Why Mainstream Economic Theory is a Program for Ecological Disaster

Robert L. Nadeau, Ph.D.

> The ideas of economists and practical philosophers, both when they are right and when they are wrong, are more powerful than is commonly understood. Indeed, the world is ruled by little else. Practical men, who believe themselves to be quite exempt from any intellectual influence, are usually the slaves of dead economists.
> —John Kenneth Galbraith

In the textbooks used in both undergraduate and graduate programs in mainstream economics, virtually nothing is said about the ideas of the dead economists that rule the world and a recent study showed that the history of mainstream economic theory has "all but vanished" in these programs.[1] A coded explanation of why this is the case is contained in two claims frequently made in these textbooks. The first is that the nineteenth century creators of neoclassical economic theory disclosed the existence of previously hidden dynamics of free market systems and transformed the study of economics into a rigorously mathematical scientific discipline. And the second is that extensions and refinements of this mathematical formalism by subsequent generations of economists fully described these dynamics. The clear suggestion here is that the history of mainstream economic theory is irrelevant to the study of economics because the full and certain truths about the machinations of the invisible hand are revealed in the mathematical formalism of this scientific theory.

The intent in this article is to accomplish three objectives. The first to reveal that the nineteenth century creators of neoclassical economic buried metaphysical or ontological assumptions about the natural laws of economics and the dynamics of free market systems under a maze of mathematical formalism borrowed from the equations of a mid-nineteenth century theory in physics. The second is to explain why the mathematical formalism borrowed from the theory in physics was predicated on unscientific axiomatic assumptions about the dynamics of market systems which effectively preclude the prospect of implementing scientifically viable and equitable economic solutions for environmental problems. And the third is to show that these unscientific axiomatic assumptions did not change in spite of the fact that subsequent generations of mainstream economists extended and refined this formalism.

The theory in physics that the creators of neoclassical economics used as the template for their mathematical theories was developed from the 1840s to the 1860s. During this period, physicists responded to the inability of Newtonian mechanics to account for the phenomena of heat, light, and electricity with a profusion of hypotheses about matter and forces. In 1847 Hermann-Ludwig Ferdinand von Helmholtz, one of the best known and most widely respected physicists at this time, posited the existence of a vague and ill-defined energy that could unify these phenomena. This served as a catalyst for a movement called "energetics" in which

physicists attempted to explain very diverse physical phenomena in terms of a unified and protean field of energy.

Because the physicists were unable to specify the actual character of this energy and could not be precise about what was being measured, their theories were not subject to repeatable experiments under controlled conditions. The amorphous character of energy in the physical theories also obliged the physicists to appeal to the law of the conservation of energy which states that the sum of kinetic and potential energy in a closed system is conserved. This appeal was necessary because it was the only means of asserting that the vaguely defined system described in the theory somehow remains the "same" as it undergoes changes and transformations.[2]

The strategy used by the creators of neoclassical economics was as simple as it was absurd—they wrote down the equations from the mid-nineteenth century theory in physics and substituted economic variables for the physical variables. Utility was substituted for energy, the sum of utility for potential energy, and expenditure for kinetic energy. The forces associated with utility-energy were represented as prices and spatial coordinates described quantities of goods. In an effort to justify the claim that the resulting formalism could disclose the hidden dynamics of market systems, the economists argued that these systems, like the physical systems described in the equations, were closed.

A number of well-known mid-nineteenth century mathematicians and physicists told the economists that the economic constructs were utterly different from the physical variables and that there was no way to assume that these constructs were in any sense comparable to the physical variables. But the economists refused or, more probably, failed to comprehend, how devastating these arguments were and repeatedly claimed that they had transformed economics into a rigorously scientific mathematical discipline. In what is surely one of the most bizarre chapters in intellectual history, the origins of neoclassical economic theory in mid-nineteenth physics were forgotten, subsequent generations of mainstream economists disguised the unscientific axiomatic assumptions about the dynamics of market systems under an increasingly more elaborate maze of mathematical formalism, and the totally unsubstantiated claim that this discipline was scientific was almost universally accepted.[3]

