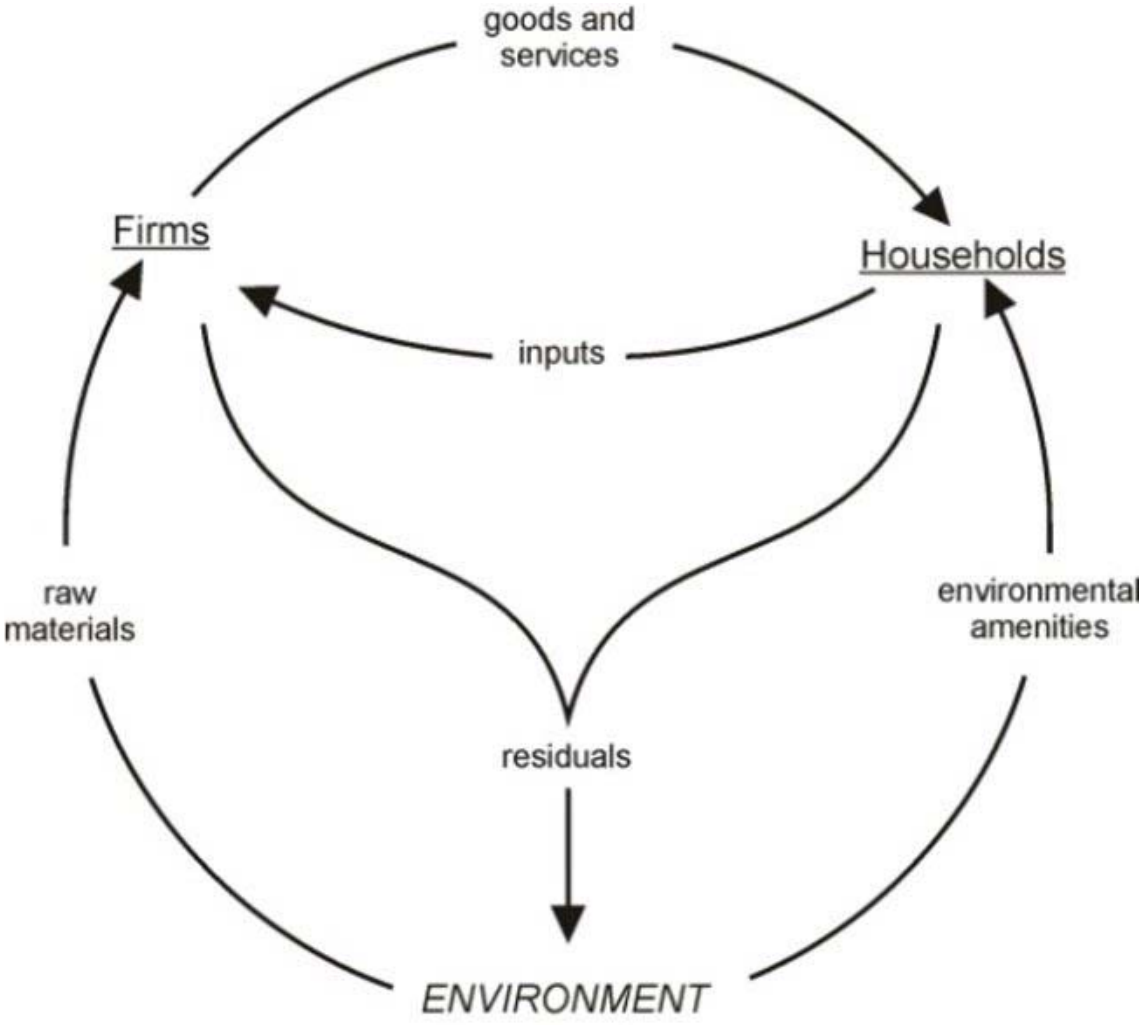

Figure 1. Linkages between the economy and the environment
(Source: Regional economics course notes, Emeritus Professor D. Chappelle, Michigan State University)

Represented at the top of the figure are the agents and relations identified early in any introductory economics class or textbook. Conveniently, although a little abstractly, economists divide agents between two broad groups: firms and households. The former group uses labor and other inputs provided by the latter to manufacture goods and services, which are consumed by households. Corresponding to the exchange of inputs and outputs, of course, are flows of monetary compensation, which have been left out of Figure 1.

