Eco-Economy

Building an economy for the earth

by Lester Brown

In 1543, Polish astronomer Nicolaus Copernicus published "On the Revolutions of the Celestial Spheres," in which he challenged the view that the Sun revolved around the earth, arguing instead that the earth revolved around the Sun. With his new model of the solar system, he began a wide-ranging debate among scientists, theologians, and others. His alternative to the earlier Ptolemaic model, which had the earth at the center of the universe, led to a revolution in thinking, to a new worldview.[1]

Today we need a similar shift in our worldview, in how we think about the relationship between the earth and the economy. The issue now is not which celestial sphere revolves around the other but whether the environment is part of the economy or the economy is part of the environment.

***Lester Brown** is founder of the Earth Policy Institute. This essay is excerpted from his book,* Eco-Economy: Building An Economy for the Earth (*W. W. Norton), which defines problems and offers solutions in the form of suggested policy changes. In addition to being available at bookstores, the book can be downloaded from www.earth-policy.org/.*

The differences between ecology and economics are fundamental. For example, ecologists worry about limits, while economists tend not to recognize any such constraints. Ecologists, taking their cue from nature, think in terms of cycles, while economists are more likely to think linearly, or curvilinearly. Economists look at the unprecedented growth of the global economy and of international trade and investment and see a promising future with more of the same. Ecologists look at this same growth and realize that it is the product of burning vast quantities of artificially cheap fossil fuels, a process that is destabilizing the climate. While economists see booming economic indicators, ecologists see an economy that is altering the climate with consequences that no one can foresee.[2]

Ecologists view the market with less reverence because they see a market that is not telling the truth. They know that a stable relationship between the economy and the earth's ecosystem is essential if economic progress is to be sustained.

Although the idea that economics must be integrated into ecology may seem radical to many, evidence is mounting that it is the only approach that reflects reality. When observations no longer support theory, it is time to change the theory — what science historian Thomas Kuhn calls a paradigm shift. If the economy is a sub-set of the earth's ecosystem, as I contend, the only formulation of economic policy that will succeed is one that respects the principles of ecology.[4]

Economy Self-destructing

Although many of us live in a high-tech urbanized society, we are as dependent on the earth's natural systems as our hunter-gatherer forebears were. To put ecosystems in economic terms, a natural system, such as a fishery, functions like an endowment. The interest income from an endowment will continue in perpetuity as long as the endowment is maintained. If the endowment is drawn down, income declines. If the endowment is eventually depleted, the interest income disappears. And so it is with natural systems. If the sustainable yield of a fishery is exceeded, fish stocks begin to shrink. Eventually stocks are depleted and the fishery collapses. The cash flow from this endowment disappears as well.

As we begin the twenty-first century, our economy is slowly destroying its support systems, consuming its endowment of natural

capital. Demands of the expanding economy, as now structured, are surpassing the sustainable yield of ecosystems. Easily a third of the world's cropland is losing topsoil at a rate that is undermining its long-term productivity. Fully fifty percent of the world's rangeland is overgrazed and deteriorating into desert. The world's forests have shrunk by about half since the dawn of agriculture and are still shrinking. Two thirds of oceanic fisheries are now being fished at or beyond their capacity; overfishing is now the rule, not the exception. And overpumping of underground water is common in key food-producing regions.[7]

"These trends are converging to form some of the largest dust storms ever recorded."

The rangelands that supply much of the world's animal protein are also under excessive pressure. As human populations grow, so do livestock numbers. With 180 million people worldwide now trying to make a living raising 3.3 billion cattle, sheep, and goats, grasslands are simply collapsing under the demand. As a result of overstocking, grasslands are now deteriorating in much of Africa, the Middle East, Central Asia, the northern part of the Indian sub-continent, and much of northwestern China.