The legacy of this misalliance between economic theory and mid-nineteenth century physics is a view of market systems predicated on the following assumptions:

- (A1) The market is a closed circular flow between production and consumption with no inlets or outlets.
- (A2) The natural laws of economics act causally on economic actors within closed market systems and these actors obey fixed decision making rules.
- (A3) The natural laws of economics, if left alone, will ensure that closed market systems will perpetually grow and expand.
- (A4) Environmental problems result from market failures or incomplete markets and these problems can be resolved via price mechanisms and more efficient technologies and productions processes.
- (A5) There are no biophysical limits to the growth of market systems.

Obviously, none of these assumptions make any sense at all in scientific or ecological terms. Economic activities are embedded in and interactive with environmental systems on all levels and there is no separation between economic and ecological economic processes. Natural resources are clearly exhaustible and wastes and pollutants are already at levels that massively disrupt virtually all biological subsystems. Last but not least, the limits to the biophysical growth of the global economy are real and inescapable, and the assumption that market systems can perpetually expand and consume more scarce and nonrenewable natural resources is utterly false.

A number of theoretical economists have argued that assumptions about economic reality in neoclassical economic theory are fundamentally flawed. But the vast majority of mainstream economists in business and government are not terribly concerned with the most advanced theoretical work in their discipline. Legions of these economists are engaged on a daily basis in developing analyses and making predictions that guide the decision-making of political leaders and economic planners. Most of these individuals are aware that the resulting economic activities could have destructive environmental impacts and seek to minimize these impacts. But these good intentions are hugely ineffectual because the mathematical theories used by the economists preclude the prospect of realistically assessing the environmental costs of economic activities and internalizing these costs in pricing systems.

A Green Thumb on the Invisible Hand

When mainstream economists are confronted with the charge that there is no basis in neoclassical economic theory for implementing scientifically viable economic solutions for environmental problems, they typically deny that this is the case by appealing to the work done by environmental economists. This orthodox approach to resolving environmental problems is taught in universities and practiced in government agencies and development banks, and the solutions are almost invariably embedded in the mathematical formalism of general equilibrium theory. What is not widely known is that environmental economics is predicated on the same set of unscientific assumptions about the dynamics of market systems in neoclassical economic theory that effectively undermine efforts to implement scientifically viable economic solutions to environmental problems. In effort to demonstrate that this is the case, we will insert A for unscientific assumption followed by the number of the assumption in the following discussion of the work done by environmental economists.

Because the practitioners of neoclassical economic theory assume that the gross national product in functional market economies must expand by at least 3% per annum, environmental economists presume that the health of these economies is sensitively dependent on the consumption of increasingly larger amounts of environmental resources (A3, A5). And because the theory is predicated on the assumption that market systems are closed and exist in a domain of reality separate and distinct from natural resources in the "external" environment, environmental economists presume that these resources are not subject to the pricing mechanisms that operate within these systems (A1, A2).

When environmental economists calculate the environmental costs of economic activities, they assume that the relative price of "each bundle" of an environmental good, service, or

amenity reveals the "real marginal values" of the consumer (A1, A2). Note what the writers of a standard textbook on environmental economics have to say about the dynamics of this process: "The power of a perfectly functioning market rests in its decentralized process of decision making and exchange; no omnipotent planner is needed to allocate resources. Rather, prices ration resources to those that value them the most and, in doing so, individuals are swept along by Adam Smith's invisible hand to achieve what is best for society as a collective. Optimal private decisions based on mutually advantageous exchange lead to optimal social outcomes."[4]

In environmental economics, the belief that optimal private decisions "based on mutually advantageous exchange" lead to "optimal social outcomes" for the state of the environment is a primary article of faith. But according to these economists, this will not occur unless the following conditions apply: the market system in which economic actors make optimal private decisions must operate more or less perfectly, and the prices, or values, of environmental goods and services must be represented as a function of those decisions. But if these conditions are met, environmental economists presume that the lawful dynamics of market systems associated with the invisible hand will resolve environmental problems when the "prices are right" (A1, A2, A4, A5).

