

EDUCATION, SUSTAINABILITY, AND ENVIRONMENTAL ECONOMICS

Douglas E. Booth

Economics Department, Marquette University, Milwaukee, WI 53201-1881, USA

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Summary

The goal of this article is to set out some of the key ideas from ecological economics that an informed citizen in the modern world should understand. The article begins with a brief discussion of the nature and cause of the ecological problem. Underlying environmental deterioration is a long-term economic growth process that creates new environmental problems. Under current economic arrangements, some but not all environmental and ecological problems get addressed. A steady-state economy is offered as a vehicle for achieving environmental sustainability.

1. Introduction

Anyone with children in school these days is well aware that basic ideas about ecological systems and the global environment are taught at all levels from kindergarten through twelfth grade. The present author's twelve year old has a fairly solid understanding of such ideas as food chains and biological productivity and knows roughly how greenhouse gases have the potential to cause global climate change. Less is taught in the public schools about the economics of environmental problems, and, in

particular, about the connection between economics and ecology. The primary task in this article is to set out some of the basic ideas about environmental and ecological economics that an informed and educated lay person should understand. This task is, unfortunately, rendered somewhat problematic by the presence of differing schools of thought on the subject. The basic approach of conventional environmental economics will be explained below, but the principal focus will be on ideas from the comparatively new field of ecological economics.

2. Utilitarian and Duty-Oriented Approaches to Environmental Issues

The conventional approach to environmental economics is utilitarian and involves the balancing of social costs and social benefits in public decisions on environmental policy. Utility is essentially a hypothetical measure of personal well-being, and the goal of a utilitarian approach to public policy is to maximize society's total utility. In practical terms, this amounts to weighing costs against benefits and choosing those environmental policies that maximize net benefits. According to this approach, greenhouse gases should be reduced by 50 percent or the Amazonian rain forest should be preserved only if doing so would yield added benefits that are greater than added costs. If the opposite is the case, then such measures should be avoided.

A duty-oriented or deontic approach to environmental issues sees conservation of the environment as a duty. The duty could be to future generations, to those suffering from environmental degradation in the current generation, or even to the preservation of non-human species and the ecosystems that support them. Unless there is a greater moral harm, duty trumps utility. If preserving climate stability or biodiversity is perceived as a duty, global warming should be halted and the Amazonian rain forest preserved even if the added costs of doing so exceed the added benefits. A duty-oriented approach to environmental decision making thus in some cases results in a different conclusion than a utilitarian approach—a conclusion which may include the reduction of cost externalization.

2.1. Cost Externalization

It is essential to understand why individual businesses and consumers do not voluntarily address on their own the environmental problems they cause. The reason they do not is fairly simple. In the framework of a capitalist economy, where the seeking of material gain by economic agents is the central principle, individual businesses and consumers will attempt to avoid the costs of their actions by externalizing them. Profits for individual businesses and utility for individual consumers can be maximized by emitting pollutants into the air or water rather than bearing the cost of emissions control equipment that would limit the discharge of pollutants. By doing so the costs of the emissions are externalized and borne by the society as a whole. Gain seeking promotes cost externalization.

This is even the case when the cost to society (assuming that it is measurable) greatly exceeds the internal costs of avoiding the environmental damage through some form of emissions control. We all, for example, contribute to the problem of air pollution when we drive our automobiles, but the reduction in air quality we experience as a result of

our own individual actions is imperceptible while emissions control devices are quite expensive for each of us individually. Consequently, few of us are willing voluntarily to install control devices on our own even though the collective costs of damage from air pollution we bear as a society much exceed the total cost of control devices. This line of reasoning applies as well to businesses that emit pollutants or cause other forms of environmental damage. The tendency is to push the burdens of limiting environmental damage off on others in a gain-seeking society, and the net result is that everyone suffers. This tendency leads us to the ecological problem.

