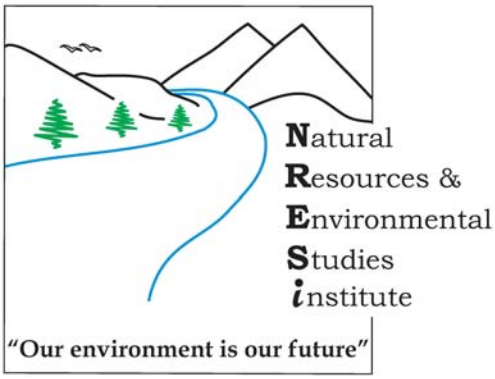

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LET'S GET SERIOUS ABOUT (UN)SUSTAINABILITY (OR IS IT ALREADY TOO LATE?)

BY
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This paper is based on the First Annual Natural Resources and Environmental Studies Institute Annual Lecture presented by **Dr. William E. Rees**, on 16 March, 2006. Dr. Rees is with the UBC School of Community and Regional Planning, University of British Columbia, #433-6333 Memorial Road, Vancouver, B.C., V6T 1Z2 Canada.

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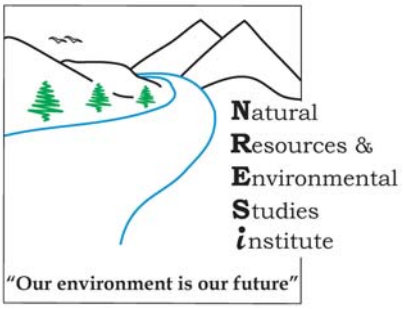

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Abstract

On 16 January 2006 James Lovelock, author of the Gaia hypothesis, wrote that “before this century is over billions of us will die and the few breeding pairs of people that survive will be in the Arctic where the climate remains tolerable.” In Lovelock’s view, humanity’s technological hubris has done us in, our attempts to manage the planet are failing and, in the face of accelerating global change, “sustaining” technoindustrial civilization is no longer a possibility. Other scientists, while not necessarily accepting the harsh finality of Lovelock’s gloomy prediction, share his basic diagnosis on the health of the planet. The Millennium Ecosystem Assessment (2005) issued a “stark warning” to world leaders — indeed, to all of us: “Human activity is putting such a strain on the natural functions of the Earth that the ability of the planet’s ecosystems to sustain future generations can no longer be taken for granted.” In this paper I examine the biological, cultural and biophysical factors that have driven modern society to the point where such “stark warnings” have become necessary. I then show why concepts and policies currently advanced under the rubric of “sustainable development” are so generally ineffective. Finally, consistent with biophysical and human behavioural reality, I outline a minimal set of ecological and socio-political conditions that would have to be met for true sustainability. Getting serious about sustainable development will require an unprecedented display of both deep compassion and hard cold reason as the international community considers the dire implications of our prevailing growth-based global development paradigm. Abandoning core cultural values, beliefs and assumptions that have become maladaptive may be wrenchingly difficult but it is also necessary if humankind is ever to become, in Lovelock’s words, "…the heart and mind of the Earth, not its malady."

Introduction: On Alternative 'Realities'

This paper is about environmental trends and the human prospect. My intent is to explore human biophysical reality, to assess whether we are actually experiencing an ecological crisis and—if we are—to suggest what we should be doing about it. This seems like a fairly straightforward objective, but even *that* perception is actually part of the problem. The way we think about 'the environment' is conflicted and much so-called 'environmental policy' is therefore useless or even counterproductive. Should I have warned you that "Getting Serious about Sustainability" requires an unconventional approach?

We can begin to understand why this is so if we reflect for a moment on the nature of 'reality.' To begin with, humans have no direct experience of 'reality'—even our most immediate sensory perceptions are reconstructions based on various secondary phenomena. For example, you don't actually see 'me' up here, you perceive a synaptic *reconstruction* of a complex, multi-coloured inverted image formed on the retinas of your eyes. These images obviously aren't 'me' and are formed from only a tiny fraction of the light that is reflected *off* me. The light itself is filtered and bent by the cornea, lens and aqueous and vitreous humours of your eyes and the images have been communicated via chemical transformations and electrical impulses to the visual cortex of your brain. Once there, yet another mysterious transformational process reconstitutes all this much filtered and distorted information into a mere *perception*, yet this is the entity that you take to be a physical object and component of your reality.

Now if our seemingly most direct experience of physical things is really so much at distance from 'reality', consider how much more tenuous and potentially contentious are our intellectual reconstructions of abstract concepts, tumultuous events, and truly complex systems. Different people don't even 'see' these things through the same conceptual lenses. Each of us brings his/her own personal and educational experiences and any number of political, disciplinary, religious and social biases to bear on our interpretations of what we see. All of these culturally acquired predispositions reflect, filter and distort any new 'incoming' data even as we attempt to make sense of it. Thus, not all new data are treated equally by equally intelligent individuals. And it is entirely possible for different observers, by selecting and connecting different bits of information from exactly the same sources, to construct rather different perceptions of the same phenomena (i.e., 'the world') and take these for 'reality.'