According to these economists, the right price is the price that economic actors have paid, or are willing to pay, to realize some marginal benefits of consuming environmental goods and services. Because the right price in neoclassical economic theory is determined by forces that operate within closed market systems, environmental economists view natural resources that cannot be valued in these terms as "environmental externalities" (A1, A2, A4, A5). And they define externalities as applying to situations in which the production or consumption of one economic actor affects another who did not pay for the good produced or consumed.

According to environmental economists, externalities are either negative or positive. Pollution is often cited as an example of the former and preservation of biological diversity as an example of the latter. When these economists use the phrase "environmental externalities," they are referring to environmental goods and services that are "external" to market systems in the sense that they are presumed to exist outside of the domain in which the dynamics of these systems allegedly govern decisions made economic actors and determine the right price.

Environmental economists often use cost-benefit analyzes different from those used by other mainstream economists to place a value on environmental externalities. The problem that these accounting procedures are intended to resolve is that the only "real" marginal values the environmental economists can confer on the environment are determined by forces associated with the natural laws of economics that operate within closed market systems (A1, A2). Given that the vast majority of the damage done to the natural environment by economic activities cannot be valued in these terms, environmental economists have developed indirect methods designed to estimate the "use-value" of these natural resources.[5]

For example, environmental economists use the travel cost method to assess the use value of non-market resources such as national parks and public forests and to determine the "willingness to pay function" of those who consume these resources (A1, A2). In this method, a statistical relationship between observed visits to non-market resources of natural beauty and the costs of visiting those resources is derived and used as a surrogate demand curve from which the consumer's surplus per visit-day can be measured. While the travel cost method of evaluation may seem rather esoteric and quite strange, it has been widely used to assess the costs and

benefits of proposals to create or preserve publicly owned recreational areas in the United States and Britain.[6]

Environmental economists use "contingent valuation surveys" to assess the use value of the non-market resources of recreation, scenic beauty, air quality, water quality, species preservation, and bequests to future generations. The word "contingent" is meant to highlight the fact that the values disclosed with the use of these surveys are contingent on the artificial or simulated market conditions described in the surveys (A1, A2). The intent of these surveys is to determine the amount that economic actors might be willing to pay to preserve natural environments (preservation or existence values), maintain the option of using natural resources (option values), and bequeath natural resources to future generations (bequest values).[7] This is normally accomplished by asking the respondents to indicate the maximal amount they are willing to pay for an increase in the quality of an environmental resource and the minimal amount they are willing to accept as compensation to forgo this increase.

For the sake of argument, let us assume that contingent valuation studies provide a basis for realistically assessing the optimal social outcomes of environmental policy decisions. Are we then to believe, as one contingent valuation showed, that reduction in chemical contaminants in drinking water was not important in economic terms because the value of a statistical life associated with a reduction in risk of death in thirty years was only $181,000?[8] Is $26 a measure of the real marginal costs of pollution because this is the average price that a household is willing to pay annually for a 10 percent improvement of visibility in eastern U.S. cities?[9] Is the value of whopping cranes the $22 per year average that one set of households was willing to pay to preserve this species[10] and that of the bald eagle the $11 per year average that another set of households would spend to preserve this apparently less valuable species?[11]

The obvious question here is how could environmental economists possible assume that the amount of money that people who have a wide range of educational levels and average incomes might be willing to pay to preserve an environmental resource or resolve an environmental problem can serve as the basis for implementing public policies that have optimal social outcomes? They do by appealing covertly or overtly to two unscientific assumptions embedded in the mathematical formalism used by these economists. The first is that market systems are closed and exist in a domain of reality separate and distinct from the external environment. And the second is that forces associated with the natural laws of economics govern decisions made by economic actors in closed market systems and determine the right price of environmental resources.