3. The Ecological Problem

In the simplest possible terms, the economic system is expanding ecologically relative to the global ecosystem. That is, as the economy grows, its effects on the global ecosystem increase. The economic system requires inputs of energy and materials from the global ecosystem. The only external input into the global ecosystem of any significance is solar energy. The energy sources currently used by human beings come primarily from nonrenewable fossil fuels, a form of indirect solar energy. We also utilize solar energy directly when we grow any kind of crop or use photovoltaic cells for generating electricity. We get materials directly from the earth's crust as well as from harvests of crops and uncultivated organic substances from nature, such as timber or fish. As the economy expands materially, more of all of these things are consumed. In addition, as a consequence of economic expansion, human beings take over natural habitat. We take over prairie lands to grow our food grains; we take over river valleys and cut down forests for farms and subdivisions; we put up dams on rivers for electric power and irrigation; we dig huge pits to mine minerals; and we fill in wetlands to build our homes and shopping centers. These are only some of the things we do to take over habitat from other species. As a consequence, humanity now extensively utilizes some 40 percent or more of the earth's terrestrial habitat. As will be seen below, scientific laws dictate that energy and matter cannot be created or destroyed. In the process of human production and consumption, useful matter and energy is reduced to waste heat and materials. These must be disposed of and are frequently harmful to human health and the health of ecosystems. Ecosystems constitute the material and organic habitats in which populations of different species live. Wastes created by economic activity are frequently harmful not only to human beings, but also to plants and animals and their ecosystems. Air pollution in the Los Angeles basin, for example, is harmful not only to the people that live there, but to the forests surrounding the basin.

3.1. Laws of Thermodynamics and the Ecological Problem

Another way to look at the ecological problem is through the prism of the laws of thermodynamics. These laws infer a fundamental ecological scarcity and suggest that the economic system is ultimately limited in terms of its size relative to the global ecosystem. The laws are as follows:

1st Law: Energy/matter cannot be created nor destroyed.

2nd Law: The entropy of energy increases; to perform work, energy is converted to a more dispersed, less useful form.

The first law clearly implies that an ever-expanding waste stream will result as a

consequence of an ever-expanding stream of human material consumption. The production and use of an automobile requires energy and materials to be taken from nature. The use of the automobile results in waste products such as waste heat, tailpipe emissions, and other waste products such as oil and tire tread wear returning to nature. And finally, when the automobile is junked, something has to be done with it. The second law implies that energy cannot be recycled. When we drive our car, useful energy in the form of gasoline is converted to waste heat that can't be recovered and used again. Thus we face an absolute scarcity of energy equal to energy stores in the earth's crust and the daily flows of energy from the sun. Moreover, the second law suggests that 100 percent materials recycling is impossible. To recover all the waste materials from tire tread wear, for example, would be virtually impossible because the waste material is too dispersed. Something like entropy is at work for material goods as well. Consequently, because 100 percent recycling is impossible, we face an ultimate absolute scarcity of materials as well. Thus material and energy scarcity impinge on how much the economic system can grow relative to the global ecosystem. Finally, human beings and other species can stand only so much waste being emitted into their environments without harm to their health, and the continuing human invasion into ecosystems ultimately drives out other species by destroying their habitats. All this suggests an ultimate absolute ecological scarcity that is incompatible with a high-growth economy.

What is the force behind economic growth? Population growth is an important part of the story—global population is somewhere around 6 billion and this is more than double the world population just 50 years ago. All we need is 1.5% population growth per year for population to double in 50 years. Just as important, is the growth of production and consumption per person. At a global level this has also been occurring at around 1.5% per year. Adding these together, the global economy expands at about a 3% rate annually. Why? Half the problem is population growth, and half is growth in consumption. Behind the latter is the drive for profit, the resulting creation of new kinds of goods and technologies, and consumerism.

3.2. Economic Growth and the Ecological Problem

New forms of economic activity feed growth. New technologies to reduce costs and new products to provide pleasures, comforts, and symbols of status are generators of growth. Without novelty, economic growth and employment would stagnate. If new products failed to come on the scene to stimulate growth in consumption, then, as new technologies reduced costs and labor requirements for old products, fewer workers would be needed and employment would decline. Novelty in the product market is needed to bolster aggregate product demand.

