<u>Economics for a Full World</u>[1]

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***Introduction**.* The Great Transition discussion is organized around four key questions: where are we; where are we going; where do we want to go; and how do we get there? It helps at the beginning to give short answers to these basic questions in terms of economics, broadly defined, with references to where each is discussed later in this essay.

<u>Where are we?</u> We are now in a full world, but still behaving as if in an empty world. Transition toward planetary civilization requires adaptation to a full world, and is discussed in I and II.

<u>Where are we going?</u> Continued growth in the full world leads us to an era of uneconomic growth, followed by probable ecological collapse, as discussed in II and III.

<u>Where do we want to go?</u> I suggest that we want to go to a steady-state economy (an economy of qualitative development without quantitative growth), characterized by longevity, sufficiency, and equity. This is discussed in IV and VI.

<u>How do we get there?</u> Part IV identifies two flawed strategies (economic imperialism and ecological reductionism), and a better one (steady-state economy). Part V outlines ten specific policies toward a steady-state economy.

I. Basic Vision: The Economy as Subsystem of the Ecosphere

When I worked at the World Bank, I often heard the statement, "There is no conflict between economics and ecology. We can and must grow the economy and protect the environment at the same time." I still hear that a lot today. Is it true? Is it possible?

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[1] An earlier version was presented as a speech on the occasion of the Blue Planet Prize, Tokyo, November 2014.

Although it is a comforting idea, I fear that it is at most half true. The "true" part comes from a confusion of reallocation with aggregate growth. There are generally always possibilities of better allocation—more of something desired in exchange for a reduction in something less desired. This is the domain of microeconomics. Aggregate growth, by contrast, means more of everything as measured by GDP--- it is the domain of macroeconomics, and is the meaning of growth in this discussion.

The economy, as shown in the Diagram 1, is an open subsystem of the larger ecosphere that is finite, non-growing, and materially closed, although open to a continual, but non-growing, throughput of solar energy. When the economy grows in physical dimensions it incorporates matter and energy from the rest of the ecosystem into itself. It must, by the law of conservation of matter and energy (First Law of Thermodynamics), encroach on the ecosystem, diverting matter and energy from previous natural uses. More human economy (more people and commodities) means less natural ecosystem. In this sense the statement is false. There is an obvious physical conflict between the growth of the economy and the preservation of the environment.

That the economy is a subsystem of the ecosphere seems perhaps too obvious to emphasize. Yet the opposite view is common in high places. For example, *"As the White Paper rightly emphasised, the environment is part of the economy and needs to be properly integrated into it so that growth opportunities will not be missed."*[2] On the contrary, it is the economy that is the part and needs to be integrated into the whole of the finite and entropic ecosphere so that growth limits will not be missed.

But is this physical conflict economically important? Some think not.

Some believe that we still live in an empty world. In the empty world the economy was small relative to the containing ecosystem, and our technologies of extraction and harvesting were not very powerful,

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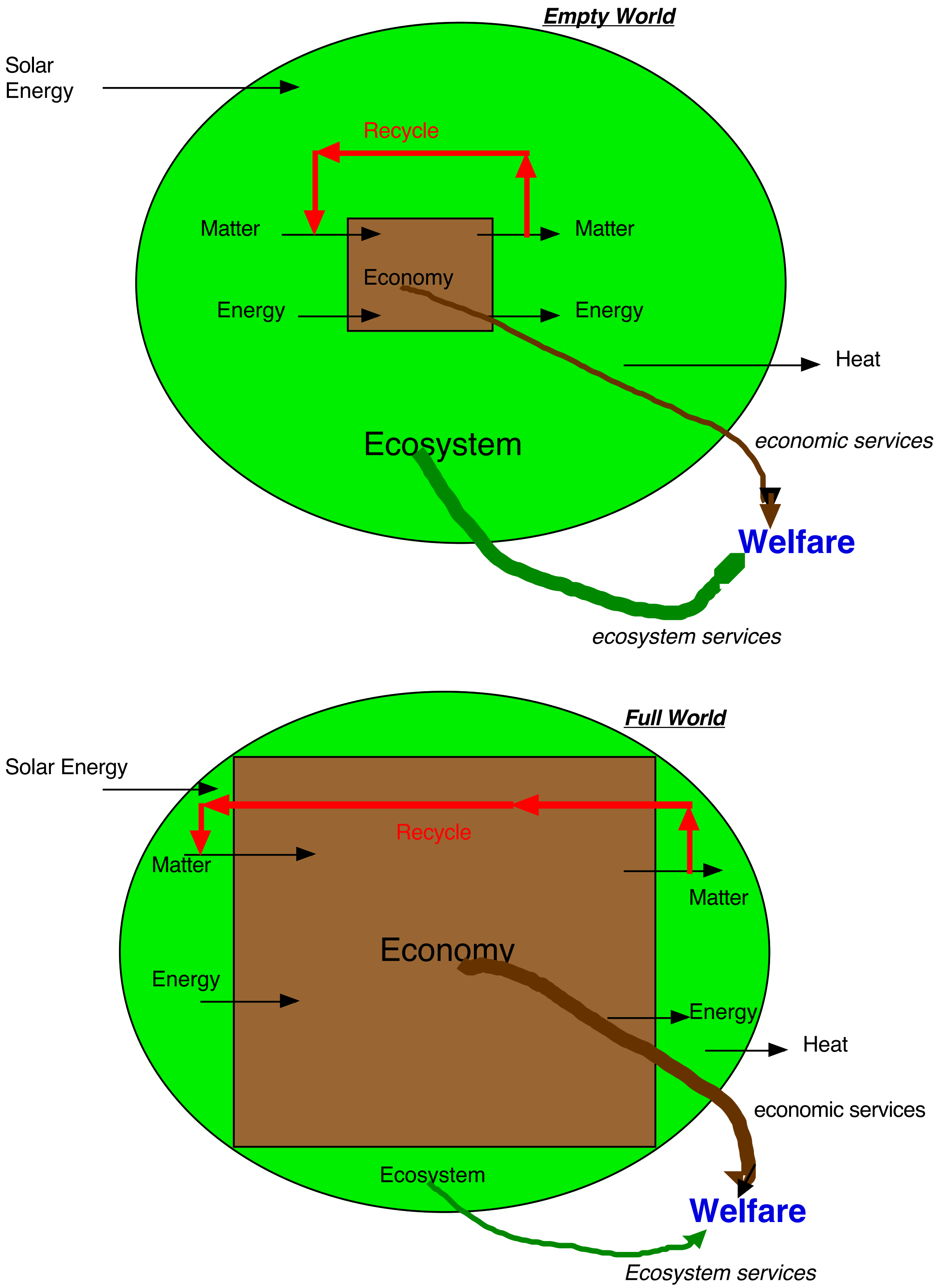
[2] Dieter Helm, Chairman of the Natural Capital Committee, The State of Natural Capital: Restoring our Natural Assets, UK. 2014.