In China, the combination of overplowing and overgrazing to satisfy rapidly expanding food needs is creating a dust bowl reminiscent of the U.S. Dust Bowl of the 1930s — but much larger. In a desperate effort to maintain grain self-sufficiency, China has plowed large areas of the northwest, much of it land that is highly erodible and should never have been plowed.[11]

As the country's demand for livestock products — meat, leather, and wool — has climbed, so have the numbers of livestock, far exceeding those of the United States, a country with comparable grazing capacity. In addition to the direct damage from overplowing and overgrazing, the northern half of China is literally drying out as aquifers are depleted by overpumping.[12]

These trends are converging to form some of the largest dust storms ever recorded. The huge dust plumes, traveling eastward, affect the cities of northeast China — blotting out the sun and reducing visibility. Eastward-moving winds also carry soil from China's northwest to the Korean Peninsula and Japan, where people regularly complain about the dust clouds that filter out the sunlight and blanket everything with dust. Unless China can reverse the overplowing and overgrazing trends that are creating the dust bowl, these trends could spur massive migration into the already crowded cities of the northeast and undermine the country's economic future.[13]

Water tables are falling under large expanses of the three leading food-producing countries — China, India, and the United States. Under the North China Plain, which accounts for twenty-five percent of China's grain harvest, the water table is falling by roughly 1.5 meters (5 feet) per year. China's Yellow River, the cradle of Chinese civilization, runs dry for part of each year, depriving farmers in its lower reaches of irrigation water.

Economic demands on forests are also excessive. Record flooding in the Yangtze River basin during the summer of 1998 drove 120 million people from their homes. Although initially referred to as a "natural disaster," the removal of eighty-five percent of the original tree cover in the basin had left little vegetative cover to hold the heavy rainfall.[18]

Deforestation also diminishes the recycling of water inland, thus reducing rainfall in the interior of continents. When rain falls on a healthy stand of dense forest, roughly one fourth runs off, returning to the sea, while three fourths evaporates, either directly or through transpiration. When land is cleared for farming or grazing or is clearcut by loggers, this ratio is reversed — three fourths of the water returns to the sea and one fourth evaporates to be carried further inland. As deforestation progresses, nature's mechanism for watering the interior of large continents such as Africa and Asia is weakening.[19]

Learning from China

The flow of startling information from China helps us understand why our economy cannot take us where we want to go. Not only is China the world's most populous

country, with nearly 1.3 billion people, but since 1980 it has been the world's fastest-growing economy — expanding more than fourfold. In effect, China is telescoping history, demonstrating what happens when large numbers of poor people rapidly become more affluent.[43]

As incomes have climbed in China, so has consumption. The Chinese have already caught up with Americans in pork consumption per person, and they are now concentrating their energies on increasing beef production. Raising per capita beef consumption in China to that of the average American would take 49 million additional tons of beef. If all this were to come from putting cattle in feedlots, American-style, it would require 343 million tons of grain a year, an amount equal to the entire U.S. grain harvest.[44]

In Japan, as population pressures on the land mounted during a comparable stage of its economic development, the Japanese turned to the sea for their animal protein. Last year, Japan consumed nearly ten million tons of seafood. If China, with ten times as many people as Japan, were to try to move down this same path, it would need 100 million tons of seafood — the entire world fish catch.[45]

In 1994, the Chinese government decided that the country would develop an automobile-centered transpor-ation system and that the automobile industry would be one of the engines of future economic growth. Beijing invited major automobile manufacturers, such as Volkswagen, General Motors, and Toyota, to invest in China. But if Beijing's goal of an auto-centered transportation system were to materialize and the Chinese were to have one or two cars in every garage and were to consume oil at the U.S. rate, China would need over 80 million barrels of oil a day — slightly more than the 74 million barrels per day the world now produces. To provide the required roads and parking lots, it would also need to pave some 16 million hectares of land, an area equal to half the size of the 31 million hectares of land currently used to produce the country's 132-million-ton annual harvest of rice, its leading food staple.[46]

Similarly, consider paper. As China modernizes, its paper consumption is rising. If annual paper use in China of 35 kilograms per person were to climb to the U.S. level of 342 kilograms, China would need more paper than the world currently produces. There go the world's forests.[47]

