Accounting for the Environment---Valuing the Priceless

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The genesis of this paper happened several years a go with an off hand response to a friend's complaint about the air quality standards in the San Joaquin Valley. She wondered why it was that if we knew so much about the damaging effects of poor air quality on our health our government didn't do more about it. It is, of course, but not with the speed that most would like to see. (This fact was recently reinforced when our country's President stepped in at the 11th hour to influence the EPA in its court ordered deadline to announce new air quality standards. They were lower than the existing standards, but were far weaker than their own scientists had unanimously recommended.)

My flip answer was that it was in large part because bad air quality was actually good for the economy, at least by the most common measure of a healthy, growing economy, the Gross National Product (GNP). First, it helps pollution-generating industries save money by not charging them for the disposal cost of a portion of their waste stream, thereby improving their

bottom line. And, second, the harm to individuals' health is not necessarily subtracted from the GNP, at least not in ways that show up as clearly measurable. Further, when someone seeks medical attention for asthma induced by poor air quality, the money they pay for health care to doctors and hospitals is added to the GNP, once again signaling a healthy, growing economy. With a positive reinforcement cycle like that, it is easy to see why there is resistance to changing air quality standards too quickly.

This view of mine was based on a few readings and a growing, though not informed, sense that our society engages in a form of economic slight of hand. Each time I confronted the subject in conversation, I was reminded of how little I really knew, despite several undergraduate and graduate economics classes. Not only did I doubt my own understanding, but always the skeptic, wondered what our national decision makers were leaving out of the equation when setting public policy, or planning or funding new projects. If we are to rely on an "invisible hand" to properly allocate resources, provide the greatest good to the widest group of our citizens, then shouldn't this "hand" be guided by all relevant information, not simply an artificial construct of economic well being?

It seemed an easy subject. I am an engineer trained in Benefit-Cost Analysis (BCA) decision making. It should only be necessary to include all the relevant data and factors in our record keeping. With this foundation of "complete" information our GNP and BCA policy and project decisions would naturally arrive at appropriate decisions affecting us and our resources. How hard could it be? As I discovered, quite! This paper is an exploration of the challenges and obstacles of the task that touches on, among other disciplines: thermodynamics, social justice, and philosophy.

The title of this paper is "Accounting for the Environment", but its focus is economics, since economic theory guides public policy setting and underlies measuring devices like the GNP. Clearly, there are shortcomings in our method of national accounting. They exist in perspective; measurement, and in valuation. In fact, some of the greatest challenges involve assigning accurate values to those things not traded in open markets, like air or water quality or view sheds, and vague concepts such as "quality of life". With this preamble, let us explore what's wrong with how we account for our economy, why we measure it the way we do, why that is a problem, what the constraints are to improving how we measure, and what we can do to address it that doesn't make a shambles of our economic record keeping or

our well being. I hope it will provide you, the reader, with at least a frame work to better understand the need for, and the challenge of accounting for the environment, and placing a value on that which has no market value, but is so precious to us.

The failure of conventional economics and our popular measure of economic progress, the GNP, is akin to Frost's "The Road Not Taken"; it is in what is not said, what is left out. Conventional economics does not value a thing or a service until it is part of an economic transaction. For example, a tree in the forest or fish in the sea has no value until it is harvested. Then, the wages paid the feller or fisherman is added into our GNP. Further, unpaid work, like stay-at-home mom's (or dad's) and grandparent baby-sitting have no value because no money changes hands. This has some far reaching consequences considering that much of the third world's economic system is based on barter or unpaid harvesting of fiber, food, and fuel. The GNP makes no value judgments about financial transactions. Ironically, illness, crime, and accidents augment our GNP in the form of medical service payments and payrolls for police and prison guards. Likewise, cleanup of environmental spills and other natural disasters increase the GNP, without furthering our financial or emotional well being beyond their starting point.

But there is much more to the discussion of "what is left out." To begin, the *total economic value*[1] of the natural world is left out of our method of accounting for our national financial growth, the GNP, the proxy measure of our welfare. These values fall into four basic categories: *direct*, *indirect* or service, *optional* or future, and *existence* or an individual's perception of a thing for its beauty alone and what it adds to their quality of life. *Direct values* include the pre-mined or pre harvested capital values of mineral deposits, aquifers, trees, rattan, nuts medicinal plants (over 2/3's of our prescription medications are derived from plants) and fish stocks in oceans, lakes and rivers. Examples of *indirect values* are the services or functions provided by of forests in carbon sequestering/climate modification, oxygen production, as watersheds, and for erosion control. Oceans, too, sequester carbon and serve as heat sinks; estuaries are important nurseries for fish stocks. Our atmosphere serves as a nearly limitless heat- and pollutant-sink. *Optional values* include the possible value of yet undiscovered medicinal plants or organisms in rain forests. Anyone who has witnessed the deterioration of our San Joaquin air quality has felt the loss of our beautiful light, of star-filled nights, and smog-burned evergreens at the bathtub ring in

[1] Economic Values and the Natural World, p. 16

our mountains. These are *existence values.* Not too mention that the intact value of one of these resources may in fact be greater than the sum of its parts. Finally, to these, we must also include the value of our own human life and health.