and our numbers were small. Fish reproduced faster than we could catch them, trees grew faster than we could harvest them, minerals in the earth's crust were abundant---natural resources were not really scarce. In the empty world it made economic sense to say that there was no conflict between economic growth and the ecosystem, even if it was not strictly true in a physical sense. But physical growth has transformed the empty world into a full world in which the remaining ecosystem is scarce. This has happened in a surprisingly short time thanks to the explosive nature of exponential growth.

Figure I

A "Macro" View of the Macroeconomy



Neoclassical economic theory developed during the empty-world era, and still embodies many assumptions from that past era. But the empty world has rapidly turned into the full world thanks to growth, the number-one goal of all countries, capitalist, communist, or in-between. In my lifetime the world population has more than tripled---from two billion to over seven billion. Similarly for the populations of cattle, chickens, pigs, and soybean plants and corn stalks. The non-living populations of cars, buildings, refrigerators and cell phones have grown even more rapidly. All these populations, both living and non-living, are what physicists call "dissipative structures" ---that is, their maintenance and reproduction requires a metabolic flow, a throughput that begins with depletion of low-entropy resources from the ecosphere and ends with the return of polluting high-entropy waste back to the ecosphere. This metabolic throughput imposes a disruption of the ecosphere at both ends, an unavoidable cost that is necessary for the production, maintenance, and reproduction of the stock of both people and wealth. Until recently the concept of metabolic throughput was absent from standard economic theory, and even now its importance is greatly downplayed, in spite of the important contributions of Nicholas Georgescu-Roegen[3] and Kenneth Boulding[4].

Recognizing the concept of metabolic throughput in economics brings with it the laws of thermodynamics that are inconvenient to the growthist ideology. The First Law, as noted above, imposes a quantitative trade-off of matter/energy between the environment and the economy. The Second Law imposes a qualitative degradation of the environment--- by extracting low-entropy resources and returning high-entropy wastes. The Second Law of Thermodynamics thus imposes an additional conflict between expansion of the economy and preservation of the environment, namely that the order and structure of the economy

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[3] The Entropy Law and the Economic Process, Harvard University Press, Cambridge, MA, 1971.

[4] "The Economics of the Coming Spaceship Earth", in H. Jarrett, ed., Environmental Quality in a Growing Economy, Johns Hopkins University Press, Baltimore, MD, 1966.

is paid for by imposing disorder in the sustaining ecosphere. Furthermore, this disorder, exported from the economy, disrupts the complex ecological interdependencies of our life-supporting ecosystem.

Another common denial of the conflict between growth and environment is the claim that because GDP is measured in value units it has no necessary physical impact on the environment. Although GDP is measured in value units, one must remember that a dollar's worth of gasoline is a physical quantity---recently about one-fourth of a gallon in my country, and currently about a half a gallon. GDP is an aggregate of all such "dollar's worth" quantities bought for final use, and is consequently a value-weighted index *of physical quantities*. GDP is certainly not perfectly correlated with resource throughput---but, for mater-dependent creatures like ourselves, the positive correlation is pretty high. Prospects for absolute "decoupling" of resource throughput from GDP are quite limited, even though much discussed and wished for.

