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Eco-logy versus Eco-nomics

John Cairns, Jr.
Department of Biological Sciences,
Virginia Polytechnic Institute and State University,
Blacksburg, Virginia 24061, USA

Abstract : The spelling of the words "eco-logy" and "eco-nomics" in the title is intended to emphasize that both words originated from the Greek word *oikos*, which means household, house, or family. Despite their common origin, never have two disciplines diverged so dramatically. Economic growth, aided by economic globalization, has markedly diminished natural capital, from which all other forms of capital are derived. Economic growth (without protecting the biospheric life support system) seems to be the primary goal of human society. In reality, the human economy is a subset of the biospheric life support system, which regenerates the resources that are the raw materials of the economic system. Yet political leaders continually state that the biospheric life support system cannot be protected if the possibility of doing so would adversely affect economic growth. However, growth of material goods and population cannot continue indefinitely without severe consequences. At present, many ecologists delay discussing biotic impoverishments with economists, fearing that such candor will "turn them off." The contextual framework of economists and ecologists is far from congruent, although the survival of human society, and even of the human species, depends on it.

Key words : Economic growth, Biotic impoverishment, Natural capital, Life support system, Carrying capacity, Limits to growth.

With laissez-fair and price atomic,
Ecology's Uneconomic
But with another kind of logic
Economy's Unecologic.

Economist Kenneth E. Boulding

No piecemeal solution is going to prevent the collapse of whole societies and ecosystems . . . a radical rethinking of our values, priorities and political systems is urgent.

Maude Barlow

The major problems in the world are the result of the difference between how nature works and the way people think. **Gregory Bateson**

The problem of climate change is so large that it can't be solved by voluntary individual responses. It requires an economy-wide solution, i.e., one that limits the total carbon intake of the economy.

Peter Barnes

We have always known that heedless self-interest was bad morals; we now know it is bad economics.

Former US President Franklin D. Roosevelt

Divergent Disciplines

Both ecologists and economists accept new information best if it is in the contextual framework of their disciplines. The flow of information in the ecological context has been markedly different from the information in the economic context. As a consequence, neither discipline can absorb "alien" information because no context exists with which to relate it. Most biological systems, including the all-important biospheric life support system, are non-linear. Thomas Malthus realized many

years ago that human population growth was exponential, but growth of the food supply was linear (technology enabled temporary exponential increases in food production). However, present evidence indicates that Malthus is correct. This contextual difference is, in part, responsible for the divergence of ecologists and economists. The 2008 global "financial meltdown" led politicians and the public to turn to economists to solve the problem, even though considerable uncertainty exists about what to do. In short, economists are still "center stage"; consequently, they gain no obvious recognition if they associate with ecologists. In addition, despite persuasive evidence that free markets are not self-regulating, economists still have far more influence with both political leaders and the general public. Brian Czech (personal communication) summarizes the focus of many economists:

> *It might interest all concerned that economic growth is not a subject that even the economists as a whole have much expertise in. A large majority of economists do microeconomics. In academia, those who could be classified as economic growth theorists would surely comprise less than one percent of economists. None of the prominent growth theories are ecologically attentive either. It's true that there is a higher proportion of economists practicing macro in the public sector, but their focus is on money supplies, interest rates, employment trends, social security and such. There is a total or near-total absence of environmental macroeconomics practiced by these economists.*

Ecologists, on the other hand, have failed to persuade humankind that the economic system is totally dependent on the biospheric life support system, as well as natural capital and the ecosystem services it provides. Carrying capacity, overpopulation (e.g., Ehrlich and Holdren, 1971), biotic impoverishment, natural capital, ecosystem services, and ubiquitous persistent toxic substances have not received the political attention they deserve, even though much has been written about them. Much less has been written about ecological overshoot, even though it is as deadly as the other threats to human existence. Despite the fact that these threats are serious for human civilization, and probably even the survival of the species, they are, collectively, not receiving the attention received by economics in general and economic growth in particular.

The developing transdisciplinary field of ecological economics (e.g., Daly, 2008) provides a unifying context for these two, now disparate disciplines. If the field of ecological economics develops rapidly, it may be widely recognized for providing a badly needed focus for these two areas. If the world is humankind's "household" (*oikos*), then the disparate disciplines of ecology and economics must be capable of mutualistic interactions or human society will not survive in its present form (i.e., primarily urban). However, sustainable use of the planet, and possibly even the survival of *Homo sapiens*, requires a consilience of probably all academic disciplines.

