NATURAL CAPITAL AND THE LIMITS TO GROWTH

S. C. Bachus

If the West Coast intelligentsia indeed proves not to be a contradiction in terms, then the *San Francisco Chronicle* on sporadically rare occasions serves to give voice to the region's intellectual concerns. For this reason many of its bleary-eyed readers awoke on the morning of January 4 this year to read front page headlines that proclaimed in a font size usually reserved for political *peccadilloes* that there were "Efforts to curb unbridled growth that's killing the planet" (*S.F. Chronicle* 1/4/14).

Although the article's title may have induced both shock and awe for some of the *Chronicle's* environmentally unwashed readers, it was a well written piece of journalism. Authored by Carolyn Whitehead, the thrust of the article is that there is a growing intellectual concern that the world's resources are being irretrievably lost to fuel economic growth, and that conservation of these resources as *natural capital* should be a higher global priority than feeding the engines of growth. This proposition, as might be expected, is subject to debate and Ms. Whitehead provides a balanced review of the issues.

Taking the position of prioritizing natural capital, Gretchen Daily, a Stanford University professor and also director of the Natural Capital Project, is quoted as saying, "The physical pressure that human activities put on the environment can't possibly be sustained." And, from the other side of the aisle, Larry Summers, a former adviser to President Obama, retorts that, "The idea that we should put limits on growth because of some natural limit is a profound error, and one that, were it ever to prove influential, would have staggering social costs." The extremity of these views, if nothing else, should alert academic event planners that it would probably be unwise to invite Ms. Daily and Mr. Summers to the same social gathering. Nonetheless, the article continues objectively on to discuss the impact of unfettered economic growth on natural capital and the resulting implications for resource exhaustion, pollution, and ultimately the human condition.

What is interesting about this article, although unintended by its author but consistent with the *Chronicle's* enduring policy of "if it bleeds it leads", is that it was cast as a front page scare piece announcing yet another new threat to the narcissistically idyllic world of the San Francisco Bay Area. Not that there is anything wrong with shaking up Bay Area narcissists now and then. But, where is the Club of Rome in this purportedly cutting-edge dialogue of economic *sturm und drang*? Assuredly some wag will observe that the reason the Club is missing is that it has decamped to Switzerland. But, more important is the fact that many of the issues inherent in the current natural capital debate were adumbrated over forty years ago with the Club of Rome's publication of *The Limits to Growth*.

Founded in 1968 at the Accademia dei Lincei in (obviously) Rome, the Club has assumed the role of a global think tank whose members, according to its website, are

"…personalities from politics, business and science, men and women who are long-term thinkers interested in contributing in a systemic interdisciplinary and holistic manner to a better world…members share a common concern for the future of humanity and the planet." In this role, which approaches the functional equivalent of the RAND corporation if it were run solely by environmentalists, the Club received lasting notoriety if not infamy for its publication of *The Limits to Growth* in 1972. The purpose of the book was to report the results of a research project designed to model global resource consumption where five key system state variables were assigned alternative simulation values. The state variables employed in the so-called "World3" model used for the simulation were *world population, industrialization, pollution, food production*, and *resource depletion*. Historically, the World3 model was an enhancement of the World2 global simulation model originally developed by Jay Forrester at the Sloan School of Management at MIT. Forrester is best known for his seminal work in system dynamics, the operational implications of which are discussed first in his *Urban Dynamics* published in 1969, and then subsequently in *World Dynamics* in 1971.

Although it became an environmental best-seller, *The Limits to Growth* was not universally well received when it was first published. The most strident criticism seems to have come from economists, many of whom were, and continue to be, well paid to keep the mantra of economic growth echoing off the marbled halls and walls of corporate America. Typically, their criticism has focused on specific quantitative values projected by the World3 model, which in fact did not occur – for example, a predicted global oil reserve of 445 billion barrels in 2003, when in that year reserves actually totaled 1.3 trillion barrels. In all fairness to the authors of *Limits*, it should be remembered that the projected 445 billion barrels was based on known oil reserves in 1972, and that the projection reflected a single system state variable the value of which could be altered for simulation purposes. Indeed, criticisms such as these implied that *The Limits to Growth* predicted that with the coming of the 21st century the world would be suffering from critical shortages of natural resources such as petroleum. To the contrary, and as observed by Matthew Simmons (see "Revisiting *The Limits to Growth*"), "…nowhere in the book was there any mention about running out of *anything* by 2000. Instead, the book's concern was entirely focused on what the world might look like 100 years later. There was not one sentence or even a single word written about an oil shortage, or limit to any specific resource, by the year 2000."

Economists have always excelled in contests involving the quantitative marking of intellectual territory, but that penchant for academic alpha status should not obscure the validity of the conceptual framework underlying *Limits* or the computer simulation techniques supporting its findings. Likewise, from the outset it would be wrong to think that it was Jay Forrester's divine hand that somehow made the firmament ready for the World3 model and with it *The Limits to Growth*. To the contrary, concepts such as natural capital, system dynamics and ultimately their ramifications for economic growth find their roots in a world historically remote from the issues of computer models and global system simulation.