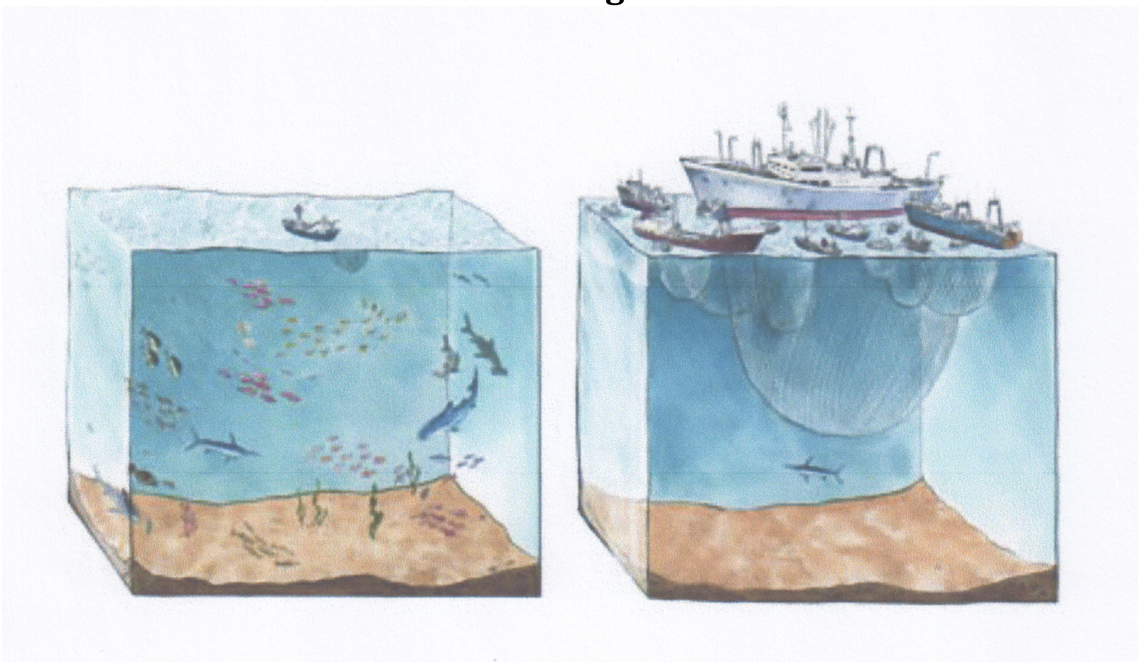
These limits are made visible by considering an input-output matrix for an economy. It reveals that nearly every sector requires inputs from, and provides outputs to, nearly every other sector. And these inputs require a further round of inputs for their production, etc. The economy grows as an integrated whole, not as a loose mix of sectors. Even the information and service sectors have substantial physical resource inputs. In addition to the supply limit of inter-industry dependence there is the demand limit of "lexicographic ordering of wants"—unless we first have sufficient physical food on the plate we are just not interested in the information contained in a million recipes on the Internet. The lexicographic sequence of demand provides an additional limit to any policy of continually lowering material intensity by substitution in the final bill of goods of GDP. And of course the Jevons Paradox leads us to do more of what has become more efficient, cancelling a large part of the resource savings. This is not to deny real possibilities of improved technical efficiency in the use of resources, or ethical improvement in the ordering of our priorities. But these represent qualitative development and are frequently not captured in GDP, which mainly reflects quantitative growth.

Since GDP reflects both costly and beneficial activity, ecological economists have not considered it to be a *desideratum*. Instead they have distinguished *growth* (quantitative increase in size by accretion or assimilation of matter), from *development* (qualitative improvement in design, technology, or ethical priorities). Ecological economists advocate *development without growth* --- qualitative improvement without quantitative increase in resource throughput beyond an ecologically sustainable scale. Given this distinction, one could indeed say that there is no necessary conflict between qualitative development and the environment, and that would be true. It is better to call different things by different names. GDP accounting mixes together both growth and development, as well as costs and benefits. It is a number that confuses more than it clarifies.

II. From Empty Word to Full World: The Limiting Factor Has Changed

When the entropic throughput becomes too large it overwhelms either the regenerative capacity of nature's sources, or the assimilative capacity of nature's sinks. That is the main signal that we no longer live in the empty world but now inhabit a full world. Natural resource flows are now the scarce factor, and labor and capital stocks are now relatively abundant. The basic pattern of scarcity has been reversed by a century of growth.

Figure 2



Empty World **Full World**

This simple picture is instructive. It tells us that in the past the fish catch was limited by number of fishing boats and fishermen. Now it is limited by number of fish and their capacity to reproduce. More fishing boats will not result in more caught fish. The limiting factor is no longer the manmade capital of boats, but remaining natural capital of fish populations and their aquatic habitat.

Economic logic says invest in the limiting factor. Economic logic has not changed, but the identity of the limiting factor has changed. The old economic policy of building more fishing boats is now uneconomic. We need to invest in natural capital, which is now the limiting factor. How do we do that? For one thing by reducing the catch to allow fish populations to increase to their previous levels, and by other measures such as fallowing agricultural land to refresh its fertility. More generally, by the kind of restoration ecology, biodiversity conservation, and sustainable use practices pioneered by the other 2014 Blue Planet Prize recipients, INBio, and Professor Janzen, and their colleagues.

One could draw similar pictures for other natural resources, not just fish.

What limits the production of cut timber? Is it the number of chainsaws, sawmills and lumberjacks, or the remaining forests and the growth rate of new trees?

What limits the crops from irrigated agriculture? Is it the number of pipes, sprinklers and pumps, or the stock of water in aquifers, their recharge rate, and the flow of surface water in rivers?

What limits the number of barrels of pumped crude oil---the number of drilling rigs or the remaining accessible deposits of petroleum?

What limits the use of all fossil fuels--- our mining equipment and combustion engines, or the capacity of the atmosphere to absorb the resulting greenhouse gasses without causing drastic climate change? In all cases it is the latter, the natural capital (whether source or sink), rather than the manmade capital.

I think these examples, while not rising to the level of proof, are enough to establish the strong presumption that the limiting factor is no longer manmade capital, but has become remaining natural capital. Traditional GDP growth, based on increasing manmade capital stocks, becomes uneconomic in the full world as the complementary factor of natural resources becomes limiting.

