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Good (Excellent) Rebuttal to Sagoff

Reply to Mark Sagoff's "Carrying capacity and ecological economics"

by Herman E. Daly

A GENERAL REPLY

After a year and a half of friendly and sometimes instructive debates initiated by my University of Maryland colleague, Mark Sagoff, shortly after my joining that faculty, I think I have finally discovered the key to understanding him: Sagoff is a Kantian ethicist, a deontologist, who fundamentally rejects utilitarian or consequentialist ethics. Consequently he rejects all economics, not just ecological economics, because it is all "the sordid lore of nicely calculated less or more" (to quote the English poet William Wordsworth)—it is utilitarian and consequentialist to the core and therefore irredeemable.

Although the strategy of Sagoff's argument is to use standard economics against ecological economics, his point is to show that there is not a dime's worth of difference between them, at least in terms of what is important to him. Both are consequentialist and utilitarian, whereas salvation is to come through direct spiritual intuition of what is inherently right and by acting accordingly (Sagoff this issue).

Alternatives to economic analysis

Sagoff tells us nothing about his preferred alternative; his direct or revealed spiritual insights into the inherent rightness of acts is not explained. He does not tell us what his perception of intrinsic value is, how to recognize it, how to distinguish more of it from less, or how we should go about increasing it, if indeed we have such an obligation. All we are told is that nature is full of divinity, that heaven is under our feet as well as above our heads, and that John Muir (1912) thought we should look to the God of the mountains rather than to the Almighty dollar.

Fine. Now in the light of that philosophy tell me how large the human population should be, what is the proper level or range of per capita resource consumption, and how much of the habitat of other species we are justified in preempting for human use. Sagoff does not try to help answer these major questions of ecological economics, but he does offer his professional services as a philosophical critic of this way of thinking, favoring yours truly with selection as Exhibit A. Fair enough, the role of critic is surely legitimate—I am a critic of neoclassical economics. It is only fair that critics should be criticized—and the critic of the critic as well.

Because Sagoff uses the neoclassical economist's arguments against the ecological economist, while simultaneously rejecting both arguments, it is easy to get confused about whose voice one is hearing at any given moment. But it is clear that the technological optimism expounded with such enthusiasm in the article represents Sagoff's view, as well as that of his otherwise disposable alter ego, the neoclassical economist. This point is important, because technological optimism mixed with Kantian deontology is an alchemist's elixir. It means that we do not have to be seriously concerned with consequentialist ethics, because technology can always neutralize any unfortunate consequences. No criterion is left but the inherent rightness of an act, because all offsetting negative consequences can be erased by technology. Life is made easy for a Kantian ethicist, if he is also a technological optimist. Utilitarian economists are invited to go soak their consequentialist heads, while deontologist philosophers decide everything on the basis of their deep intuitions of inherent rightness, secure in the faith that technology is likely to mop up whatever mess they make.

Outstripping spiritual purpose

Sagoff wants to arrive at the conclusion of the early environmentalists, as stated at the beginning of his article, namely, "economic activity had outstripped not its resource base, but its spiritual purpose" (Sagoff this issue). In the time of Henry David Thoreau the economy had not yet outstripped its resource base, and instrumentalist arguments were naturally less pressing than they are today. I do not doubt that even then the economy was disconnected from spiritual purpose. Today, however, the instrumental arguments have become important as the growing scale of the human economy has indeed begun to erode its resource base. Does this situation mean that the intrinsic value arguments disappear? By no means. Instrumental value is by definition instrumental to the realization of intrinsic value, and without intrinsic value it would not exist.

Sagoff is fond of the *not this, but that* construction: Not resource base, but spiritual purpose. Why not both resource base and spiritual purpose, especially after a century of exponential economic and demographic growth has changed Thoreau's world beyond recognition? Sagoff's fondness for this construction was noted also by Garrett Hardin (1991), who, in a different context, quoted Sagoff's "remarkable assertion" that: "Pollution results not from our numbers...but from our life styles and rate of consumption" (Hardin

1991, p. 53). The false denial of cause A in order more forcefully to assert cause B is faulty as logic and tiresome as rhetoric. It becomes ludicrous when the effect is caused by multiplying A and B together.