Sometimes, of course, we come together to discuss, massage and meld our differing interpretations to reach a mutually satisfactory explanation. (Consider formal inquiries, legal tribunals or courts of law, for example.) In effect, we come to a shared version of 'truth' by negotiated agreement. This process is what sociologists call 'the social construction of reality', but

because much of the negotiated vision may be little more than *shared illusion*, it really ought to be called 'the social construction of *perception'*.

The main point is that different people 'connect the dots' in conflicting ways and even if we eventually agree on the picture revealed, we should not assume that the resulting image is 'valid' (in the sense that it is an accurate depiction of biophysical reality, for example). The simple fact is that some pictures are better than others and some of the 'others' may actually be severe *distortions* of reality. This is hardly an original observation but sometimes, before we go to the wall over some constructed belief, we need to be reminded of it. Linguist and media theorist Neil Postman (1999) put the matter this way:

> "You may say, if you wish, that all reality is a social construction, but you cannot deny that some constructions are 'truer' than others. They are not 'truer' because they are privileged, they [become] privileged because they are 'truer.'"

Philosopher Karl Popper (1953) had a similar view:

> "What the scientist's and the lunatic's theories have in common is that both belong to conjectural knowledge. But some conjectures are much better than others…"

All of which brings us to conflicting visions of the ecological plight of humanity.

To some people — let's call them the cornucopians — there *is* no plight. Their expansionary 'conjecture' sees the glass not as merely half-full but rather as endlessly overflowing. Economist Lawrence Summers, then Chief Economist of the World Bank, exemplified this belief (and displayed a deep disciplinary bias) in 1991 when he utterly dismissed the notion that there are any practical constraints on economic growth:

> "There are no... limits to the carrying capacity of the earth that are likely to bind any time in the foreseeable future. There isn't a risk of an apocalypse due to global warming or anything else. 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" (Summers 1991).

By "staggering social costs," Summers meant that to limit growth would condemn billions of people to perpetual poverty. In his view, growing the global economy was the only way to bring at least material sufficiency to all, on grounds that "a rising tide raises all boats."

The key to belief in perpetual growth is utter faith in what is sometimes called 'the principle of near-perfect substitution.' By this logic nature is replaceable. 'The environment' is mere backdrop on the stage of human affairs. Human ingenuity, expressed through modern technology, is more than sufficient to overcome any resource shortages or other environmental problem likely to come our way. Many economists and technological optimists think this way, but the prize for the most ebullient expression of the faith must surely go to the late professor Julian Simon who (often) argued that:

> "Technology exists now to produce in virtually inexhaustible quantities just about all the products made by nature…", and: "We have in our hands now… the technology to feed, clothe, and supply energy to an ever-

> growing population for the next seven billion years…" (Simon 1995).

This is not a modest assertion, but buoyant hubris is generally well-received by all those who support the status quo and see nothing but good in growth-bound 'progress.'[1]

There are, of course, alternative 'social constructions' of the state of the world. At the polar extreme from the cornucopian view is the rather more humble ecological perspective. Its proponents are increasingly nervous about observable trends—some believe that humanity has actually past a critical tipping point beyond which returning to ecological stability and security is no longer even possible. According to Professor James Lovelock, for example, efforts to counter global warming cannot succeed and civilisation as we know it is now unlikely to survive:

> "We are in a fool's climate, accidentally kept cool by smoke, and before this century is over billions of us will die and the few breeding pairs of people that survive will be in the Arctic where the climate remains tolerable" (Lovelock 2006).

Lovelock's fatally depressing assertion seems so irreconcilable with Simon's over-the-top optimism that it is difficult to understand how the two well-known professors could actually share the same planet. We should excuse ordinary people if they seem confused about the actual state of human affairs.

Unfortunately, ordinary people will not be reassured to learn that the scientific community at large leans rather more toward Lovelock's conjecture than to Simon's and have been doing so for some time. Here is what the Union of Concerned Scientists had to say about human ecological reality in 1992, the year of the famous "United Nations Conference on Environment and Development" in Rio de Janeiro that popularized the concept of 'sustainable development:'

> "We the undersigned, senior members of the world's scientific community, hereby warn all humanity of what lies ahead. A great change in our stewardship of the earth and the life on it is required if vast human misery is to be avoided and our global home on this planet is not to be irretrievably mutilated" (UCS 1992).