The understanding of global ecosystem services is still rudimentary and must be expanded rapidly due to the multiple worldwide crises already afflicting humankind. "The people who are affected and those who provide resources are increasingly asking for evidence that interventions improve ecosystem services and human well-being. New research is needed that considers the full ensemble of processes and feedbacks, for a range of biophysical and social systems, to better understand and manage the dynamics of the relationship between humans and the

ecosystems on which they rely" (Carpenter *et al*., 2009).

Consilience Anyone?

Wilson (1999) reports on the consilience (literally "leaping together") of a wide variety of disciplines, and more transdisciplinary activities have occurred since his volume on this concept was published. The major question is: Will the consilience occur in the professions in time to avoid catastrophic climate change? Equally important is whether the general public understands and implements the necessary changes.

Sanger (2009) calls attention to Thomas Jefferson's statement that, for the American democracy to work, an informed citizenry is essential. However, neither the American citizenry nor its political representatives has been receptive to the findings of science during the first eight years of the 21st century. For example, during the last US presidential elections, a sizable number of candidates went on record stating that they did not believe in evolution – a well accepted scientific theory. In the US Congress, Senator Inhofe described global warming science as a hoax. Legislation limiting anthropogenic greenhouse emissions has not been successful despite a preponderance of scientific evidence that humans are a very significant part of the problem.

President Obama, the US Congress, and the American public have identified the troubled economy as the number one problem. Other problems also exist: a huge national debt, huge personal debt, two wars, unusually high foreclosures on houses, and over 8.1% unemployment (when US President Franklin D. Roosevelt took office in the 1930s, unemployment was 25%) (Cohen, 2009). President Roosevelt supported an economic stimulus package during his years in office that included environmental components, such as planting trees, which is literally a "shovel ready" activity that simultaneously increases employment and helps the environment. Some members of the US Congress feel that President Obama's financial stimulus package will cost too much and that, over time, the economy will cure itself (Cohen, 2009). Ecologists and economists must collaborate on all global problems with both short- and long-term perspectives. How can these efforts be initiated?

The oceans are the world's largest commons (especially if the atmosphere above them is included). Most nations have at least a shoreline on a marine ecosystem, and all have a stake in restoring the health and integrity of the oceans. *Troubled Waters: A Special Report on the Sea* (Grimond, 2009) suggests a superb opportunity for ecologists and economists to collaborate on CO_2 increases: "Even more alarmingly, the processes now set in train cannot easily be stopped, let alone reversed. Though CO_2 in the surface layer is readily exchanged with the atmosphere, the mixing of that water with deeper layers takes several hundred years, meaning the acidification at the top is there for the duration. It is, said Britain's Royal Society in 2005, 'essentially irreversible' during the lifetime of anyone alive" (Grimond, 2009). In addition, a new study "projects that if carbon dioxide concentrations peak at 600 ppm, several regions of the world – including southwestern North America, the Mediterranean and southern Africa – will face major droughts as bad or worse than the [US] Dust Bowl of the 1930s . . . Even if the world managed to halt the carbon dioxide buildup at 450 ppm, . . . the subtropics would experience a 10 percent decline in precipitation, compared with the 15% decrease that would occur at 600 ppm" (Eilperin, 2009).

The economic downturn of 2008 and 2009 has resulted in significantly increased US

unemployment/job losses, home foreclosures, and loss of retirement savings. Naturally, US citizens place economic recovery at the top of their priority list. However, environmental catastrophes have already occurred and will worsen dramatically if humankind continues "business as usual." US President Obama is well aware of the threats of climate change as evidenced from his recent decision to support California's mandates for a cut in automobile CO_2 emissions (Romm, 2009). "The President has no doubts about the 'irreversible catastrophe' we face on our current emissions path – violent conflict, terrible storms, shrinking coastlines – . . ." (Romm, 2009). However, a "pioneering study . . . shows how changes in surface temperatures, rainfall, and sea level are largely irreversible for more than 1,000 years after carbon dioxide (CO_2) emissions are completely stopped" (NOAA, 2009; Associated Press, 2009a). Largely irreversible for more than 1,000 years if anthropogenic carbon dioxide emissions are completely stopped – what a challenge for ecologists and economists! In his latest book, Lovelock (2009) gives a final warning that little, if any, time remains to preserve Gaia – the planetary life support system. Very possibly, this estimate is optimistic since no precedents exist for anthropogenic greenhouse gas emission comparable to present emissions.