The population context is relevant to the point I am making. Because reproduction is a life-promoting act that our spiritual intuition tells us must be good, it is inconvenient to the deontologist to recognize negative consequences that could lead to too much of a good thing, lest he then be pushed into the consequentialist's camp. Therefore, it is convenient if population size has nothing to do with pollution. Only per capita consumption levels cause pollution, and because per capita consumption at currently desired levels is determined by greed rather than by conjugal love, we can escape the embarrassment of a utilitarian evaluation of the consequences of an excess of blessed events and remain on the high ground of direct spiritual intuition. Whatever base consequence of growth you can point to, our alchemist is likely to convert it into gold with his philosopher's stone of technology, aided by mercurial suspensions of the laws of thermodynamics.

It is instructive to revisit the story of Jonah, with which Sagoff both begins and ends his article. The reason for the tempest is that Jonah was running away, resisting God's command to preach repentance to the Ninevites. Toss Jonah overboard, purify the boat of sin, and all is well—no matter how many people or how much cargo we load on the ship. Our problems have moral causes—that is one lesson Sagoff draws for us from the story. I agree. He also suggests that physical factors have little or nothing to do with our problems. I disagree. I think the true lesson from the story of Jonah comes at the end: On a hill overlooking Nineveh, Jonah sits in the shade, angry because God has forgiven the Ninevites. After hearing Jonah's presentation of God's message—"either repent or be smitten"—the Ninevites prudently decided to repent. But in Jonah's opinion their repentance was too much based on prudence (too consequentialist) and not enough on morality (insufficiently deontological). Jonah's standards were "higher" than God's. Jonah was so angry he wanted to die. God told Jonah to think about the improved well-being of the more than 120,000 Ninevites, and even that of their animals, and to remember that this outcome was a good consequence of Jonah's actions.

SOME SPECIFIC REPLIES

Is knowledge key?

Citing many authorities, Sagoff argues that knowledge is the key, and resources are of minor importance. However, suppose that all man-made capital was reduced to rubble overnight, but all knowledge in people's heads and in libraries was to remain intact. Suppose also that the natural capital remained as it was on the day that all man-made capital was destroyed. Could we, on the basis of our undiminished knowledge, reconstruct the destroyed man-made capital using the remaining natural capital? The answer is no, because we would have to begin again—not with East Texas oil that bubbles from the ground, but with undersea Alaskan oil that is inaccessible; not with Mesabi iron ore, but with leaner ores or recycled metals.

Knowledge, to mean anything for the economy, must be imprinted on the physical world. Not all parts of the physical world are equally capable of receiving and holding the imprint of human knowledge. The quality of matter/energy that makes it receptive to the imprint of human knowledge is low entropy: No low-entropy matter/energy, no man-made capital—regardless of knowledge; less low-entropy resources, less possibility of imprinting knowledge into physical structures (i.e., of making capital). Capital, as economist Kenneth Boulding said, is human knowledge "frozen" into physical structures. Entropy melts those structures, giving rise to the need for a continuous input of low entropy from the environment for maintenance. Organisms also represent information—the genetic knowledge imprinted in physical structures. The population of an organism is not limited by its genetic knowledge but rather by the availability in its environment of the forms of matter/energy needed to convert the genotype into a phenotype. Populations of capital are similar.

Knowledge and low-entropy matter/energy are fundamentally complements. Even though there are many possibilities for substitution of one source of low entropy for another, there is no substitute for low entropy (exergy) itself. Intelligent substitutions and technical adaptations should not blind us to the existence of the fundamental constraint to which they are still only adaptations. To those who get carried away with the independent power of knowledge and information, Frederick Soddy, Nobel Prize–winning chemist and underground economist, provided a pithy reminder, "No phosphorous, no thought." If you are hungry, do not ask Sagoff for a sandwich—he is likely to just give you the recipe.

Economist Robert Solow (1956, 1957) is cited as having provided empirical evidence that most growth over the last century has come from technological progress—from knowledge, not from resources. Solow used a two-factor aggregate production function (labor and capital) to explain production growth. The large, unexplained residual that he found might have been an embarrassment to some, but it was seen by Solow as an indirect measure of technological progress and a confirmation of his hypothesis that technology was of dominant importance. But if technological progress is a residual, then it includes the effect of everything that is not labor and capital, including most notably the contribution of increased resource use!