How have traditional economists reacted to this change in the identity of the limiting factor, this new pattern of scarcity? In three ways. First, by ignoring it—by continuing to believe that we live in the empty world. Second, by pretending that GDP is an ethereal angelic number rather than a physical aggregate. Third, by claiming that it cannot be true that natural capital has replaced manmade capital as the limiting factor, because manmade and natural capital are substitutes, they say. Only if factors are complements can the one in short supply be limiting. So even if natural capital is now scarcer than before that is no problem in their view because manmade capital, embodying new technology, is considered a "near perfect" substitute for natural resources.

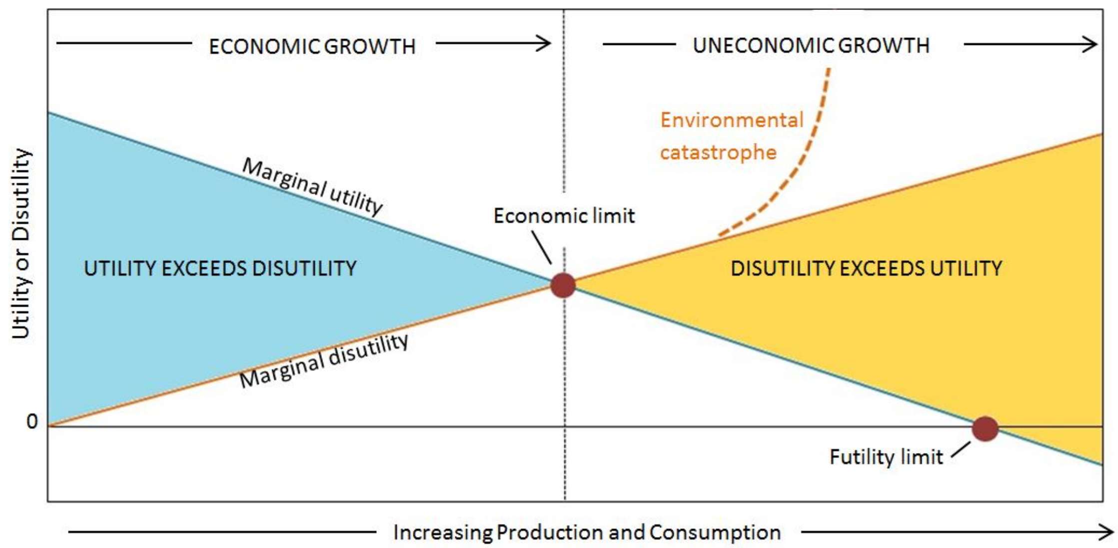
While improved technologies can certainly reduce wastage in the use of resources, as well as make recycling easier, it is hard to imagine how the fund of agents of transformation (capital or labor) can substitute for or replace the flow of that which is being transformed (resources). Can we produce a ten-pound cake with only one pound of ingredients, simply by using more cooks and ovens? And further, how could we make more capital (or labor) without also using more natural resources? While a capital investment in sonar may help locate those remaining fish it is hardly a good substitute for more fish in the sea. And what happens to the capital value of fishing boats, including their sonar, as the fish disappear?

III. Limits to Growth and Optimal Scale of the Economy in a Full World

It is clear from Figure I that the transition from empty to full world involves both costs and benefits. The brown arrow from economy to Welfare represents economic services (benefits from the economy). It is small in the empty world but large in the full world. It grows at a diminishing rate (because as rational beings we satisfy our most important wants first—law of diminishing marginal utility). The costs of growth are represented by the shrinking ecosystem services (green arrow) that are large in the empty world and small in the full world. It diminishes at an increasing rate as the ecosystem is displaced by the economy (because we presumably sacrifice the least important ecosystem services first---law of increasing marginal costs).

We can restate this in terms of Figure 3, showing declining marginal benefit of growth of the economy and increasing marginal cost of the resulting environmental sacrifice.

Figure 3



From the diagram we can distinguish three concepts of limits to growth.

1. The "*futility limit* "occurs when marginal utility of production falls to zero. Even with no cost of production there is a limit to how much we can consume and still enjoy it. There is a limit to how many goods we can enjoy in a given time period, as well as a limit to our stomachs and to the sensory capacity of our nervous systems. In a world with considerable poverty, and in which the poor observe the very rich apparently still enjoying their extra wealth, this futility limit is thought to be far away, not only for the poor, but for everyone. By its "non satiety" postulate neoclassical economics formally denies the concept of the futility limit. However, studies showing that, beyond a threshold, self-evaluated happiness (total utility) ceases to increase with GDP, strengthen the relevance of the futility limit.

2. The "*ecological catastrophe limit"* is represented by a sharp increase to the vertical of the marginal cost curve. Some human activity, or novel

combination of activities, may induce a chain reaction, or tipping point, and collapse our ecological niche. The leading candidate for the catastrophe limit at present is runaway climate change induced by greenhouse gasses emitted in pursuit of economic growth. Where along the horizontal axis it might occur is uncertain. I should note that the assumption of a continuously and smoothly increasing marginal cost curve is quite optimistic. Given our limited understanding of how the ecosystem functions we cannot be sure that we have correctly sequenced our sacrifices of ecological services from least to most important. In making way for growth we may ignorantly sacrifice a vital ecosystem service ahead of a trivial one. Thus the marginal cost curve might in reality zig-zag up and down discontinuously, making it difficult to define the third and most important limit, namely the economic limit.

3. The *"economic limit"* is defined by marginal cost equal to marginal benefit and the consequent maximization of net benefit. The good thing about the economic limit is that it would appear to be the *first* limit encountered. It certainly occurs before the futility limit, and likely before the catastrophe limit, although that is uncertain. At worst the catastrophe limit might coincide with and discontinuously determine the economic limit. Therefore it is very important to estimate the risks of catastrophe and include them as costs counted in the disutility curve, as far as possible.