Opportunity Cost Analysis

Economists and ecologists have another huge opportunity to focus on a unifying theme – a recent study reveals that the costs associated with the US government's generous support for ethanol is not justified on either economic or ecological grounds (Philpott, 2009). Ethanol received 76% of funding ($3 billion); solar, wind, geothermal 19% ($750 million); and biodiesel 5% ($180 million) (Philpott, 2009). "In short, the dubious practice of turning corn and soy into liquid car fuel is crowding out other more energy-rich and sustainable energy sources" (Philpott, 2009). "About 6.7% of the gasoline used in the U.S. will be displaced by ethanol in 2009, when corrected for the lower energy content of ethanol and assuming an annual gasoline consumption of 140 billion gallons. Assuming a net energy gain in the conversion of corn to ethanol of 1.25, there is a net energy displacement of approximately 2.8 billion galloons of gasoline, about a 2% net energy gain. If the energy in nonfuel byproducts (e.g. distillers grains, which are used for cattle feed) is removed from the equation, the net energy gain is close to nil. In other words, ethanol from corn will do nothing to boost net energy supplies" (Keeney, 2009).

These data could have been used for opportunity cost analysis before ethanol for fuel plants were constructed, before Congress passed a 57 cents/gallon subsidy for ethanol, and before corn prices rose and affected food prices in many countries. Snyder (2009) notes: "The corn ethanol industry sucks up $2 out of every $3 the government spends to support renewable energy, according to a new report from the Environmental Working Group (EWG) based on data from the Energy Information Administration." Surely even a preliminary opportunity cost analysis would have prevented this gross mismanagement of tax dollars.

What could ecologists contribute to this analysis? For example, "the ethanol mandates have led to more corn production, which has further polluted streams and rivers with fertilizer runoff" (Snyder, 2009). In addition, evidence indicates that biofuels are not as "environmentally friendly" as they were once thought to be. Also, any form of energy that produces carbon dioxide influences climate change, which affects all species, including humans. Both the public and politicians do not fully support wind and solar power as a replacement for fossil fuels, despite an

increasing evidence base supporting this position. Until recently, both politicians and the general public supported biofuels as an energy source, but recent information demonstrates that this choice is not a sound one (e.g., Sawahel, 2009).

Saving Humankind from Climate Change

In response to the question: "Do we have time to do a similar thing (ban chlorofluorocarbons) with carbon emissions to save ourselves from climate change?", James Lovelock stated: "not a hope" (Vince, 2009). In response to the question: "What about work to sequester carbon dioxide?", James Lovelock stated: "That is a waste of time. It's a crazy idea – and dangerous. It would take so long and use so much energy it will not be done" (Vince, 2009). Lovelock does have an unproven plan for turning agricultural waste into non-biodegradable charcoal and burying it; however, "I don't think humans react fast enough or are clever enough to handle what's coming up" (Vince, 2009). Lehmann (2009) reports that the "United States is failing to prepare for the impending effects of climate change, leaving the nation vulnerable to disease, storms, and other rising risks, according to . . . the report titled "The Climate Crisis and the Adaptation Myth'" (Repetto, 2008). The report notes that adaptation studies should have begun years ago and were not, but "also cites a more devious reason [for inaction]: an effort by climate skeptics in industry and government who have been 'deliberately sowing confusion' about the effects of rising temperatures" (Repetto, 2008). The temperature increase will probably, not just possibly, be at least 2°C, and the probability is rising, due to increased anthropogenic greenhouse gas emissions and increased effects of positive feedback loops, that it will reach the dreaded 3°C.

"The United States needs a policy vision for addressing energy security while beating back climate change . . . (Marshall, 2009). All policies on climate change, overpopulation, biotic impoverishment, and ecological overshoot must be global or they will fail. However, a national policy is a good way to begin.

"Hail Mary" Technological Solutions to Climate Change

For those unfamiliar with American football (not soccer), a "Hail Mary" pass is a forward pass made in desperation, with only a small chance of success. The collective international failure to curb the growing anthropogenic emissions of carbon dioxide has meant that an alternative to merely curbing emissions may become necessary (Connor, 2009). Stated more bluntly, humankind may be engaged in the use of untested, on a global scale, technology that might well have appalling, unintended consequences. "The plan would involve highly controversial proposals to lower global temperatures artificially through daringly ambitious schemes that either reduce sunlight levels by man-made means or take CO_z out of the air. This 'geoengineering' approach – including schemes such as fertilising the oceans with iron to stimulate algal blooms – would have been dismissed as a distraction a few years ago but is now being seen by the majority of scientists we surveyed as a viable emergency backup plan that could save the planet from the worst effects of climate change, at least until deep cuts are made in CO_2 emissions" (Connor, 2009). Having the approval of 54% of 80 international specialists in climate science (Connor, 2009) for the geoengineering approach is simply neither adequate nor persuasive since no precedents or validated predictive models exist for these vast global experiments. For such undertakings, several dynamics would have to be in place before even giving a preliminary endorsement to "Hail Mary" technologies: a nearly 100% endorsement by the thousands of scientists who served on the