The absurdity of the assumption that market systems exist in a domain of reality separate and distinct from the external environment is painfully apparent in an article written by a well-known environmental economist on the potential economic impacts of global warming. After concluding that "climate change is likely to have different impacts on different sectors in different countries," the author says the following about the U.S. economy: "In reality, most of the U.S. economy has little interaction with climate. For example, cardiovascular surgery and parallel computing are undertaken in carefully controlled environments and are unlikely to be directly affected by climate change. More generally, underground mining, most services, communications, and manufacturing are sectors likely to be largely unaffected by climate change—sectors that comprise about 85 percent of GNP"[12] (A1, A2, A3, A5).

Obviously, there is no basis for assuming that sectors of an economy can be isolated from the impacts of global warming because they have little or no "interaction" with climate. If average earth temperature increases by three or four degrees Centigrade, which now seems very likely, climate change would have disastrous impacts on environmental systems in virtually all regions or territories on the planet, including those in United States. And since these impacts would massively disrupt production, distribution and transportation systems in all sectors of the U. S. economy, the claim that sectors that now "comprise about 85% of GNP" will be "largely unaffected by climate change" is patently absurd.

Mainstream economists do not view themselves as priests in the temple where the true believers in the absentee Deistic god with the invisible hand have given them the power to legislate over the future of life on planet earth. But this is a fairly accurate description of the role played by these economists in the process of developing and implementing economic solutions for environmental problems. And the status of the priests in the temple of neoclassical economic theory has been greatly enhanced by the widespread belief that this theory is scientific.

Climate Change and the Global Market System

The business as usual approach to resolving the environmental crisis embraced by virtually all political leaders and economic planners is predicated on unscientific assumptions about the dynamics of market systems in neoclassical economic theory. The large problem here is that a great deal of scientific research has clearly demonstrated that this approach to resolving the crisis is a program for ecological disaster. For example, research on the nonlinear dynamics of climate change has revealed that marginal increases in Earth temperature are not only resulting in a dramatic increase in the frequency and intensity of extreme weather events. This research has also shown that conditions created by climate change are triggering clusters or cascades of extreme weather events in regions of the planet geographically distant from each other.

In the United States, most people, along with most of their representatives in Congress, seem blissfully unconcerned about what science has revealed about the potentially very destructive impacts of extreme weather events. But this is not the case in the U.S. intelligence agencies. Three lengthy reports funded by these agencies on the threats to national security that could result from extreme weather events have recently been published and all of them demonstrate in great detail that these threats are menacingly real.

The most recent of these reports by the National Research Council makes the following prediction about the extreme weather events that are likely to occur over the next ten years:"The conjunctions of events will likely include clusters of apparently unrelated climate events occurring closely in time, although perhaps widely separated geographically, which actually do have common causes: sequences or cascades of events in which a climate event precipitates a series of physical or biological consequences in unexpected ways; and disruptions of globally connected systems, such as food markets, supply chains for strategic commodities, or global public health systems." The report also warns that these events "will produce consequences that exceed the capacity of the affected societies or global systems to manage." (http:www.nap.edu.catalog.php?record-id=14882)

For example, the report predicts that there will be shortages of water in many countries during this period and that these shortages will be particularly severe in arid and semi-arid countries. One large concern here is that the 263 rivers that supply water to over 40% of the global population cross the boundaries of 145 countries and the flow of water in most of these rivers is rapidly decreasing as a result of climate change. According to the authors of this report, this clearly suggests that competition for access to this scarce resource over the next decade could escalate into cross border conflicts. And they also claim that these conflicts are most likely to occur in the Hindu Kush Himalayan region that includes parts of Afghanistan, Bangladesh, Bhutan, China, Nepal and Pakistan.

The report does not attempt to assess the potential impacts of clusters or cascades of extreme weather events on the global financial and market systems. But if one reads this document carefully, it seems quite clear this is a large problem that we simply cannot afford to ignore. For example, the report predicts that tropical storms and increased storm surges over the next decade will massively disrupt production, refining, and transport of petroleum. One reason why this is could be the case is that one third of the U.S. petroleum refining and processing facilities are located in coastal areas vulnerable to storms and flooding and similar vulnerabilities exist for the facilities in Europe and China. Another is that offshore oil and gas platforms are particularly vulnerable to extreme weather events and the rapid melting of the permafrost in the Arctic is already massively disrupting drilling and pipeline operations in this region.