It seems that no one heard the scientists' warning. Certainly nobody important to the overall scheme of things paid it much heed. Global ecological trends continued to deteriorate so that, more than a decade later, the Board of the Millennium Ecosystem Assessment (MEA) — the most comprehensive sustainability assessment ever

[1] Challenged on his statement, Simon replied that there had been a typo. He had meant to say only seven *million* years. This error represents a thousand-fold backing down! Even so, seven million years is a long time. With a 1995 starting population of 5.7 billion people and just 1% growth per annum, the human population after 'only' seven million years would be 2.3×10^{30410}. This is an unimaginably large number, about 30,000 orders of magnitude larger than the estimated number of atoms in the known universe (Bartlett 1996). Simon's ebullient optimism rests on a laughable mathematical fiction that should never have been published but is nonetheless taken seriously by true believers in the impossibility theorem of unlimited growth.

undertaken — was moved to summarize that project's findings this way:

> "At the heart of this assessment is a stark warning. Human activity is putting such a strain on the natural functions of the Earth that the ability of the planet's ecosystems so sustain future generations can no longer be taken for granted" (MEA 2005).

The MEA's gloomy prognosis was scarcely reported in the popular press and has since dropped entirely from view. Not so applause for the surging global economy. Clearly the global community — or, more fairly, those in charge — are rather more taken by Summer's and Simon's blinkers-on optimism than by Lovelock's apocalypse or other scientists' cautionary realism.

The Human Nature of (Un)Sustainability

How can we explain this anomaly? We claim to be a science-based culture yet world leaders and society at large pay little attention to the critical analyses and collective assessments of the world's top scientists. On the contrary, politicians everywhere prefer to stoke the fires of our economic engines. And for good reason: it's the only way to get elected by the people.

This section develops one possible explanation. I begin with the observation (illustrated above) that *H. sapiens* is, by nature, a conflicted species. On one hand we extol our self-awareness and uniquely well-developed capacity for rational thought and forward planning. These are all products of the neo-cortex, the evolutionarily modern part of the brain that occupies two-thirds of the human brain by volume. On the other hand, much of our individual and social behaviour is actually shaped or determined — unconsciously — by cognitive mechanisms, emotions, and instincts dedicated to preserving our identities, elevating our social status and ensuring our physical survival. These latter motivators spring from the evolutionarily older — and therefore more 'experienced' and assertive — mid-brain (limbic system) and reptilian brainstem.

From within this framework, my analysis starts from two related premises: First, *H. sapiens*, has evolved over time in much the same way as any other species — we are the product of natural selection.[2] There is, however, a twist in the human story. *H. sapiens*' evolution has long been as much or more determined by socio-cultural factors (memes) as by biological factors (genes). Memes are bits of culturally acquired information and genes are bits of genetically acquired information; both help to make us who and what we are, and both are passed on from one generation to the next. The important point here is that both memes and genes are subject to natural selection. This means that flawed memes and genes can both be 'selected out' by a changing environment. History suggests that nature is as adept at eliminating cultures governed by maladaptive memes (beliefs, values, assumptions

[2] Indeed, we are still evolving—*H. Sapiens* is a work in progress and the real sustainability question is whether we will survive flaws in the present model long enough to take the next adaptive steps forward.

and technologies) as it is in eliminating individuals burdened by maladaptive genes (e.g., see Diamond 2005).

My second premise is closely related to the first: *H. sapiens* is inherently biased against sustainability. In particular, I argue that 'unsustainability' is an *inevitable emergent property* of the systemic interaction between contemporary growth-oriented techno-industrial society and the ecosphere. Certain natural, genetically-determined qualities of the human species, combine with certain characteristics of industrial society, to make the behaviour of the modern human enterprise fundamentally incompatible with the behaviour of the ecosphere that supports it. In a nutshell, human genetic coding predisposes people to potentially unsustainable behaviours and these behavioural pre-dispositions are currently being *reinforced* by maladaptive cultural factors, particularly various meme complexes associated with cornucopian expansionism.

The universal biological drivers

Humans share certain basic survival-oriented qualities with all other species. Two are central to the (un)sustainability conundrum. Until constrained by negative feedback, all species populations:

1) expand to fill all accessible habitats (all species are capable of geometric growth in unconstrained 'environments'); and
2) use all available resources (in the case of humans, "availability" is variable and depends on the current state of technology).

These qualities have been verified in dozens of experiments involving non-human species ranging from bacteria placed in nutrient media (or yeast in vats of grape juice) to reindeer introduced to resource-rich, but previously unoccupied, islands. In every case, the introduced population expands exponentially for a time until it occupies all available space, exhausts its food or other resources, or poisons itself with its own waste ('pollution'). At this point, 'negative feedback' overwhelms the 'positive feedback' driving the exponential growth phase and the population crashes, sometimes never to recover.