After joining with Matthew Boulton to manufacture the first commercially successful steam engine, James Watt in 1788 discovered a wonderful little centrifuge-like device that would prevent his new machine from "running-away" with a full head of steam. This cleverly conceived piece of machinery Watt referred to as a *governor* because it controlled, in addition to the throttle, the energy output of his newly patented engine. Watt's choice of the word *governor* is fascinating in that it finds its linguistic roots in the Greek word κυβερνήτης (*kybernētēs*) which translates directly into our modern usage of the term *cybernetics*. Certainly, it would be ill-advised to consider Watt a nascent systems theorist for precisely the same reason that we cannot think of Willard Gibbs as the progenitor of entropic information theory – i.e., their work was not conceptually based on a pre-existing systems theoretic framework. Nonetheless, we cannot dismiss the importance of both Watt and Gibbs in contributing to the epistemological foundation of later systems theorists and thinkers such as Alan Turing, Norbert Wiener, Claude Shannon, Ludvig von Bertalanffy, and those that followed their path, including of course Jay Forrester, and the authors of *The Limits to Growth*, Donella Meadows, Dennis Meadows, Jørgen Randers, and William W. Behrens.

But where does that path lead, and will it help us find a way out of the apparently contradictory but fragile woods of natural capital preservation and the big bad wolf of unchained economic growth? To find our way, we best choose a global route, given the worldwide implications of increasing population, pollution and related issues of resource depletion. Although Herr Spengler would probably advise to the contrary, perhaps we should simply trace the path taken by those less than contented legions of Saxon and other Frankish tribes who settled in the plains and valleys of Western Europe, and whose progeny for a millennia following flowed in successive waves on to the plains and valleys of the Americas. It was the pressure of an expanding population that drove the Saxons off the North German plain, and it was this same demographic force that ultimately settled the plains and valleys of the New World. No matter by which academically correct or incorrect term we name it, was not the Westward Movement, or Manifest Destiny, or the California Dream, the product of an expanding population that required a concomitantly increasing resource base? Certainly, one man knew the answer to this question, and it is for this reason he remains one of the shrewdest capitalists in the annals of American economic history. Thomas Jefferson, with the Louisiana Purchase, set the bar so high for ROI -- given the natural capital returned on an investment of $15 million -- that in comparison today's venture capitalists look like pikers.

Regardless of Jefferson's foresight, and viewed from the standpoint of conventional systems theory, the economic growth of the western democracies has nonetheless come with some rather significant costs. After those grim-faced Saxons waded through the mud of the Jutland marshes, got in their boats and arrived in post-Roman Britain, they found across that bucolic green island giant oaks – great trees unknown in the tidal wastes of their homeland. By the 18th century, the oak forests were almost all gone, having been felled to build the royal navy and the British mercantile fleet. But, of course there were trees in the colonies - in fact there were a lot of other resources out there across the oceans. Systemically, in view of an expanding population, growing

industrialization, and significant local resource depletion, 18th century Britain would have become a critically closed system, had it not opened that system by expanding its political and economic boundaries to coincide with global lands that became its Empire.

Unfortunately, the intellectual *damnosa hereditas* of the West has been the continuing assumption by its economists that the earth is an infinitely open system. This little bit of theoretic deception could last, however, only as long as we kept expanding the boundaries of our economies until they ultimately matched those of the planet. Not a tear was shed in 1893 when Frederick Jackson Turner announced that the American frontier was closed. Not to worry, America had simply to grab the world by its bully tail, and we would have all the resources our gluttonous economic appetites desired. And, we did – just look at the petroleum reserves, the forests, the mineral deposits that *were* out there. In this sense Marx had it only partially right: not only does capital follow labor – the truth of the matter is that capital follows just about any economically exploitable resource. Many of the passengers on the two-century train ride taken by the American economy missed hearing what the conductor was really announcing in 1893 – there's only one more stop before we reach the end of the line. Now, in the second decade of the 21st century, desired or not, we have come to the end of tracks – our economic systems are globalized and their boundaries are those of the planet.

But, some would argue, is not there a contradiction here? If the Earth is an infinitely open system, then assuredly there must be an infinite reserve of resources. Beyond its Aristotelianism, this bit of malign reasoning overlooks the operative implications of using *infinitely* as an attribute when describing the planet as an open system. Yes, Earth is an open system, and will be one as long as it has a sun around which it can orbit. It is the sun, or more precisely, the energy from the sun that renders our rather small little world, and the natural processes that occur upon it, an open system. Economists -- especially those of Mr. Summers ilk who in Pavlovian cadence bark "Malthusian" every time they perceive a threat to economic growth – must realize that, although planet Earth is an open system, it most assuredly is a *time-dependent* open system. The processes that put petroleum in the ground did not occur in six divinely inspired days, and the same thing can be said for the great oaks that once grew on English hillsides. Yes, assuming the Earth gets a re-run of the Eocene, then we may once again have a seemingly endless reserve of petroleum. That, however, may take awhile, so economic growth and its proponents may just have to be a bit more patient than has historically been the case.