Other economists (Jorgenson and Grilliches 1967), using the more sensible approach of constructing an index of real inputs and seeing how much its variation explained the variation of real outputs, found small residuals and consequently not much that could be attributed to knowledge or anything else. But Sagoff is convinced that technical knowledge is the quintessence, the fifth essence through which the alchemist can

transform the traditional four essences (earth, air, fire, and water) into each other, thereby fulfilling the quest for unlimited substitution—the shared dream of alchemists and neoclassical economists.

Different types of substitutions

Sagoff fails to firmly grasp the distinction between the simple substitution of one resource for another (bricks for lumber in construction) and the not-so-simple, indeed impossible, substitution of capital in general for resources in general (saws for lumber in the construction of a wooden house, trowels for bricks in the construction of a brick house). Efficient cause (saws and trowels) cannot substitute for material cause (lumber and bricks). They are complements. Sagoff is wrong in his belief that neoclassical economists have never suggested the substitution of capital in general for resources in general. Because he finds my discussion enigmatic, let me quote the clear and precise critique by economist Nicholas Georgescu-Roegen (to which, as far as I can discover, Solow, Stiglitz, or other neoclassical economists have never replied).

Georgescu-Roegen (1979) wrote the Solow-Stiglitz variant of the Cobb-Douglas function as:

$$Q = K^{a_1} R^{a_2} L^{a_3}$$

where Q is output, K is the stock of capital, R is the flow of natural resources used in production, L is the labor supply, and $a_1 + a_2 + a_3 = 1$ and of course, $a_i > 0$.

From this formula it follows that with a constant labor power, L_0, one could obtain any Q_0, if the flow of natural resources satisfies the condition

$$R^{a_2} = \frac{Q_0}{K^{a_1} L_0^{a_3}}$$

This shows that R may be as small as we wish, provided K is sufficiently large. Ergo, we can obtain a constant annual product indefinitely even from a very small stock of resources $R > 0$, if we decompose R into an infinite series $R = \Sigma R_i$, with $R_i \to 0$, use R_i in year i, and increase the stock of capital each year as required by the second equation. But this ergo is not valid in actuality. In actuality, the increase of capital implies an additional depletion of resources. And if $K \to$ infinity, then R will rapidly be exhausted by the production of capital. Solow and Stiglitz could not have come out with their conjuring trick had they borne in mind, first, that any material process consists in the transformation of some materials into others (the flow elements) by some agents (the fund elements), and second, that natural resources are the very sap of the economic process. They are not just like any other production factor. A change in capital or labor can only diminish the amount of waste in the production of a commodity: no agent can create the material on which it works. Nor can capital create the stuff out of which it is made. In some cases, it may also be that the same service can be provided by a design that requires less matter or energy. But even in this direction there exists a limit, unless we believe that the ultimate fate of the economic process is an earthly Garden of Eden.

The question that confronts us today is whether we are going to discover new sources of energy that can be safely used. No elasticities of some Cobb-Douglas function can help us to answer it. (p. 98)

Sagoff thinks that by putting R in the production function, neoclassical economists have given the physical world its due regard, without noticing that in their formulation R can be as small as one likes. This ever-shrinking R is mathematical fun and games with infinity rather than serious economics. To dismiss Georgescu-Roegen's argument by saying that engineers, not economists, are the ones to consult about new sources of energy is far too glib.

Clarifying growth, development, and throughput

Sagoff considers the concepts of growth, development, and scale of throughput to be unclear. Let me attempt to clarify them. Growth is a physical increase in matter/energy throughput. Sagoff is right to point out that concept is absent in mainstream economic thought, which is precisely the problem and the reason for introducing it and distinguishing it from development. Development is qualitative change; growth is quantitative physical increase—this usage is straight from the dictionary, so it is not idiosyncratic, as Sagoff claims. Because standard economics does not make this distinction, gross national product is a mixture of growth and development. Because quantitative physical increase and qualitative improvement are different things, subject to different limits, conflating them can, and has, caused much confusion—a confusion in which growth economists, like rabbits in a briar patch, can hide under one bush and when discovered can then scurry to the other.

Consider a given pattern or vector of throughput flows of matter and energy. Multiply that vector by a scalar. The result is an increase in scale of throughput. An increase in scale will surely result in a greater load on the environment. Of course, a different pattern of throughputs may be more environmentally benign. But a scale increase in that, or any other, pattern would still increase the environmental load relative to what it was. Sagoff mixes scale increase with pattern change.