We are learning that the western industrial development model is not viable for China, simply because there are not enough resources for it to work. Global land and water resources are not sufficient to satisfy the growing grain needs in China if it continues along the current economic development path. Nor will the existing fossil-fuel-based energy economy supply the needed energy, simply because world oil production is not projected to rise much above current levels in the years ahead. Apart from the availability of oil, if carbon emissions per person in China ever reach the U.S. level, this alone would roughly double global emissions, accelerating the rise in the atmospheric CO_2 level.[48]

China faces a formidable challenge in fashioning a development strategy simply because of the density of its population. Although it has almost exactly the same amount of land as the United States, most of China's 1.3 billion people live in a 1,500-kilometer strip on the eastern and southern coasts. Reaching the equivalent population density in the United States would require squeezing the entire US population into the area east of the Mississippi and then multiplying it by four.[49]

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Interestingly, the adoption of the western economic model for China is being challenged from within. A group of prominent scientists, including many in the Chinese Academy of Sciences, wrote a white paper questioning the government's decision to develop an automobile-centered transportation system. They pointed out that China does not have enough land both to feed its people and to provide the

roads, highways, and parking lots needed to accommodate the automobile. They also noted the heavy dependence on imported oil that would be required and the potential air pollution and traffic congestion that would result if they followed the U.S. path.[50]

If the fossil-fuel-based, automobile-centered, throwaway economy will not work for China, then it will not work for India with its 1 billion people, or for the other 2 billion people in the developing world. In a world with a shared ecosystem and an increasingly integrated global economy, it will ultimately not work for the industrial economies either.

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China is showing that the world cannot remain for long on the current economic path. It is underlining the urgency of restructuring the global economy, of building a new economy — an economy designed for the earth.

The Acceleration of History

Rapidly advancing technology is accelerating history, making it difficult for social institutions to manage it effectively. This is also true for unprecedented world population growth, even faster economic growth, and the increasingly frequent collisions between the expanding economy and the limits of the earth's natural systems. The current rate of change has no precedent. Until recently, population growth was so slow that it aroused little concern. But since 1950 we have added more people to world population than during the preceding 4 million years since our early ancestors first stood upright. Economic expansion in earlier times was similarly slow. To illustrate, growth in the world economy during the year 2000 exceeded that during the entire nineteenth century.[52]

Throughout most of human history, the growth of population, the rise in income, and the development of new technologies were so slow as to be imperceptible during an individual life span. For example, the climb in grainland productivity from 1.1 tonnes per hectare in 1950 to 2.8 tonnes per hectare in 2000 exceeds that during the 11,000 years from the beginning of agriculture until 1950.[53]

The world economy is growing even faster. The sevenfold growth in global output of goods and services since 1950 dwarfs anything in history. In the earlier stages of the Industrial Revolution, economic expansion rarely exceeded 1 or 2 percent a year. Developing countries that are industrializing now are doing so much faster than their predecessors simply because they do not have to invent the technologies needed by a modern industrial society, such as power plants, automobiles, and refrigerators. As a result, the countries that were successfully industrializing in the late twentieth century did so at a record rate. Economic growth in the developing countries of East Asia, for instance, has averaged almost 7 percent annually since 1990—far higher than growth rates in industrial countries at any time in their history.[55]

The pace of history is also accelerating as soaring human demands collide with the earth's natural limits. National political leaders are spending more time dealing with the consequences of the collisions described earlier — collapsing fisheries, falling water tables, food shortages, and increasingly destructive storms — along with a steadily swelling international flow of environmental refugees and the many other effects of overshooting natural limits. As change has accelerated, the situation has evolved from one where individuals and societies change only rarely to one where they change continuously. They are changing not only in response to growth itself, but also to the consequences of growth.

The central question is whether the accelerating change that is an integral part of the modern landscape is beginning to exceed the capacity of our social institutions to cope with change. Change is particularly difficult for institutions dealing with international or global issues that require a concerted, cooperative effort by many countries with contrasting cultures if they are to succeed. For example, sustaining the existing oceanic fish

catch may be possible only if numerous agreements are reached among countries on the limits to fishing in individual oceanic fisheries. And can governments, working together at the global level, move fast enough to stabilize climate before it disrupts economic progress?