The authors of the report also stress that a "disruption in one part of the infrastructure" of the globally integrated and very complex petroleum industry "can easily cause severe discontinuities elsewhere in the system." They also claim this could easily result in a situation where demand for petroleum exceeds supplies and the barrel price of oil on the international market increases dramatically. And since clusters or cascades of extreme climate events could massively disrupt multiple parts of the infrastructure of the petroleum industry, the report predicts that the costs of petroleum and petroleum based products in virtually all countries could increase dramatically, that severe shortages of petroleum could occur in poorer countries, and that the global financial and market systems could be massively disrupted.

The report also describes in some detail how extreme weather events have already disrupted these systems. For example, the floods in Thailand in 2010-2011 that caused 800 deaths and damaged 7,700 square miles of farmland also inundated the production facilities areas where one third of the hard drives and a large percentage of other components used in the manufacture of computers are made. This resulted in a worldwide shortage of hard drives and components, suppliers began to stockpile the available hardware, and manufactures discovered that that they did not have a sufficient number of parts to meet production quotas. The floods in Thailand also inundated areas where automotive parts are manufactured and the resulting shortages forced Honda and Toyota to slow down their production lines in many countries.

When one considers the potential impacts of clusters or cascades of extreme events on systems of production, distribution and exchange over the next decade, it is not difficult to conclude that these systems will be massively disrupted. Even more disturbing, a great deal of scientific research strongly suggests that worldwide emissions of greenhouse house gases could soon increase to levels where irreversible large scale changes in the global climate system occur. And if, as now seems likely, these changes occur, the global financial and market systems would quickly collapse and the terms for human survival would be very harsh indeed.

Toward a New Theory of Economics

The creators of neoclassical economic theory claimed that the mathematical formalism that resulted from the substitution of economic constructs for physical variables in the equations borrowed from the theory in physics revealed the existence of a field of energy/utility that governs decisions made by economic actors. In an effort to justify this claim, they were obliged to assume that economic actors are supremely rational human beings who have a prodigious knowledge of all of the complex variables involved in making decisions that maximize their utility. As David Brooks points out in *The Social Animal*, this resulted in an utterly distorted view of economic actors in neoclassical economic theory:

"The human being envisioned in classical economics is smooth, brilliant, calm, and perpetually unastonished by events. He surveys the world with series of uncanny modeled in his head, anticipating what will come next. His memory in incredible; he is capable of a myriad of decision making options in his mind, and weighting the trade-offs involved in each one. He knows exactly what he wants and never flip-flops between contradictory desires. He seeks to maximize his utility (whatever that is). His relationships are all contingent, contractural, and ephemeral. If one relationship is not helping him maximize this utility, then he trades up to another. He has perfect knowledge and can restrain impulses that may prevent him from competing. He doesn't get caught up in emotional contagions or groupthink, but makes his own decisions on the basis of incentives."

As Brooks also points out, "neoclassical economists readily concede that that this sort of person does not exist. But they argue that this caricature is close enough to reality to build models that accurately predict real human behavior. Moreover, the caricature allows them to build rigorous mathematical models, which are the measure of true genius in the economics profession. It allows them to turn economics from a soft squishy muddleheaded field like psychology into a hard, rigorous, and tough minded field like physics."[13]

If we are to prevent to prevent an ecological disaster on a truly horrendous scale, we must recognize and come to terms with three incontrovertible scientific truths:

- The allegedly scientific theory of neoclassical theory is predicated on unscientific assumptions about the dynamics of market systems that are effectively undermining efforts to implement scientifically viable and equitable solutions for environmental problems.
- The business as usual approach to resolving the environmental crisis is a program for the ecological disaster that it is allegedly trying to prevent.
- The invisible hand does not exist and the agency that creates and sustains market systems is the collective actions of flawed and often irrational human beings.
- The new terms of human survival dictate that we must begin very soon to replace neoclassical economic theory with an environmentally responsible economic theory

> which can serve as the basis for implementing scientifically viable and equitable solutions for what is now a large number of very menacing environmental problems.