"If we ignore pollution problems, fossil fuels could subsidize the global economy for quite a while," Sagoff explains (this issue). Sure, but why ignore pollution, because that is the relevant constraint. Indeed, falling extraction costs, considered as evidence against scarcity in another context, make the pollution problem worse. It is in the context of a discussion of entropy that Sagoff considers it appropriate to ignore pollution problems. The implication that pollution is not a manifestation of entropy is part of Sagoff's alchemy.

Peter Vitousek and his colleagues' (1986) calculation is a reasonable attempt to put some quantitative dimension on the scale of the human economy relative to the total ecosystem. Sagoff's riposte that the whole world has long been co-opted by humans and that therefore the relative size of the human niche is by definition 100% is not a *reductio*

ad absurdum of Vitousek and his colleagues. It just calls attention to the need, recognized in practice by Vitousek and his colleagues, to determine how significant the chains of cause and effect have to be before we define them as part of human cooptation.

The precautionary principle advocated by Robert Costanza (1994) and others should be compared to Sagoff's technological optimism, not to the savagery and inhospitality of nature, especially because in other contexts we are told that nature is divine, heaven is under our feet, and Muir's God of the mountains will take care of us. If one is a technological optimist and believes that resources are unimportant for the economic process, then one should not object to a policy of limiting the resource throughput, thereby raising its price. Such a policy would induce exactly the technological advances that use resources more efficiently—the very technology in which the optimists have so much faith. If a side effect of reduced resource throughput is to gain some insurance under the precautionary principle, as well as to preserve more of the earth as habitat for other species, then why object? Does the deontological, technological optimist have the courage of his convictions? If so, then join the ecological economists in advocating the policy of raising the price of natural resources and natural capital services, say through shifting the tax base away from income and onto throughput. If technology is the answer, why not actively promote its advance?

I and many other ecological economists have long considered that the limits to growth stem from both possibility and desirability. We are not addicted to the *not this...but that* construction. Even so, one welcomes Sagoff's reminder that economic growth may be undesirable even if possible. We also recognize that, after some point, growth becomes impossible, even if still desirable. However, in most cases what should limit economic growth is neither pure desirability nor pure possibility. It is the economic interplay of these two considerations, as reflected in the comparison of benefits (desirability conditions) with costs (possibility conditions). Exactly the "sordid lore of nicely calculated less or more" that has become Sagoff's bete noire.

If we believe that expanding the human niche a bit more is likely to, at the margin, increase intrinsic value by more than the consequent reduction of the natural environment is likely to diminish it, then we should grow a bit more. If we believe that a reduction in the human niche is likely to reduce intrinsic value by less than the consequent expansion of the natural environment is likely to increase it, then we should shrink. This approach is a consequentialist one without apology, although its demands far exceed the capacity of market prices to measure the relevant costs and benefits.

If Sagoff wants to tell standard economists not to be so anthropocentric in their concept of intrinsic value and to remember the welfare of other species in some appropriate way, then he should join ecological economists. If he wants to tell economists to consider the welfare of future generations, then more reason to join. If he wants to remind economists that markets do a poor job of measuring full costs and benefits, still more reason to join. If he also thinks that scale and distribution issues cannot be handled by markets alone, then he would be an ecological economist.

After we have recognized the intrinsic value of the natural world, then we have an obligation to protect and increase that value. That realization leads us to pay attention to instrumental value. From a philosopher, we might reasonably have hoped for enlightenment on the source and basis of intrinsic value. Instead Sagoff puts intrinsic and instrumental value in opposition to each other in another of his *not this...but that* formulations. But in this case the relation absolutely has to be *both-and*. Unless we have a notion of intrinsic value then there is nothing to which instrumental value can be instrumental. And unless we have a notion of instrumental value, we have no operational means of serving intrinsic value. It is a further mistake to identify intrinsic value with morality and instrumental value with prudence and then set up an opposition between them as Sagoff does.

Intuitions of inherent rightness

Prudential reasoning in terms of costs and benefits arising from the consequences of our actions, is, in my opinion, necessary to protect and enhance the intrinsic value of God's creation and its evolutionary potential. We must pay first attention to our intuitions of inherent rightness, especially as guided by religious tradition. I hope Sagoff helps us with that someday. But without cross examination in the light of consequences, our intuitions of inherent rightness can lead to fanaticism. Furthermore, I think those religious intuitions are in danger of being distorted, mainly by the alchemical heresy that technology is omnipotent, but also, paradoxically, by pantheistic sentimentality about the divinity of nature.

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