Placing one's self at the economic limit and looking backwards one sees the large net benefit of growth, and will be asked, "how can you oppose growth when it has done so much good?" Looking forward the answer is clear--- we have reached the optimum and now growth yields net costs, not net benefits.

From the graph it is evident that increasing production and consumption is rightly called *economic* growth only up to the economic limit. Beyond that point it becomes *uneconomic* growth because it increases costs by more than benefits, making us poorer, not richer. Unfortunately it seems that we perversely continue to call it *economic* growth! Indeed, you will not find the term "uneconomic growth" in any textbook in macroeconomics. Any increase in real GDP is called "economic growth" even if it increases costs faster than benefits. Richer (more net wealth) is better than poorer---that is a truism. The relevant question is, does growth any longer make us richer, or has it begun to make us poorer by increasing "illth" faster than wealth? The relevant question is seldom asked.

Examples of illth are everywhere, even if unmeasured in national accounts, and include: nuclear wastes, climate change from excess carbon in the atmosphere, biodiversity loss, depleted mines, deforestation, eroded topsoil, dry wells and rivers, sea level rise, the dead zone in the Gulf of Mexico, gyres of plastic trash in the oceans, the ozone hole, exhausting and dangerous labor, and the un-repayable debt from trying to push growth in the symbolic financial sector beyond what is possible in the real sector.

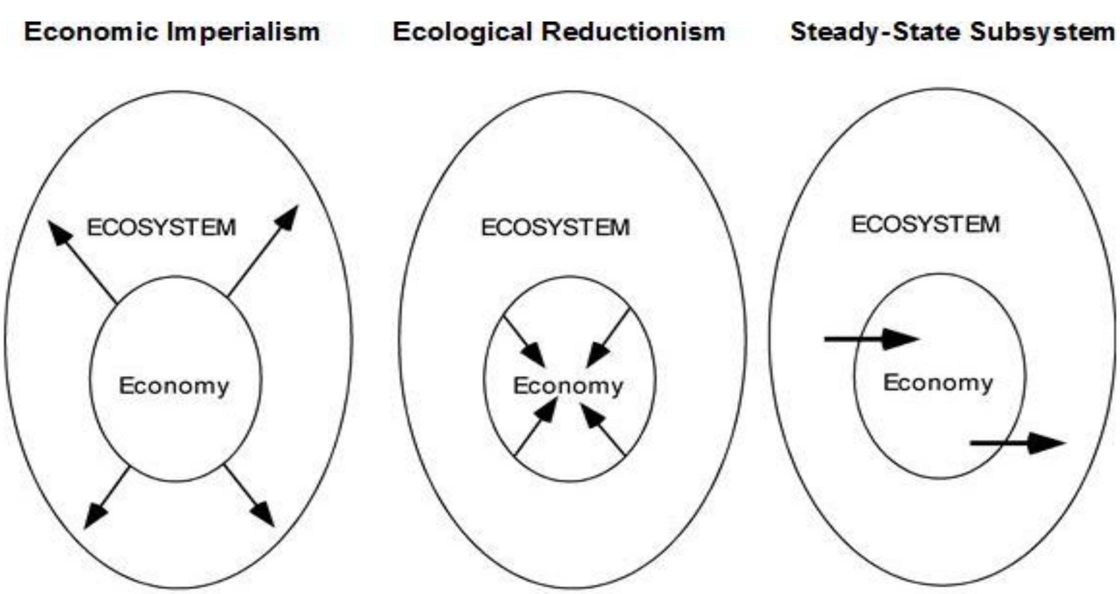
Economists will note that the logic employed in Figure 3 is familiar in microeconomics---marginal cost equal to marginal benefit defines the optimal size of a microeconomic unit, be it a firm or household. That logic is not applied to the macro-economy, however, because the latter is thought to be the Whole rather than a Part. When a Part expands into the finite Whole it imposes an opportunity cost on other Parts that must shrink to make room for it. When the Whole itself expands it is thought to impose no opportunity cost because it displaces nothing, presumably expanding into the void. But as seen in Figure 1 the macro-economy is not the Whole. It too is a Part, a part of the larger natural economy, the ecosphere, and its growth does inflict opportunity costs on the finite Whole that must be counted. Ignoring this fact is why many economists cannot conceive of the possibility that growth in GDP could ever be uneconomic.

Standard economists might accept this diagram as a static picture, but argue that in a dynamic world technology will shift the marginal benefit curve upward and the marginal cost curve downward, moving their intersection (economic limit) ever to the right, so that continual growth remains both desirable and possible. However, the macroeconomic curve-shifters need to remember three things. First, the physically growing macro-economy is still limited by its displacement of the finite ecosphere, and by the entropic nature of its maintenance throughput. Second, the timing of new technology is uncertain. The expected technology may not be invented or come on line until after we have passed the economic limit. Do we then endure uneconomic growth while waiting and hoping for the curves to shift? Third, let us remember that the curves can also shift in the wrong directions, moving the economic limit back to the left. Did the technological "advances" of tetraethyl lead and chlorofluorocarbons shift the cost curve down or up? How about nuclear power? Or "fracking"? Adopting a steady–state economy allows us to avoid being shoved past the economic limit. We could take our time to evaluate new technology rather than letting it blindly push growth that may well be uneconomic. And the steady state gives us some insurance against the risks of ecological catastrophe that increase with growthism and technological impatience.