The only current 'experiment' involving humans is the one we are doing with the Earth. Here the evidence so far seems unequivocal — our species is distressingly similar to bacteria in its responses to available habitats and resources but runs an additional risk because trade and technology (cultural memes) delay the on-set of negative feedback. The result has been spectacular. Fowler and Hobbs (2003) recently compared the biophysical characteristics of humans with those of dozens of ecologically similar species. Their data show that contemporary *H. sapiens* falls far above the normal range of natural variation displayed by a large selection of non-human organisms. Humanity's geographical range, population size, energy use, carbon dioxide emissions, and biomass consumption exceed those of similar species by orders of

magnitude. Human consumption of biomass, for example, was two orders of magnitude greater than the upper 95% confidence limits for biomass ingestion by 96 non-human mammals.

Such studies show that *H. sapiens* is, directly or indirectly, the dominant macro-consumer in all major terrestrial and accessible marine ecosystems on the planet. Indeed, we may well be the most voraciously successful predatory and herbivorous vertebrate ever to walk the earth (Rees 2004, 2006). We are not simply *like* other species in our use of the earth; our supposed intelligence and advanced technology makes us much better at exploiting resources than the non-human competition. The problem for long-term sustainability is that while "there is considerable variation in detail, there is remarkable consistency in the history of resource exploitation: resources are inevitably overexploited, often to the point of collapse or extinction." (Ludwig, et al. 1993). As I suggested, humans tend to use up all available resources.

Socio-cultural reinforcement

> "The masses have never thirsted after truth. They turn aside from evidence that is not to their taste, preferring to deify error, if error seduce them. Whoever can supply them with illusions is easily their master; whoever attempts to destroy their illusions is always their victim" (Gustave le Bon 1896).

From the perspective of sustainability, modern humans may well be creating the worst of all possible worlds. The behavioural tendencies that lead people to deplete their resources are being powerfully reinforced, not only by growing technological prowess, but also by the conceptual meme complexes that comprise our dominant social paradigms. The problem is that, because both genetic predispositions and memetic templates (and their interactions) operate beneath consciousness, people are not fully aware of what motivates their behaviour at either the individual or the social levels.

Consider, for example, the role myth-making. That myth has any role at all is difficult for some to accept because the western world, at least, thinks of itself as a post-enlightenment world. People are supposedly no longer the slaves and dupes of myth. Humanity has long moved beyond the groundless fears, superstitions and unscientific beliefs that distorted reality and shaped the lives of earlier cultures. We denizens of industrial societies like to believe that, by and large, our actions are governed by intelligence, reason and the human capacity for critical thinking. This is a reassuring story, but one that is hard to reconcile with much of contemporary history. It is time to acknowledge an increasingly evident paradox. This is nominally the age of science, but this has not prevented even industrial society from being as myth-bound as any that has preceded it.

The paradox is understandable if one appreciates the adaptive advantage that might accrue to myth-making. Shared stories about life and death and the mysterious forces of nature, have always contributed to the social glue that keeps people together and enables them to identify with other members of the 'tribe.'

Moreover, myths and paradigms comprise important cultural memes that help to determine how we relate to each other and to the rest of nature. Colin Grant recognized this with his enlightened perception of myths, not as superstitious lore or primitive misperceptions, but rather as shared comprehensive visions "that give shape and direction to life" (Grant 1998). From this perspective, we can appreciate that myth-making in diverse forms — think 'political ideology,' 'disciplinary paradigm,' 'religious doctrine' — is a universal feature of human societies, one that plays a vital role in every culture *including our own*.[3] Ironically, the belief that ours is a myth-free society is one of our most revealing cultural myths!

Mything Out on Sustainability

Our most *ecologically* significant myth is 'the perpetual growth ethic' introduced at the outset. Virtually all international agencies and national governments share a comprehensive vision of global development centered on unlimited economic expansion, fuelled by more liberalized trade (Rees 2002). This contemporary compound myth has been the principal force giving 'shape and direction' to political and civil life in both high-income and so-called developing countries on every continent for at least half a century.

The expansionist myth is a social construction on many levels. Even 'consumerism' and the so-called 'consumer society' are the product of a story-telling machine deliberately created to give shape and direction to industrial economies in the second half of the 20th Century.

In the years following World War II, North America found itself with a great stock of underutilized capital (i.e., war-time factories) and large numbers of underemployed workers (i.e., returned soldiers). Meanwhile, the general population, whose economic habits been shaped by material deprivation during the depression and subsequent war-time rationing, was quite used to living modestly. To take advantage of all that idle capital, North American industry, therefore, first had to break people of their under-consuming ways and then turn North America into a throw-away society. The ultimate goal was to make of consumption the purpose of existence and a way of life. As retail analyst Victor Lebow described the mission:

> "Our enormously productive economy demands that we make consumption our way of life, that we convert the buying and use of goods into rituals, that we seek our spiritual satisfaction and our ego satisfaction in consumption. We need things consumed, burned up, worn out, replaced and discarded at an ever-increasing rate" (Lebow, 1955).