Yet, no matter how important these natural resource funds and functions and our life and health are in economic decision making, there are larger challenges to establishing a reliable, measurable value for them. How do we price values for which no markets exist? There is also a social justice or distribution question-- whose values matter? How do we avoid discounting the poor or yet unborn future generations? What financial discount rate do we apply when assessing the cost of future pollution? If it is high enough, future generations don't matter. This brings up the question of sustainability in our economic decision making. Finally, how do we relate all to some common unit?

Values can, and are, set for many natural resources or estimated for the functional values of forests and oceans. But they are often clumsy, reverse calculations of what it takes to clean up a water supply, rather than its pristine value. One technique to establish how much a case of bronchitis was

worth involved indirect mall interviews asking unsuspecting shoppers to choose between two communities and how much more they would pay to live in the one where they had a lower chance of contracting bronchitis. This exercise produced a value of $883,000 in 1987 dollars, and was later used by the EPA as the starting point for valuing chronic bronchitis in a benefit cost analysis of the Clean Air Act. For the record, the EPA eventually revised the amount down to $260,000 by throwing out the extremes and applying a few more statistical manipulations.[2] Yet more surprising, and a demonstration of the cost and difficulty of establishing values for our state of health, this same study and figure was used by the EPA in evaluating allowable arsenic levels in drinking water to assign a value to non-fatal bladder cancers.[3]

Estimates are often fraught with wide degrees of uncertainty in pricing factors. For example, "Principe (1989) estimates that the probability of a given plant species giving rise to a successful drug is between 1 in 10,000 and 1 in 1,000. These estimates are based on discussions with drug company experts. Estimates of the number of plant species likely to be extinct in the next 50 years or so vary, but a figure of 60,000 is widely quoted. This suggests that somewhere between 6 and 60 of these species

[2] Priceless, pp. 94-97
[3] Ibid., p. 97

could have significant drug values. Put another way, if biodiversity use was favored over alternative land uses, the realized benefit as far as medicinal drugs are concerned would be the economic value of these 6 to 60 species."[4,5] The estimated annual loss to the US economy alone would be approximately $8.8 billion. By comparison, the GNP for the whole of the Brazilian Amazonia is approximately $18.0 billion.

The criteria for valuing a human life are just as complicated. Methods vary widely between what life insurance actuaries, personal injury attorneys and a federal agency using benefit cost analysis would assign. Life insurance underwriting standards only permit insuring someone up to the limit of their lost financial value. By that standard, a 35 year old earning $50,000 per year is worth much more than a 50 year old earning the same amount. Of course that wouldn't play in a murder trial, nor would it when explaining grandpa died prematurely of "name your toxin" worksite poisoning. If there is to be a just value, all lives count equally.

Valuation is necessary if we are to implement projects, programs and policies. But these, too, raise their own sets of questions. How shall we

[4] Economic Values and the Natural World, p.85
[5] Principe, P., The Economic Significance of Plants and Their Constituents as Drugs, *Economic and Medicinal Plant Research*, vol. 3, London, Academic Press,1989 pp1-17

apply the values, how to apply regulation to the benefit of the public with out crippling the economy or harming one sector over the other? Who owns the resources being regulated? An industry that has for generations spilled some of its waste product at no cost into the air or a water body, might consider it a "taking" by the government if it begins fining the corporation for the doing so or taxing it based on pounds of effluent per year. Can't the market regulate itself through classic market mechanisms? Not if the asset is not owned by an individual or a government body. Who owns the atmosphere? When everyone "owns" an asset, no one owns it. This is the tragedy of the commons where each user of the common pasture independently determines that by adding one additional animal to their grazing herd they will reap 100% of the economic benefit of it, and share in perhaps only 1/100 of the damage or loss caused by it. This is rarely a problem at low density useage, but that is not where we are in the world today. One need only look to the problems we and all fishing nations face in the international seas with declining fish stocks. It is, also, inappropriate to think or expect corporations/industry to be concerned about the environment where externalities, i.e. pollution are involved. They are neither moral nor immoral.[6] They are charged with earning a profit for their shareholders. To

[6] Supercapitalism, p. 12

act in any other manner is fiscally irresponsible and their officers would suffer

The preceding examples are not meant to shock; simply to illustrate the complexity of the valuation and regulation challenges.