IV. Three Strategies for Integrating Economy and Ecosystem

It follows that our vision and policies should be based on an integrated view of the economy as a subsystem of the finite and non growing ecosphere. Attempts at integration, leading to policy, have been based on three different theoretical understandings. All three start from the vision of the economy as a subsystem of the ecosphere.

Figure 4



Thus all three recognize limits to growth. The differences concern the way they each treat the boundary between the economy and the rest of the ecosystem, and that has large policy consequences for how we accommodate to limits.

Economic imperialism seeks to expand the boundary of the economic subsystem until it encompasses the entire ecosphere. The goal is one system, the macro-economy as the Whole. This is to be accomplished by complete internalization of all external costs and benefits into prices. Those myriad aspects of the biosphere not customarily traded in markets are treated as if they were by imputation of "shadow prices"–-the economist's best estimate of what the price of the function or thing would be if it were traded in a competitive market. Everything in the ecosphere is theoretically rendered comparable in terms of its priced ability to help or hinder individuals in satisfying their wants. Implicitly, the end pursued is an ever-greater level of consumption, and the way to effectively achieve this end is growth in the aggregate exchange value of marketed final goods and services (GDP).

Economic imperialism is basically the neoclassical approach. Subjective individual preferences, however whimsical or uninstructed, are taken as the ultimate source of value. This is a perverse value judgment, although usually treated as the avoidance of a value judgment. Since subjective wants are thought to be infinite in the aggregate, as well as sovereign, there is a tendency for the scale of activities devoted to satisfying them to expand. The expansion is considered legitimate as long as "all costs are internalized into prices."

While costs should certainly be internalized into prices, this procedure should not become an excuse for allowing excessive takeover of the ecosphere by economic growth. Many of the costs of growth that we have experienced have come as surprises. We cannot internalize them if we cannot first imagine and foresee them. Furthermore, even after some external costs have become visible to all (e.g., climate change), internalization has been very slow, partial, and much resisted. Profit maximizing firms have an incentive to externalize costs. As long as the evolutionary fitness of the environment to support life is not perceived by economists as a value, it is likely to be destroyed in the imperialistic quest to make every molecule and photon in creation pay their way according to the pecuniary rules of present value maximization.

There is no doubt that once the scale of the economy has grown to the point that formerly free environmental goods and services become scarce, it is better that they should have a positive price reflecting their scarcity than to continue to be priced at zero. But there remains the prior question: Are we better off at the new larger scale with formerly free goods correctly priced, or at the old smaller scale with free goods also correctly priced (at zero)? In both cases, the prices are right. This is the suppressed question of optimal macro scale, not answered, indeed not even asked, by either neoclassical or Keynesian economics in their blind quest for growth.

Ecological reductionism begins with the true insight that humans and markets are not exempt from the laws of nature. It then proceeds to the false inference that human action is totally explainable by, reducible to, the laws of nature. It seeks to explain whatever happens within the economic subsystem by exactly the same natural laws that it applies to the rest of the ecosystem. It subsumes the economic subsystem indifferently into the natural system, erasing its boundary. Taken to the extreme, in this view all is explained by a materialist deterministic system that has no room for purpose or will. This is a sensible vision from which to study the ecology of a coral reef or a rainforest. But if one adopts it for studying the human economy, one is stuck from the beginning with the inconvenient policy implication that policy can make no difference.

Economic imperialism and ecological reductionism have in common that they are monistic visions, albeit rather opposite monisms. It is the monistic quest for a single entity or principle by which to explain everything that leads to excessive reductionism on both sides. Certainly science should strive for the most reduced or parsimonious explanation possible without ignoring the facts. But respect for the basic empirical facts of natural laws on the one hand, and self-conscious purpose and will on the other hand, should lead us to a kind of practical dualism. After all, that our world should consist of two fundamental features offers no greater inherent improbability than that it should rest on one only. How these two fundamental features of our world (material cause and final cause) interact is a venerable mystery-–precisely the mystery that the monists of both kinds are seeking to avoid. But economists are too much in the middle of things to adopt either extreme. Economists are better off denying the tidy-mindedness of either monism than denying the facts that point to an untidy dualism.

The remaining strategy is the **steady-state subsystem**. It does not attempt to eliminate the subsystem boundary, either by expanding it to coincide with the whole system or by reducing it to nothing. Rather, it affirms both the interdependence and the qualitative difference between the human economy and the natural ecosystem. The boundary must be recognized and drawn in the right place. The scale of the human subsystem defined by the boundary has an optimum, and the throughput by which the ecosphere physically maintains and replenishes the economic subsystem must be ecologically sustainable. That throughput is indeed entropic, but rather than maximizing entropy, as some natural systems seem to do, the economy seeks to minimize entropy subject to the maintenance of production levels sufficient for a good life for all. The goal of the economy is to minimize the low-entropy used up to attain a sufficient standard of living–-by sifting it slowly and carefully through efficient technologies aimed at important purposes. The economy should not be viewed as an idiot machine dedicated to maximizing waste. Its final cause is not competitive exclusion by preemption of energy and maximization of waste, as some ecological reductionists seem to claim, but the maintenance and enjoyment of life for a long time (not forever) at a sufficient level of wealth for a good (not luxurious) life.

The idea of a steady-state economy comes from classical economics, and was most developed by John Stuart Mill (1857), who referred to it as the "stationary state." The main idea was that population and the capital stock were not growing, even though the art of living continued to improve. The constancy of these two physical stocks defined the scale of the economic subsystem. Birth rates would be equal to death rates and production rates equal to depreciation rates. Today we add that both rates should be equal at low levels rather than high levels because we value longevity of people and durability of artifacts, and wish to minimize throughput, subject to maintenance of sufficient stocks for a good life.