Today a multi-billion dollar global advertising industry remains dedicated to maintaining the consumer binge, mainly by making people unhappy with whatever they have, no matter that it is practically new and perfectly functional. According to contemporary mythology, social status is associated with style of dress, the make and age of one's automobile, location and

[3] This ubiquity itself suggests that the propensity for myth-making evolved to reinforce behaviours that enhance survival.

size of residence, and diversity of electronic gadgets and other markers of conspicuous consumption. (note that this strategy appeals both to people's natural acquisitiveness and to their instinctive drive for social status, genetic propensities that reside in the brain's limbic system and reptilian stem). In effect, globalization and socially-constructed consumer values have succeeded in banishing moderation and sanctifying greed, thereby liberating *H. economicus* from any moral or ethical constraints on consumption. The undisputed success of this most remarkable example of mass social engineering ensures that the consumer bandwagon keeps rolling — the world economy booms along, growing at several percent per year.

Of course, even mythic constructs can have material consequences and the effects of the perpetual growth myth are quite remarkable. During the 20th Century (mostly the second half of the 20th Century):

- the human population quadrupled to 6.3 billion (it will reach 6.6 billion in 2007) and to sustain all these people with their rising material expectations;
- energy use increased 16-fold;
- industrial production grew by a factor of 40;
- fish catches (but not fish stocks) expanded by a factor of 35; and
- water use increased nine-fold, etc.

Of course, all economic production/consumption implies waste generation, so:

- CO^2 emissions increased 17-fold;
- sulphur emissions are 13 times higher;
- other air pollutants are typically up by a factor of five;
- hypoxic marine 'dead zones' are expanding;
- industrial processes now fix more atmospheric nitrogen and inject it into terrestrial ecosystems than do all natural terrestrial processes combined; and
- our water, food and soils are burdened by thousands of industrial contaminants (including excess nitrogen), etc.

Meanwhile, half of the land area of Earth has been directly transformed by human action, more than half of the planet's accessible fresh water is already being used by people and climate change threatens us all, a roiling cloud over humanity's future (data from McNeill 2000, Myers and Worm 2003, Lubchenco 1998,Vitousek et al., 1997). Are there, after all, real — biophysical — limits to growth? Ironically, it is our continuing allegiance to the myth of infinite expansion that is forcing humanity to reconsider the concept of carrying capacity.

Reality Check: Ecological Footprint Analysis

> "…I say that the power of population is indefinitely greater that the power in the earth to produce subsistence for man." (Thomas Malthus 1798)

'Ecological footprint analysis' (EFA) was actually designed specifically to rekindle the debate on human carrying capacity (Rees 1996, Wackernagel and Rees 1996). EFA gains much of its analytic strength by *inverting* the standard carrying capacity ratio. If carrying capacity asks 'how large a population can a particular area support' (a question that can be rendered seemingly irrelevant by trade) EFA asks 'how large an area is required to support a particular population' (a question that includes those areas that are effectively 'imported' through trade). Answering the latter question enables any population to compare its total biophysical demand on Earth to the biocapacity of its domestic land-base, thus revealing the extent to which that population is living beyond its local ecological means. We can do the same at the global level.

Eco-footprinting is based on resource consumption and waste production. Thus, the idealized 'ecological footprint' (EF) of a specified population is *the area of land and water ecosystems required to produce the resources that the population consumes, and to assimilate the wastes that the population produces, wherever on Earth the relevant land/water may be located.* We convert the Eco-footprint estimates to 'global average hectares' (gha) to facilitate comparison among different populations and countries with differing lifestyles and resource productivities. [4]

EFA reveals how closely material consumption and waste output is correlated with income. The average per capita ecological footprints of residents of high-income countries range between four and ten hectares (10 to 25 acres), while the residents of the poorest countries survive on less than half a hectare (Figure 1, data from WWF 2006). Not surprisingly, many high-income regions and even entire countries (e.g., the US, European countries, Japan) ecologically 'occupy' a land-base *scattered all over the planet* that is larger than their domestic territories (Figure 2). We say that such countries are running an 'ecological deficit' with other countries and the global commons. Only a few countries such as Canada (i.e., large land base, small population) seem to enjoy surplus biocapacity, but such surpluses are already more than taken up by ecological deficits of other countries.[5]

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[4] This allows us to represent all EFs in a *common currency* based on average global productivity. For example, if an individual's estimated actual eco-footprint is 1.5 hectare, but the corresponding land-base is twice as productive as world average land, his/her EF estimate would be converted to 3 gha, the area of global average land needed to support that person.

[5] For example, Canada is running down its forest, soil fisheries and energy resources mainly in the satisfaction of export markets around the world.