Let us now turn to reviewing how we arrived at our current methods of measuring what is important to us financially and how the market works for us to allocate scarce resources make policy decisions. For all its shortcomings and challenges, the GNP has remained a popular instrument for measuring our economic and, by proxy, our welfare. There are several reasons for this:

1. The importance of measuring economic growth, both from the perspective of improving that which we measure or track and for comparison to other economies.
2. The environment is still viewed by many as limitless.
3. Our free market system is seen as the best means of allocating "scarce resources.", and

4. It is entrenched; changing it would disrupt large amounts of recorded economic data, so there is a great deal of inertia to changing it.

Economic theory defines itself and its objectives: "…. the study of the allocation of limited, or scarce resources among alternative, competing ends. We can choose, for example, to allocate steel to plowshares or SUV's……Really, economics is about what we desire and what we are willing to give up to get it."[7]

Further, economic theory holds that "Welfare depends on what people want, which they reveal through market transactions—by what goods or services they buy and sell. Naturally this only reveals preferences for market goods and implicitly assumes that non-market goods contribute little to welfare. Humans are assumed to be insatiable so welfare is increased through the ever-greater provision of goods and services, as measured by their market value. Thus, unending economic growth is typically considered an adequate measurable proxy for a desirable end." [8]

[7] Ecological Economics, p. 3
[8] Ecological Economics, p. 3

If one were to point to a single reason, however, why conventional economics measures what it does, it is because "…conventional economics sees the economy, the entire macroeconomy, as the whole. To the extent that nature or the environment are considered at all, they are thought of as parts or sectors of the macroeconomy---forests, fisheries, grasslands, mines, wells, ecotourist sites, and so on."[9] Conventional economics models itself as an isolated system, with the earth and its natural resources contained within it. Yet it cannot be so in reality, for it is not a perpetual motion machine. If it were, it would contradict the Second Law of Thermodynamics---the entropy law. The construct of macroeconomics' circular flow of Goods and Services for Factors of Production appears to be complete, but is only a useful abstraction of the real world for the basis of monetary, fiscal, and exchange rate policy. If it were the whole, then it would not be reliant upon continuing inputs of raw materials (mines, wells, fisheries, croplands) and to the world's ecosystem's sinks for its waste (atmosphere, oceans, rivers, lakes, and dumps.) There is a linear throughput by which the economy lives off the environment. The economy is an open system that exists within the closed system of the earth.

[9] Ecological Economics, p.15

Unfortunately, it this mistaking of the part for the whole that has lead to our failure to measure and account for the value of all the natural resources expended each year and the cost of the waste or pollution. Although necessary to sustain our lifestyle at our present level of technology, the amount is not trivial: "…In sum, Americans waste or cause to be wasted nearly 1 million pounds of materials per person per year."[10] "If the Earth's resources were available in infinite quantities, and if they could be deployed at zero cost, there would be no economic problem."[11] If the economy were sufficiently small, it could fit within an "infinite world of natural resources." But this is an "empty" world view of things and the world is not infinite and it is filling up rapidly. As a closed system, there is a finite limit to the replenishment rate of its renewable resources, and ability of the oceans and atmosphere to assimilate waste. As growth pushes us toward a "full" world, the limiting factor in production becomes natural capital, not manmade capital. For example, the limiting factor in the fish catch becomes the supply of fish in the ocean, not the number of fishing boats. Where this misguided approach to economic accounting becomes a serious problem is that by focusing on the wrong capital account the macroeconomic model, lacks a "Stop" signal for environmental asset depletion. There is only the

[10] Hawken, A. Lovins, and H. Lovins, *Natural Capitalism*, Boston, Little, Brown, 1999, pp. 51-52
[11] Economic Values and the Natural World, p. 1

"Go" signal for more throughput, promoting unending economic growth, the desired measure welfare. In other words, failure to account for "external" costs can lead to a misallocation of resources because the market mechanism does not have the information to calculate the opportunity cost of extracting the next, marginal unit of resource or dumping the next, marginal unit of waste. Or, the market keeps signaling, "build more boats" when the supply of fish runs low.