This new economic theory would be designed to achieve the following objectives: 1) "ecological balance between aggregate human consumption and the regenerative capacity of the biosphere;" 2) "equitable distribution of real wealth to meet the needs of all;" and 3) "a living democracy to secure economic and political accountability to people and community through active citizen participation."[14] This theory would be predicated on our most advanced scientific understanding of what will be required to coordinate global economic activities in ways that will preserve and protect the capacity of the ecosystem to sustain human life. Economic progress would be measured in terms of decreases in the percentage of the global human population now living under conditions of extreme poverty and increases in the health and happiness of all people, households and communities. But it will not be possible to achieve these objectives in the absence of the political will and moral courage required to climb out of the swamp of cognitive dissonance and denial and begin the arduous process of resolving the environmental crisis during the relatively short timeframe in which this will remain a possibility.

May 10, 2013 Draft

This article will appear in a report published by the Capital Institute in the Third Millennium Economy Project entitled "Economics, Finance, Governance, and Ethics for the Anthropocene.

Robert Nadeau, Professor Emeritus at George Mason University, has published three books and numerous articles on mainstream economic theory and the environment.

---

[1] David Colander, *The Making of an Economist, Redux* (Princeton: Princeton University Press, 2007), p. 238.

[2] Philip Mirowski, *Against Mechanism: Protecting Economics from Science* (Lanham, Md.: Rowman & Littlefield, 1988).

[3] Robert L. Nadeau, *The Wealth of Nature: How Mainstream Economics Has Failed the Environment* (New York: Columbia University Press, 2003); Nadeau, *The Environmental Endgame: Mainstream Economics, Ecological Disaster, and Human Survival* (New Brunswick, N.J.: Rutgers University Press, 2006); Nadeau, *Rebirth of the Sacred: Science, Religion, and the New Environmental Ethos* (New York: Oxford University Press, 2013).

[4] Nick Hanley, Jason E. Shrogren and Ben White, *Environmental Economics in Theory and Practice*, (New York: Oxford University Press, 1997), p. 358.

[5] W. Michael Hanneman, "Valuing the Environment through Contingent Value," *Journal of Economic Perspectives* 8, no. 4 (Fall, 1994): 19.

[6] J. W. Fletcher, W. Adamowicz, and T. Graham-Tomasi, "The Travel Cost Model of Recreation Demand," *Leisure Studies* 12 (1990): 119-147.

[7] Mark Sagoff, "Some Problems with Environmental Economics," *Environmental Ethics* 10 (Spring 1988): 55.

[8] Robert C. Mitchell and Richard T. Carson, "Valuing Drinking Water Risk Reduction Using the Contingent Valuation Methods: A Methodological Study of Risks from THM and Giardia," paper prepared for Resources for the Future, Washington, D.C., 1986.

[9] George Tolley at al., "Establishing and Valuing the Effects of Improved Visibility in Eastern United States," paper prepared for the Environmental Protection Agency, Washington, D.C., 1986.

[10] James Bowker and John R. Stoll, "Use of Dichotomous Choice Nonmarket Methods to Value the Whopping Crane Resource," *American Journal of Agricultural Economy* 23, no. 5 (May 1987): 372-381.

[11] Kevin J. Boyle and Richard C. Bishop, "Valuing Wildlife in Benefit-Cost Analyses: A Case Study Involving Endangered Species," *Water Resources Research* 23, no. 5 (May 1987): 943-950.

[12] William D. Norhaus, "Reflections on the Economics of Climate Change," *Journal of Economic Perspectives* 7 no. 4 (Fall, 1993): 14.

[13] David Brooks, The Social Animal: The Hidden Sources of Love, Character and Achievement (Random House: New York, 2011) pp. 177-178.

[14] David Korten, "Taking Ecological Economics Seriously: It's the Biosphere, Stupid," Presentation to the U.S. Society for Ecological Economics, June 19, 2011 http://livingeonomiesforum.org/taking-ecological-economcs-seriously