V. Outline of Policies for a Steady-State Economy

Ecological economics should seek to develop the steady-state vision, and get beyond the dead ends of both economic imperialism and ecological reductionism. Ten policies for moving toward a steady-state economy are outlined below. Of course ten is an arbitrary number, just a way to get specific, which at this point is surely necessary if only to provoke discussion of improved policies. Many of the policies could be adopted independently and gradually, although they cohere in the sense that some compensate for the shortcomings of others.

Figure 5

Some Basic Policies for a Sustainable Steady-State Economy

I. Cap-Auction-Trade systems for basic resources (especially fossil fuels).

1. Set caps with reference to 3 rules for resource exploitation. The three rules are: first, renewable resources should not be depleted faster than they regenerate, second, non renewable resources should not be depleted faster than renewable substitutes are developed, third, wastes from all resource use should not be returned to the ecosystem faster than it can be absorbed and reconstituted by natural systems. This gives sustainable scale and avoids the Jevons effect.
2. The auction revenues substitute for income taxes, especially on the poor, fostering just distribution.
3. Market exchange of auctioned depletion or pollution quotas allows efficient allocation.

II. Shift the tax base from "value added" (labor and capital) to "that to which value is added" (natural resource throughput).

1. Resource throughput (depletion and pollution) is a cost, so tax it when not already limited by cap-auction-trade.
2. Value added to resources by labor and capital is a benefit, so stop taxing it and substitute revenue from resource taxes.

3. Resources have become the limiting factor, so raise their price by tax to induce more efficient use.

III. Limit the range of inequality in distribution.

1. Establish minimum and maximum income limits.
2. Range of income differences sufficient for incentives,
3. But not sufficient for plutocracy.

IV. Move from fractional reserve banking system to 100% reserve requirements on demand deposits.

1. Money would no longer be mainly interest-bearing debt created by private banks, but non interest-bearing government debt issued by the Treasury.
2. Seigniorage would accrue to the Treasury, not commercial banks.
3. Every dollar loaned for investment would be a dollar previously saved by someone, restoring the classical balance between investment and abstinence from consumption.
4. It dampens boom and bust business cycle.

V. Move from free trade and free capital mobility to balanced and regulated international trade.

1. Interdependence of national economies recognized; integration into one global economy resisted.
2. National cost-internalization policies are undercut in a globalized world, encouraging a race to the bottom.
3. Recognize that free capital mobility invalidates the basic comparative advantage argument for free trade in goods.

VI. Free up the length of the working day, week, and year

1. Allow greater option for part-time or personal work, and enjoying progress as more leisure rather than more production.

VII. Stabilize population.

1. Work toward a balance in which births plus in-migrants equals deaths plus out-migrants, and in which every birth is a wanted birth.

VIII. Reform national accounts

1. Separate GDP into a cost account and a benefits account. Compare costs and benefits of a growing throughput at the margin, stop throughput growth when marginal costs equal marginal benefits.

IX. Restore the U. S. Full Employment Act of 1945 or its Equivalent

1. Once again make full employment the end, and economic growth the temporary means, rather than economic growth the permanent end, with unemployment the price we pay for growth from automation, off-shoring, deregulated trade, and a cheap-labor immigration policy.

X. Seek World Community as a Federation of National Communities, Not as the Dissolution of Nations Into a Single "World Without Borders"

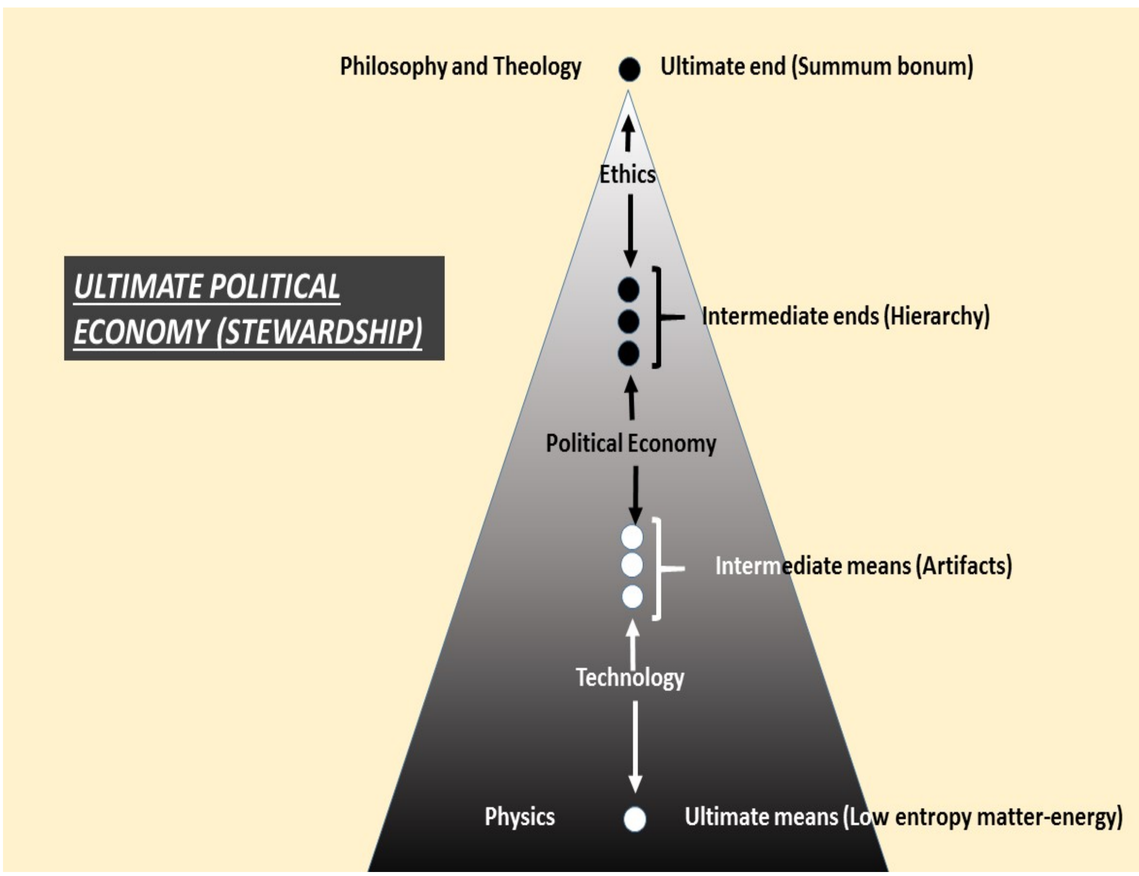
1. Globalization by free trade, free capital mobility, and free migration dissolves national community, leaving nothing to then federate.
2. Such globalization is individualism writ large--- a post-national corporate feudalism in a global commons. Better to strengthen the original Bretton Woods vision of interdependent national economies, and resist the later WTO vision of a single integrated global economy.
3. Respect the principle of subsidiarity: e.g., climate change and arms control require global institutions; basic law enforcement and infrastructure maintenance do not. Focus our limited capacity for global cooperation on the most important things that really require it .