Historical examples of new technologies and products driving economic expansion abound. The development of railroads in the nineteenth century opened up the prairie states for settlement and the creation of a commercial agriculture. The invention of a variety of electrical devices, including the light bulb, the dynamo, and the electric motor, resulted not only in the creation of a host of new consumer goods—electric lighting, vacuum cleaners, refrigerators, automatic washers, radios, TVs—but also led to a second industrial revolution with electricity replacing steam power. Without the

highly flexible electric motor, the assembly line would have been impossible, and the mass production of low cost consumer goods would have been much delayed. It goes without saying that the automobile changed our economic and social life like no other consumer good. The existence of interstate highways in a country like the United States, together with suburbs, shopping malls, and acres of parking lots are attributable directly to the adoption of the automobile as a major mode of transportation. In the first quarter of the past century and again after World War II, the automobile was probably the North American economy's primary engine of growth. In our lifetime the personal computer and the Internet will change the economic landscapes in ways we cannot yet imagine. Without all this novelty and newness, it might have been possible to turn away from economic endeavors as the central path to pleasure and status. The point is simple. Novelty and new forms of economic activity are essential for expanding aggregate demand.

The fundamental problem for the environment is that businesses find it highly profitable to supply consumers with new comforts and pleasures and new means to exhibit economic status. The provision of novelty is a profitable undertaking. The constant supply of new consumer goods results in the creation of new industries, and new industries, of course, feed economic growth. New industries, however, do something else; they bring with them new kinds of environmental problems. The settlement of the Midwest with the help of the railroad in the nineteenth century resulted in the virtual disappearance of the tall-grass prairie and its wonderful sea of grasses and flowers. Industrialization in general increased the use of coal and created new air pollution problems. Urban concentrations needed to supply labor to factories resulted in a host of water pollution problems. The invention of the auto resulted in the switch to petroleum as our major energy source and created new kinds of air pollution problems, including global warming. Global warming occurs because whenever we burn a gallon of gas or fuel oil, carbon dioxide is emitted and added to the earth's atmosphere. Carbon works like a greenhouse, trapping heat and warming up the earth's climate with potentially devastating consequences. Suburban development fostered by the automobile paved over natural habitats and created runoff water pollution problems damaging aquatic life and water quality in our local streams and rivers. The increased use of fertilizers and pesticides since World War II has further augmented the runoff pollution problem. These same pesticides and other powerful new organic chemicals such as PCBs are playing havoc with reproductive systems in wildlife and maybe even human populations. These are but a few of the environmental problems resulting from the creation of new technologies and consumer goods. They represent the underside of satisfying our comforts, pleasures, and desires for status. In sum, economic growth brings with it new environmental problems.

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Biographical Sketch

Douglas E. Booth holds a Ph. D. in economics from the University of Washington and is an associate professor of economics in the College of Business at Marquette University in Milwaukee, WI, and has been on the faculty for 25 years. Booth teaches introductory economics, environmental and natural resource economics, and an interdisciplinary course on the environment and the city. He also administers the Urban and Environmental Affairs Program which includes undergraduate interdisciplinary minors and majors.

In recent years Professor Booth's research has focused on the link between economics, ethics, and ecology. The subject of much of this research has been on the role that ethical and economic values have played in policy making on the question of old-growth forest protection. This research has been brought together in a book, *Valuing Nature: the Decline and Preservation of Old-Growth Forests* (1994), as well as in a number of published articles. The central conclusion of this research is that ethical values in addition to economic values play a role in public evaluations of the natural environment and that ethical values should be a part of the public policy decision process.

A more recent work, *The Environmental Consequences of Growth: Steady-State Economics as an Alternative to Ecological Decline* (1998), develops a theory of the relationship between economic growth and environmental decline, provides historical evidence to back up the theory, and offers a steady-state approach as an alternative to environmental decline. Again, this work focuses on the role of ethical values in public policy decision making. Professor Booth's most recent work, *Searching for Paradise: Economic Growth and Environmental Change in the Mountain West*, addresses the ecological causes and environmental consequences of new kinds of economic development occurring in the U.S. rural mountain West. Prior to focusing on environmental questions, Professor Booth did extensive research on urban issues and administers an interdisciplinary course called the Environment and the City that emphasizes environmental problems that affect urban areas. This course blends the economics, science, and ethics of urban environmental issues.