Intergovernmental Panel on Climate Change (IPCC), their estimate of the risk for "business as usual," each of the "Plan B" schemes, and their analysis of each situation. In addition, these "Hail Mary" technologies are untested and neither persuasive evidence that they will work as expected nor robust evidence of deleterious side effects exists. At the very least, humankind should realize the consequences of passing at least one more global climate tipping point, which is the critical point in an evolving situation that leads to a new and irreversible development (IT Knowledge Exchange). Gladwell (2000) describes a variety of tipping points, and Pearce (2008) describes the sudden violent consequences of passing a tipping point. These two volumes provide an overview for skeptics and/or deniers who state that climate change and other tipping points do not exist.

For example, humankind should be aware of its choices – a new report shows that investing in energy efficiency instead of building a coal-fired plant in Wise County (Virginia, USA) to meet the same electricity demand would yield hundreds of millions of dollars more annually for the state and create at least 2,600 more jobs than the controversial 585-megawatt-coal-fired power plant (Chesapeake Climate Action Network, 2009). Brown (2009) notes: "Projections from the International Energy Agency show global energy demand growing by close to 30 percent by 2020, setting the stage for massive growth in carbon dioxide emissions that are warming our planet. But dramatically ramping up energy efficiency would allow the world to not only avoid growth in energy demand but actually reduce global demand to below 2006 levels by 2020" – much more appealing and far less hazardous than the untested "Hail Mary" technologies. Humankind has only one planet to study, so "Hail Mary" solutions to climate change must be approached with extreme caution. A deleterious change in climate could create a major food crisis by 2100 (Agence France Presse, 2009).

Is Australia the Canary in the Climate Mine?

A common statement about global crises is: "I'm looking out for #1 – I don't have time for other people's problems." This statement demonstrates a dangerous lack of compassion and concern for others. Each person must have a strong sense of belonging to a global community or attempts to solve global problems (e.g., climate change, overpopulation, ecological overshoot, scarcity of food) will fail. A good test case concerning a sense of global community is Australia's recent climate problems – severe heat waves (Wilson and Stapleton, 2009), floods and torrential rains (Associated Press, 2009b), and massive fires in southern Australia that are visible from space (Sullivan, 2009). Australia's climate is definitely changing and not to conditions favorable to humans and much of Australia's wildlife. Many people are unaware of these tragic events and, even if they were, they do not seem to realize that such changes could occur elsewhere in the world. The United States has contributed greenhouse gases and is, therefore, partly responsible. However, the biggest problem is lack of empathy and compassion.

Conclusions

A continual collaboration is mandatory between economists and ecologists to protect the global household. The source of all capital for the human economy is natural systems. If the biospheric life support system is driven into disequilibrium by human activities and numbers, it will probably reach a new, different equilibrium in evolutionary time. The chief cause for concern is that global climate catastrophes have already occurred. Moreover, when the climate does change catastrophically, it may reach a new equilibrium

and never return to pre-catastrophic conditions. In fact, a tipping point is, by definition, an "end time."

One common thought is that the United States cannot simultaneously correct the economic decline and reduce greenhouse gas emissions. Meyer (2009) states: "But it's a silly question [i.e., which should come first] and a false, unnecessary choice. It hides the most rational course of action: doing both simultaneously." Along this line, "US President Obama wants the world's two biggest polluters to form a partnership in the battle against global warming" (Lean, 2009). Lovelock (2007, I Preface) remarks: "The planet we live on has merely to shrug to take some fraction of a million people to their death. But this is nothing compared with what may soon happen; we are now so abusing the Earth that it may rise and move back to the hot state it was in fifty-five million years ago, and if it does most of us, and our descendants, will die."

Ecologists and economists must collaborate in helping humankind cope with an economic meltdown and climate catastrophes simultaneously. Obviously, the solution of any global problem will require more than two disciplines, but these two are capable of providing a unifying context for the issue now foremost on people's minds – the economy – as well as the life support system, without which humankind cannot survive.

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