VI. The Larger Ethical and Ecological Context of Economics

It is one thing to suggest a general outline of policies. They can be discussed in more detail. But it is something else entirely to say from where we will get the will, strength, and clarity of purpose to carry out these policies that necessarily limit growth---especially when for the last century we have treated growth as the *summum bonum*. This requires a major change in philosophical vision and ethical practice. There is no guarantee that we can do it.

As a way to contemplate such a change, consider the "ends-means pyramid" in Figure 6**.** The policies I have suggested belong in the middle, under "Political Economy". At the base of the pyramid are our ultimate means, low entropy matter-energy--- that which we require to satisfy our wants, but which we cannot make, but only use up. We use these ultimate means directly, guided by technology, to produce intermediate means (artifacts, commodities, services…) that directly satisfy our needs. These intermediate means are allocated by political economy to serve our intermediate ends (health, comfort, education…), which are ranked ethically in a hierarchy by how strongly they contribute to the Ultimate End under existing circumstances. We can perceive the Ultimate End only dimly and vaguely, but in order to ethically rank our intermediate ends we must compare them to some ultimate criterion. We cannot avoid philosophical and theological inquiry into the Ultimate End just because it is difficult. To prioritize requires that something must go in first place.

Figure 6



The ends-means pyramid or spectrum relates the basic physical requirement for usefulness (low entropy matter-energy) through technology, political economy, and ethics, to the service of the Ultimate

End, dimly perceived but logically necessary. The goal is to unite the material of this world with our best vision of the good.

The middle position of economics is significant. Economics traditionally deals with the allocation of *given* intermediate means to satisfy a *given* hierarchy of intermediate ends. It takes the technological problem of converting ultimate means into intermediate means as solved. Likewise it takes the ethical problem of ranking intermediate ends with reference to a vision of the Ultimate End as also solved. So all economics has to do is efficiently allocate given means among a given hierarchy of ends. In neglecting the Ultimate End and ethics economics has been too materialistic; in neglecting ultimate physical means and technology it has not been materialistic enough.

Ultimate political economy (stewardship) is the total problem of using ultimate means to best serve the Ultimate End, no longer taking technology and ethics as given, but as steps in the total problem to be solved. The overall problem is too large to be tackled without breaking it down into its pieces. But without a vision of the total problem the pieces do not add up or fit together.

The dark base of the pyramid is meant to represent the fact that we have relatively solid and consensual knowledge of various sources of low entropy matter-energy. The light apex of the pyramid represents the fact that our knowledge of the Ultimate End is uncertain and not nearly as consensual as physics. The single apex will annoy pluralists who think that there are many “ultimate ends”. Grammatically and logically, however, “ultimate” requires the singular. Yet there is certainly room for more than one perception of the nature of the singular Ultimate End, and much need for tolerance and patience in reasoning together about it. Such reasoning together is short-circuited by a facile pluralism that avoids ethical ranking of ends by declaring them to be “equally ultimate”. This reasoning appears rather top-down, but in practice it is often the concrete bottom-up struggle to rank particular intermediate ends that gives us a clue or insight into what the Ultimate End must be to justify our intuitive ranking.

As a start in that reasoning together I suggest the proposition that the Ultimate End, whatever it may be, cannot be growth! A better starting point for reasoning together is John Ruskin's aphorism that *"there is no wealth but life".* How might that insight be restated as an economic policy goal? For initiating discussion I suggest: *"maximizing the cumulative number of lives ever to be lived over time at a level of per capita wealth sufficient for a good life."* This leaves open the traditional ethical question of what is a good life, while conditioning its answer to the realities of ecology and the economics of sufficiency. At a minimum it seems a more reasonable approximation to the Ultimate End than the current impossible goal of "ever more things for ever more people forever".