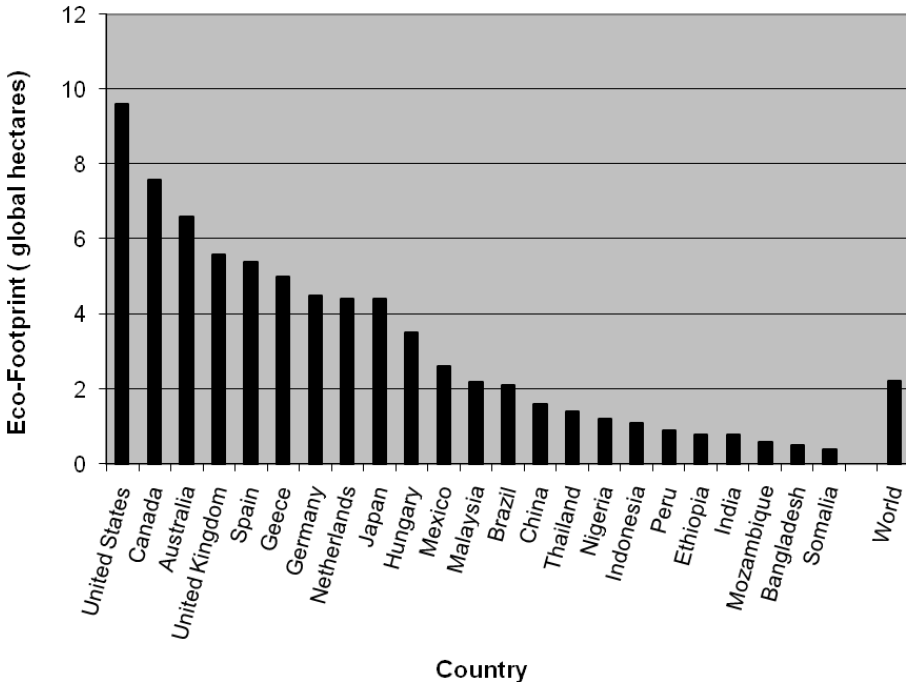

Figure 1. Per capita ecological footprints of selected countires (2003 data from WWF 2006).

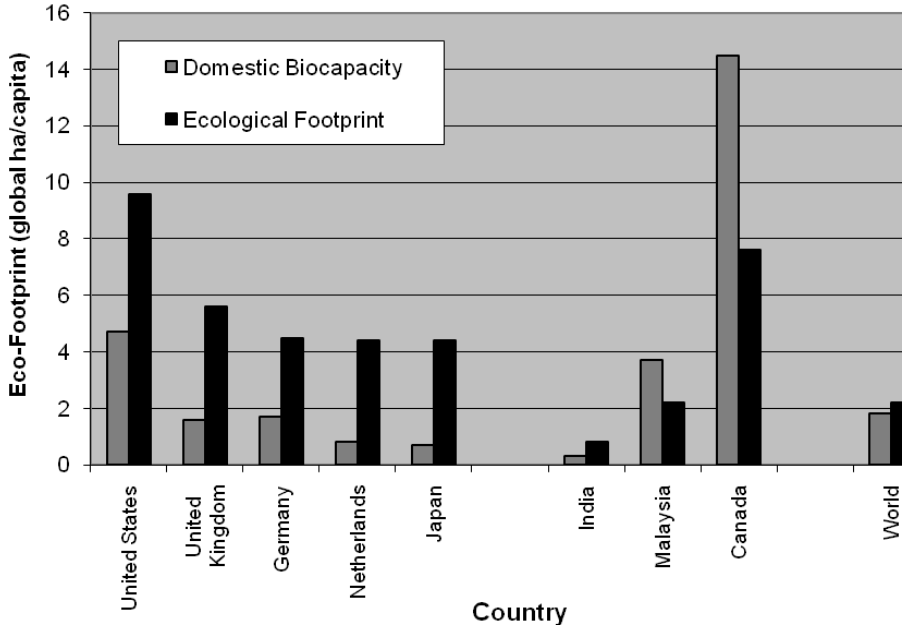

Figure 2. Biocapacities and ecological footprints of selected countries compared to the global averages (2003 data from WWF 2006).

Indeed, the aggregate human enterprise is in deficit with the ecosphere. The average member of the human family requires about 2.2 gha to support him/herself, yet there are only about 1.8 gha of adequately productive land and water ecosystems per capita on Earth. (This represents each person's 'fair Earth-share). EFA thus suggests that human demand for biophysical goods and services is already running about 25% ahead of long-term global biocapacity (and, of anything, this is an underestimate because EF methodology is quite conservative).