The issue is not whether we know what needs to be done or whether we have the technologies to do it. The issue is whether our social institutions are capable of bringing about the change in the time available. As H. G. Wells wrote in *The Outline of History*, "Human history becomes more and more a race between education and catastrophe."[57]

The Option: Restructure or Decline

Whether we study the environmental undermining of earlier civilizations or look at how adoption of the western industrial model by China would affect the earth's ecosystem, it is evident that the existing industrial economic model cannot sustain economic progress. We spend a lot of time worrying about our economic deficits, but it is the ecological deficits that threaten our long-term economic future. Economic deficits are what we borrow from each other; ecological deficits are what we take from future generations.[58] Herman Daly, the intellectual pioneer of the fast-growing field of ecological economics, notes that the world "has passed from an era in which manmade capital represented the limiting factor in economic development (an 'empty' world) to an era in which increasingly scarce natural capital has taken its place (a 'full' world)."

When our numbers were small relative to the size of the planet, it was humanmade capital that was scarce. Natural capital was abundant. Now that has changed. As the human enterprise continues to expand, the products and services provided by the earth's ecosystem are increasingly scarce, and natural capital is fast becoming the limiting factor while humanmade capital is increasingly abundant.[59]

Transforming our environmentally destructive economy into one that can sustain progress depends on a Copernican shift in our economic mindset. A redesigned economy can be integrated into the ecosystem in a way that will stabilize the relationship between the two, enabling economic progress to continue. Unfortunately, present-day economics does not provide the conceptual framework needed to build such an economy. It will have to be designed with an understanding of basic ecological concepts such as sustainable yield, carrying capacity, nutrient cycles, the hydrological cycle, and the climate system. Designers must also know that natural systems provide not only goods, but also services — services that are often more valuable than the goods.

We know the kind of restructuring that is needed. In simplest terms, our fossil-fuel-based, automobile-centered, throwaway economy is not a viable model for the world. The alternative is a solar/hydrogen energy economy, an urban transport system that is centered on advanced-design public rail systems and that relies more on the bicycle and less on the automobile, and a comprehensive reuse/recycle economy. And we need to stabilize population as soon as possible.

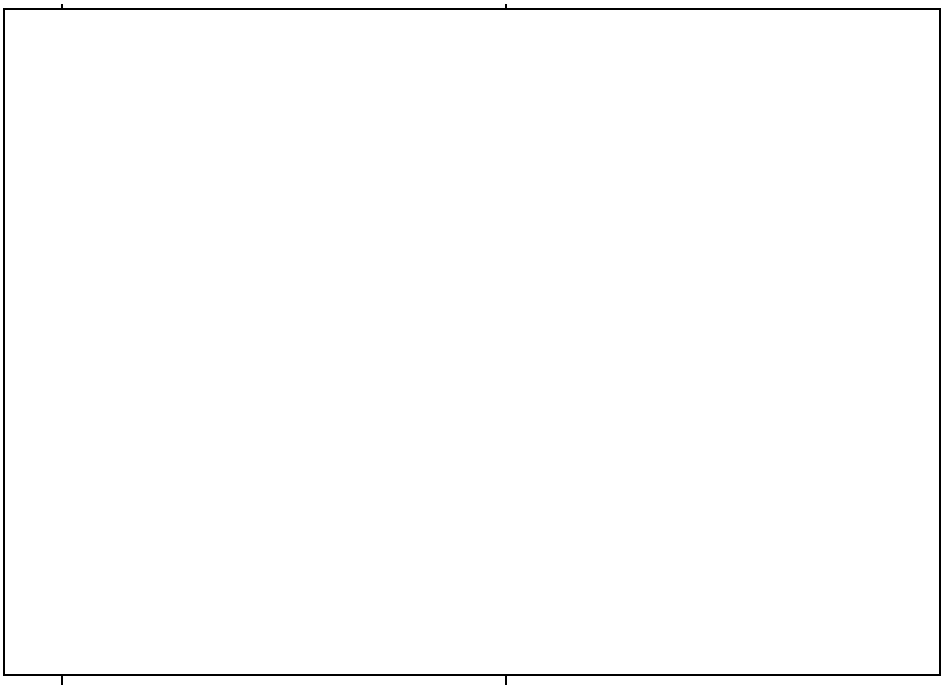
How do we achieve this economic transformation when all economic decision makers — whether political leaders, corporate planners, investment bankers, or individual consumers — are guided by market signals, not the principles of ecological sustainability? How do we integrate ecological awareness into economic decision making? Is it possible for all of us who are making economic decisions to "think like ecologists," to understand the ecological consequences of our