To better appreciate the value of a stop or slow sign, consider the popular riddle of the Petri dish. If the area of the dish covered in bacteria doubles every hour, and the dish is inoculated at noon on day one, and is completely full at noon on day two (and thereafter the population crashes because it has exhausted its food supply and is inundated in waste), when is the dish half full? The answer, of course, is 11:00am on the final day. At 9:00am it was 7/8 empty! The question is: How close are we till noon? A follow up question is: How full must it be before we feel the pinch? Hint: Think of your computer hard drive at 75% full. Hint 2: Think of living in Hong Kong.

Of course, pollution and natural asset depletion have not gone un-noticed. In the United States we know the Ogllala aquifer, filled with ice age glacial melt, is rapidly depleting, that the Riverside and portions of the San Joaquin Valley aquifers are contaminated by nitrates from human activity, and that the west coast salmon runs are at record and dangerous lows. And we are well aware of the deterioration of San Joaquin Valley's air quality. From this public knowledge and subsequent political policy making we now have important national laws like the Clean Water Act, the Clean Air Act, the Environmental Protection Act, and dramatic fish stock protection regulations proposed and actual. There is ample evidence that progress has be made. The cap and trade provisions of the Clean Air Act have done much to reduce acid rain in the eastern states, and near shore fishing stocks have recovered where monitored and regulated. The point is not that nothing has been done to address the problems, but that more must be done to build in self-correcting, early warning features in our market system to prevent further degradation of our environment and our health. And perhaps what is called for is a paradigm shift in our approach to solving the complex valuation problems, and the subsequent challenge of designing appropriate policies designed to achieve what everyone does want---a healthy economy and a healthy life.

It would be a mistake to say that traditional economists have ignored the environment altogether. Pressure from the public, policy makers and the market itself due to a rapidly "filling" world have forced them to develop means of accounting for the environment. In fact, they have created "Environmental economics, a subset of neoclassical economics, recognizes that welfare also depends to a large extent on ecosystem services and suffers from pollution, but is still devoted to efficiency. As markets rarely exist in either ecosystem services or pollution, environmental economists use a variety of techniques to assign market values to them so that they, too, may be incorporated into the market model."[12] Environmental economics' approach to correcting the problem has been to create side accounts and develop ways to price "externalities" so as to bring them into the current market model; a process that becomes more awkward with time. And, to continue our earlier discussion of conventional economics' objectives, it sees efficiency as so important that it is often an end in itself. This is where a new view of accounting, Ecological Economics, departs from conventional, and its subset, environmental economics. Ecological economics sees efficiency as subordinate to scale or sustainability. By way of example, a

[12] Ecological Economics, p.5

ship efficiently loaded will be in trim and float upright. Yet to overload it, is to risk sinking it, efficiently, in the first large storm. Scale is more important than efficiency. This new school of economics is not a repudiation of conventional economics. It is a necessary outgrowth from it, and represents a dramatic shift in perspective or paradigm. It shares conventional economics concerns for a good allocation of resources as efficient, a good distribution of income as just, and a good scale as at least sustainable. "As growth pushes us from an empty world into a full world, the limiting factor in production will be natural capital, not manmade capital……As we move into a full world, economic logic remains the same---to economize on and invest in the limiting factor. But the identity of the limiting factor changes from manmade to remaining natural capital, and our economizing efforts and policies must change accordingly."[13]

I draw two conclusions from the various sources for this paper and the news items we can read daily on the environment, our natural resources, and our own financial and emotional sense of well being. First, it is important to accept and work with the concept that our economy is a subset of our environment. As the economy gets grows in its goal of providing "more

[13] Ecological Economics, p. 426

welfare for more people" it can and will fill the world. "Once this growth in scale has become uneconomic, it can no longer be appealed to as the solution to poverty."[14] We will have run out of the fuel that drives the bus, and technology cannot create matter out of energy—at least not in any sustainable or useable way. Second,

Albert Einstein's well known quote comes to mind, "Not everything that can be counted counts, and not everything that counts can be counted." Our method of benefit cost analysis may be the best we means we have for enabling our decision making process, but it is weak indeed. It typically overvalues values costs, usually the more easily measured half of the equation, and undervalues that which is most important to us—the intangibles of health, a bright spring morning, a healthy environment for our children to play in. "To say that life, health, and nature are priceless is not to say that we should pay an infinite amount to protect them. Rather, it is to say that translating life, health and nature into dollars is not a fruitful way of deciding how much protection to give them."[15]

We need a new a new approach that blends new economic perspectives, ecological economics, with a political philosophy that "… offers an attitude

[14] Ibid., p. 427
[15] Priceless, p. 9

rather than an algorithm”[16] to make these decisions so important to us, our world, and our progeny.

[16] Priceless, p.11

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