EFA clearly challenges the expansionist vision of sustainability. We are already in a state of global overshoot and, to bring just the present world population up to North American material standards sustainably, would require four additional Earth-like planets! Reverend Malthus may have been put to rest in contemporary myth, but his spirit lives on in the real world — humans invariably press against the limits of carrying capacity. And yes, Virginia, there really is an ecological crisis.

On Social Justice and the Income Gap

We are finally beginning to question seriously whether myth-propelled indiscriminate economic (material) growth is really the best route to sustainability; this, in turn, forces us to contemplate the alternatives. The most obvious alternative requires that we purposefully restructure the world economy to reduce consumption in high-income countries and redirect economic growth to countries where it is actually needed.

Certainly available socio-economic data support the idea of income redistribution. The world has never been richer, yet more than a billion people still subsist on less than one dollar a day and another 1.5 billion live on only one to two dollars per day. United Nations data show that:

- the richest 20% of the world's population take home 75% of the world's income (the most impoverished 20% of people survive on 1.5%);
- the richest 10% of the world's population enjoy 54% of the world's income; and
- the richest 50 people in the world enjoy a combined income greater than that of the poorest 416 million.

And despite decades of steady growth in gross world product, the income gap between rich and poor is widening, both between nations and within even rich countries:

- the average American, who was 38 times richer than the average Tanzanian in 1990, is 61 times richer today!; and
- in 1960, in the United States, the income ratio between the top 20% and the bottom 20% was 30:1 — today it is 75:1 and the poorest of the poor are relatively and *absolutely* worse off than they were two decades ago (UNDP 2005).

In short, the world is ecologically full, but remains grossly inequitable and, while the cornucopian "rising

tide" is still raising the largest yachts, it is dashing the smallest rowboats on the reefs of despair.

The material goals of sustainability with equity

More than a decade ago even the World Business Council on Sustainable Development recognized that, to achieve a necessary 50% absolute reduction in global energy and material consumption,

> "Industrialised world reductions in material throughput, energy use, and environmental degradation of over 90% will be required by 2040 to meet the needs of a growing world population fairly within the planet's ecological means" (BCSD 1993).

This means that

> "…the richer countries need to dematerialize their technical basis of wealth—or increase the resource productivity—by at least a factor of 10 on the average" to create the ecological space for needed growth in the Third World (Schmidt-Bleek 2000).

(Our [more conservative] eco-footprint analysis similarly suggests that North Americans should be working to reduce their per capita ecological footprints by 80% from about nine gha/capita to about 1.8 gha/capita.)

Reductions in energy and material use on this scale sound impossible, particularly to a culture accustomed to continuous growth and ever-rising material expectations. No politician has yet dared to run a campaign based on promises to shrink or even stabilize the economy. Nevertheless, many scientists and economists believe that such much-reduced resource use is at least technologically possible without significant loss of material comfort (see, for example Weizsäcker et al. 1997). Perhaps more surprising is the increasing evidence that, even if we are ultimately required to adopt materially simpler life-styles, the accompanying adjustments could actually produce greater social well-being. This is because, beyond a certain point, there is no further positive correlation between income growth and either objective indicators of population health or subjective assessments of well-being.

Consider that between 1957 and 1993, US real *per capita* income more than doubled to $16,000. During this period Americans acquired "twice as many cars per person — plus microwave ovens, color TVs, air conditioners, answering machines and $12 billion worth of new brand-name athletic shoes a year" (Myers and Deiner 1995). But all the new 'stuff' didn't make them any happier. In 1957, 35% of respondents told the National Opinion Research Center that they were "very happy." With doubled affluence, 32% said the same in 1993. Certainly to judge by "soaring rates of depression, a quintupled rate of reported violent crime since 1960, a doubled divorce rate, a slight decline in marital happiness among the marital survivors, and a tripled teen suicide rate, Americans are richer, and no happier" (Myers and Diener 1995). Is seems that people are working harder in pursuit of the good life only to be confounded by

> "…the strange, seemingly contradictory pattern in the United States of rising real income and a falling index of subjective well-

being" (people reporting themselves as 'very happy') (Lane 2000).

Studies in other rich countries report similar results. In short, people in rich countries may well have more to gain than lose by giving up on growth.

Toward Resolution: Are Humans *Capable* of Sustainability?

> "There are indeed potions in our own bodies and brains, capable of forcing on us behaviours that we may or may not be able to suppress by strong resolution" (Damasio 1994).
>
> "The rise and fall of cultures… has always been primarily determined by the tides of human passion, not by the ebb and flow of reason" (Morrison 1999).