decisions? The answer is probably not. It simply may not be possible.

But there may be another approach, a simpler way of achieving our goal. Everyone making economic decisions relies on market signals for guidance. The problem is that the market often fails to tell the ecological truth. It regularly underprices products and services by failing to incorporate the environ-mental costs of providing them.

Compare, for example, the cost of wind-generated electricity with that from a coal-fired power plant. The cost of the wind-generated electricity reflects the costs of manufacturing the turbine, installing it, maintaining it, and delivering the electricity to consumers.

The cost of the coal-fired electricity includes building the power plant, mining the coal, transporting it to the power plant, and distributing the electricity to consumers. What it does not include is the cost of climate disruption caused by carbon emissions from coal burning — whether it be more destructive storms, melting ice caps, rising sea level, or record heat waves. Nor does it include the damage to freshwater lakes and forests from acid rain, or the health care costs of treating respiratory illnesses caused by air pollution. Thus the market price of coal-fired electricity greatly understates its cost to society.



One way to remedy this situation would be to have environmental scientists and economists work together to calculate the cost of climate disruption, acid rain, and air pollution. This figure could then be incorporated as a tax on coal-fired electricity that, when added to the current price, would give the full cost of coal use. This procedure, followed across the board, would mean that all economic decision makers — governments and individual consumers — would have the information needed to make more intelligent, ecologically responsible decisions.

We can build an eco-economy with existing technologies. It is economically feasible if we can get the market to tell us the full cost of the products and services that we buy.

The question is not how much will it cost to make this transformation but how much it will cost if we fail to do it. ystein Dahle, retired Vice President of Esso for Norway and the North Sea, observes, "Socialism collapsed because it did not allow prices to tell the economic truth. Capitalism may collapse because it does not allow prices to tell the ecological truth."[60]

Building an eco-economy is exciting and satisfying. It means we can live in a world where energy comes from wind turbines instead of coal mines, where recycling industries replace mining industries, and where cities are designed for people, not for cars. And perhaps most important of all, we will have the satisfaction of building an economy that will support, not undermine, future generations. •

Eco-Economy. "Earth Policy Institute.". Includes bibliographical references (p. [277]-322) and index. 1. The economy and the Earth -- 2. Signs of stress : climate and water -- 3. Signs of stress : the biological base -- 4. The shape of the eco-economy -- 5. Building the solar/hydrogen economy -- 6. Designing a new materials economy -- 7. Feeding everyone well -- 8. Protecting forest products and services. -- 9. Redesigning cities for people -- 10. Stabilizing population by reducing fertility -- 11. Tools for restructuring the economy -- 12. The exchange of resources in ECO is based on an entirely player-created economy which players can use to sell goods and services. Unlike most games which only allow players to sell items, Eco allows players to sell contracts for labor, which the game will enforce. Need someone to build you a house? Take out a contract and they will complete the job, with payment being held in escrow until completion. ECO-ECONOMICS. 2. Stress development over growth. That is, make the economy better at satisfying human needs, not simply bigger. This is partly about eco-efficiency. It's now cost-effective to boost resource efficiency by at least a factor of fourâ€”and possibly by a factor of 20.Â ECO-ECONOMICS. 5. The precautionary principle. This is just the age-old wisdom of "first, do no harm" and "look before you leap," but applied to public policy toward new products (like chemicals) and technologies that could pose serious risk.