Natural resources may or may not be mentioned in an introductory course or textbook as firms' decisions about input-output combinations, households' choices regarding purchases, work, and leisure, and the performance of markets that coordinate these decisions and choices, are examined. If they are mentioned, the first linkage between the

environment and the economy depicted in Figure 1, which has to do with the supply of raw materials, is apt to be stressed.

All infratemporal aspects of the allocation of labor and other inputs apply as well to environmental factors of production. Competition over energy, for example, occurs among various consuming sectors. Likewise, resources must be divided up within any single sector. But allocating environmental inputs also has an intertemporal dimension if current extraction impinges at all on future resource availability and consumption. This can occur if depletion of deposits that are unusually productive or readily accessible obliges a switch to inferior deposits. In addition, available stocks may simply be insufficient to satisfy all current and future demands.

Further complicating the task of managing environmental resources wisely is that more than one use can be made of many of the places where raw materials naturally occur. As indicated in Figure 1, the environment, along with being a source of raw materials, performs a cleansing function, receiving and neutralizing the physical residuals of production and consumption. As long as residual flows do not strain this function, then emitting wastes is, for all intents and purposes, costless. However, as emissions increase and the capacity for neutralization is placed under ever more pressure, environmental quality suffers, thereby reducing raw material availability. For example, using a stream to carry away large volumes of industrial or municipal pollutants may so impair water quality that it can no longer be used as an irrigation source.

A third linkage between the economy and the environment is depicted in Figure 1. Different from raw materials, which are combined with labor and other factors to produce the goods and services consumed by households, environmental amenities are consumed directly by people. These include scenic views and clean ambient conditions. Environmental disamenities, which also are consumed directly by households, exist as well, because of raw material extraction or residual flows above what the environment can accommodate. Contamination of free-flowing rivers suitable for swimming and fishing, and smog resulting from vehicular traffic, are two examples.

To summarize, environmental management requires the assessment of opportunity costs of little relevance to the allocation of, say, loaves of bread or person-days of labor. Choices about when to make use of natural resource commodities have to be made. Furthermore, trade-offs between different uses of the same site must be faced. In particular, due consideration must be given to the value of alternative uses that are sacrificed whenever a particular site is set aside solely for resource extraction, for waste disposal, or as a source of environmental amenities.

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Biographical Sketch

Douglas Southgate is a natural resource economist with a doctorate from the University of Wisconsin. He is a Full Professor in the Department of Agricultural, Environmental, and Development Economics at Ohio State University, where he joined the faculty in 1980. His research focuses on tropical deforestation, watershed deterioration, and other environmental problems arising in developing countries. To date, he has published three books, three monographs, an edited volume, twenty chapters in edited volumes, as well as thirty-two articles in *Land Economics*, the *American Journal of Agricultural Economics*, *World Development*, *Ambio*, and other scholarly journals. Dr. Southgate is best known for his analysis of government policies influencing the development of renewable natural resources in Latin America. In addition to reflecting his research, this work draws on his experience as a consultant for the Ford Foundation, the Inter-American Development Bank, the U.S. Agency for International Development (USAID), and the World Bank in fifteen countries. A member of *Phi Beta Kappa* and the American Economic Association, Dr. Southgate served on the Tropical Ecosystems Directorate of the U.S. Man and the Biosphere Program during the late 1980s and held a Joint Career Corps assignment with USAID in Ecuador during the early 1990s. More recently, he has directed Ohio State University's Center for International Studies and Latin American Studies Program.