We can summarize the sustainability conundrum this way: against both logic and evidence, humanity still mainly acts as if perpetual material growth will solve all social and ecological problems on a finite planet. Universal subscription to this myth is spreading our socially constructed consumer culture around the world. The (predictable) result is the degradation of the very ecosystems and life-support services upon which the human survival depends. Meanwhile, we have structured the global economy so that most income growth goes to the already wealthy who don't need it while those who would actually benefit from higher consumption are left behind. Despite the cascade of data from our best physical and social science that humanity is on a collision course with reality, myth-bound decision-makers everywhere resist making the changes necessary to avoid catastrophe. It seems fair to ask: where is the evidence of intelligent life on Earth?

A truly intelligent species would examine the data and adjust its developmental paradigm to conform to evident reality. In so doing, it might ask: "what is the optimal physical scale for economic activity on this finite orb (i.e., what is the highest level of energy and material throughput that the ecosphere can safely sustain indefinitely)" and "how can we distribute the benefits of the corresponding level of economic activity in such a way that it maximizes human well-being and happiness?" It might even dare to ponder: "given the limits to material throughput and to well-being via material goods, what are the socially optimal population levels for communities and the world as a whole?"

But intelligence is not the primary determinant of human socio-economic and political behaviour. When individual social status, personal prestige, political survival or sacred mythology are at stake, emotions and instinct may well trump intelligent analysis:

> "…only a small fraction of the population is consistently capable of applying the most basic rules of evidence to emotionally-derived or emotionally-loaded information" (Morrison 1999).[6]

It follows that irrational defence of the status quo is not uncommon. Indeed,

[6] In other words, the time-tested urgings of the mid-brain and brain-stem trump the reasoned analyses of the neo-cortex.

> "For us to maintain our way of living, we must… tell lies to each other and especially to ourselves… [the lies] are necessary because without them many deplorable acts would become impossibilities" (Jensen 2000).

One problem is that, for perfectly good evolutionary reasons, humans naturally discount the future — we prefer short-term gain even at the risk of long-term pain. US historian Barbara Tuchman documents how governments throughout history have taken policy decisions against their own long-term interests, or the interests of their constituents, even though viable alternatives are known and available. Sheer "wooden-headedness, the source of self deception ...plays a remarkably large role in government. It consists in assessing a situation in terms of preconceived fixed notions [e.g., myth, ideology] while ignoring any contrary signs. It is acting according to wish while not allowing oneself to be deflected by the facts" (Tuchman 1984). The result of such intransigent faith in the status quo can be tragic, including the collapse of entire societies (Diamond 2005). The latter is actually a frequent occurrence:

> "...what is perhaps most intriguing in the evolution of human societies is the regularity with which the pattern of increasing complexity is interrupted by collapse…" (Tainter 1995).

Knowing the fates of failed previous cultures and the reasons for their failures does, of course, give modern humans a unique opportunity deliberately to reinvent global society. For sustainability, the world community must commit to the purposeful creation of a new, more adaptive development myth that will better serve us all. This is an unprecedented challenge that requires a dialectic between self-conscious collective reason and the opposing urgings of more unconscious individualistic predisposition. The goal is nothing less than the imposition of universal constraints on genetic and cultural drivers that are still perceived to serve individual nations well even as they drive contemporary global society toward the abyss.

The eco-cognitive bottom line

Let's be clear. I am arguing here that if we are serious about sustainability, if we really want civilization to survive, human intelligence must learn consciously to override maladaptive socio-behavioural tendencies on both the individual and societal levels. The short-term logic and survival instincts that served humanity well in ancient stable environments are no longer suited to the rapidly changing global environment humans themselves have created. In particular, the deeply ingrained propensity of nations to favour their own short-term narrow self-interest must concede to the longer-term collective interests of humanity *as a whole*. The evolutionary imperative would still be satisfied: survival now depends on our capacity to equate our individual self-interest with humanity's

mutual interest in protecting the integrity of the ecosphere.

As a starting point, we should begin a generalized shift in the values underpinning techno-industrial society away from their present emphasis on individualism, narrow self-interest, short-term vision, growth-bound competitiveness and nature-as-resource-trove, toward insistence on community and societal values, cooperative institutions, global concerns, long-term planning, steady-state economies and a sense of participatory consciousness in nature. Within this new 'mythic frame,' the world's people would have to work together to develop a new class of international treaties and legal instruments to reduce the overall human ecological footprint, share the global commons more equitably and restrain the behavioural universals that invariably lead to dominance-seeking through violent aggression. Finally, let us acknowledge that it is not too late to act — *but act we must*. Avoidance of, or failure in, the task at hand is literally not a viable option. As I have written elsewhere,

> "Homo sapiens will either rise above mere animal instinct and become fully human, or wink out ignominiously, a guttering candle in a violent storm of our own making" (Rees 2002).

Ecological destruction, civil strife, and resource wars will conspire against us. And techno-industrial society, with its complex array of destructive memes, will be 'selected out,' tossed unceremoniously into the waste-bin of history (a waste-bin already brimming with failed cultural experiments).

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