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The Diseconomies of Environmental Catastrophes

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Abstract : Four factors are almost certain to lead to one or more catastrophes unless major remedial measures are taken.

(1) China has replaced the United States as the world's leading consumer of resources, except for oil (Brown, 2006a), but China is already a major factor in the world market in this area also. Together, China and the United States consume approximately half the world's resources and the global population is still increasing on a finite planet.

(2) The over 20% global ecological overshoot is simply too large to persist without catastrophic effects.

(3) Natural law does not function on human intent. Talk about sustainable development continues, but minor evidence of living sustainably will not alter evolutionary selective processes.

(4) Increased evidence indicates that global warming, with rises in sea levels, may already be irreversible.

(5) Peak oil will be followed by a decline in cheap energy, which has made *Homo sapiens* a dominant species.

Key words : Diseconomies, Environmental catastrophes, Ecological overshoot, Global warming, Peak oil, Resource wars.

If some great catastrophe is not announced every morning, we feel a certain void. Nothing in the paper today, we sigh.

Lord Acton

Human history becomes more and more a race between education and catastrophe.

H. G. Wells

Men and nations behave wisely once they have exhausted all other alternatives.

Abba Eban

Only two things are infinite, the universe and human stupidity, and I'm not sure about the former.
Albert Einstein

It has become appallingly obvious that our technology has exceeded our humanity.

Albert Einstein

If stupidity got us into this mess, then why can't it get us out? **Will Rogers**

Diseconomies of scale occur when long-term average costs rise as output rises. Usually, this term refers to the effect that production effort per quantity goes up if controlled by a large organization (*e.g.*, overhead). In short, the corporation has become too large and inefficient. This term can also appropriately be applied to both overuse and damage to the planet's ecological life support system.

Various catastrophes are likely to produce diseconomies and discontinuities in the biospheric life support system. For example, adverse climate change will affect food production, freshwater supplies (both drought and floods will occur), energy demands and supplies (materials for biofuels may be difficult to produce), and spread disease. Humankind is destroying the resource base upon which the human economy depends by overuse, pollution, habitat destruction, and the like.

The Tragedy of Exponential Growth :

When any number (*e.g.*, population, oil consumption) is increasing at a fixed percentage per year, the growth is exponential — for example, a single microorganism that divides every minute (doubling time = 1 minute) is placed in a flask at 11:00 a.m. and fills the flask at noon. Curiously, humankind rejoices in exponential growth despite the reality of being on a finite planet. One explanation is possible for this seemingly irrational behavior. At 11:54 a.m., the flask with the microorganism is only 1.5% full; even at 11:59 a.m., the flask is still only 50% full, so why worry? However, one minute later, at noon, the flask is full. At 12:0l p.m., a new flask is needed. Many examples are available of serious, mostly unaddressed, problems caused by exponential growth (Bartlett, 2004). Nevertheless, well orchestrated, amply funded attempts to marginalize the serious problems of exponential growth of resource consumption and human population continue. However, sustainable use of the planet requires that the human population be stabilized at some point considerably lower than the present. On April 19, 1977, former US President Jimmy Carter attempted to enlighten American citizens about the oil crisis: "…and in each of these decades (the 1950s and 1960s), more oil was consumed than in all of man's previous history combined." The news media, oil company executives, and the general public ignored the simple arithmetic involved and denounced the statement. Had Carter's statement, easily verified by available data, been given the attention it deserved, the crisis (*e.g.*, peak oil, global warming) would be much more manageable today. However, humankind still ignores evidence widely accepted by mainstream scientists.

Irreversible Damage :

A major concern is that quantitative analyses seem to have too small an impact on society's addiction to unsustainable practices. At present, mainstream science estimates that humankind may only have a decade or two to avoid pushing environmental systems past their tipping points, after which avoiding catastrophic change will be impossible. Kolbert's (2006) *Field Notes from a Catastrophe*, which first appeared as a series of articles in *The New Yorker*, documents signs of climate change in various locations. Humans are not the first species to cause major climate change. Methane (a potent greenhouse gas) produced by bacteria caused a temperature spike and mass extinctions. Plants (forests, etc.) that remove carbon dioxide from the atmosphere have played a significant role in both climate change and climate stability. Humans are the only "intelligent" species to have caused global environmental change. Increasing scientific evidence gives cause for concern. For example, Overpeck *et al.* (2006) call attention to the potential major threat of future climate change from sea level rise from melting polar ice sheets. Spotts (2006) calls attention to scientific studies that show that Arctic temperatures are near a prehistoric level when seas were 16 to 20 feet higher than they are today. Revkin (2006) notes that the influence of humans on Earth's climate could lead to a long and irreversible rise in sea levels by eroding the planet's polar ice sheets. A *Time* (2006) magazine/ABC News/Stanford University poll showed that 85% of

Americans think that global warming is probably happening; 88% think global warming threatens future generations; 60% think it threatens them a great deal; 70% think global weather patterns have become more unstable in the last three years; 66% think that US President George W. Bush's policies did little or nothing to help the environment in the past year. However, 62% of Americans think much can be done to curb global warming, and 61% would support a government mandate on lowering paper plant emissions. However, the poll revealed a remarkable cognitive dissonance – 68% opposes higher gasoline taxes and a substantial percentage opposes higher taxes on electricity. Both types of taxes would appreciably decrease both driving and use of electricity. Unless a more coherent integration of wishes and responsibility is accomplished, catastrophes are highly probable.

Reduced Oil Consumption/Global Warming :

Fenderson and Anderson (2006) quote from a recently released US Army strategic report : "The days of inexpensive, convenient, abundant energy sources are quickly drawing to a close." This one statement summarizes the present situation superbly – oil and other energy sources will be less available and more expensive. Another key statement is: "The impact of excessive unsustainable energy consumption may undermine the very culture and activities it supports. There is no perfect energy source, all are used at a cost." How will these events affect the production of anthropogenic greenhouse gases and global warming trends? More efficient use of energy should be inevitable. Individuals and organization that continue to waste energy will suffer economically and be less competitive in the global marketplace. New construction of housing, industry, and municipalities should emphasize energy efficiency, as should renovations of existing facilities. Wind and solar power sources should markedly reduce dependence upon fossil fuels and provide increased energy security as well. However, exponential growth in fossil fuel consumption will inevitably result in a peak, followed by rapid decline. The consensus is that humankind is rapidly approaching peak oil availability, which is likely to be followed by a rapid decline in availability and use Heinberg (2005, p. 31, his figure 1) feels that the peak oil year may have been 2000. The transitional period to alternative energy sources will probably be chaotic since comprehensive plans and policies for coping with this major transition are not in place.

The best case scenario is that all the measures just mentioned will be implemented at once. This adjustment would require a major change in lifestyle, particularly in countries with high energy use, such as the United States. Economic survival will also depend on the ability of individuals to transport themselves to work or school, to obtain food and health and police services, to attend religious services, and to have some form of recreation. The infrastructure to obtain these needs is not yet available, although some American cities are better prepared than others. A robust attempt to find and use alternative energy sources not dependent upon fossil fuel would be a major additional benefit. Even if all these activities are achieved

expeditiously, no certainty exists that these reductions in anthropogenic greenhouse gases will, short term, significantly alter established trends in global warming. The residence time of atmospheric carbon dioxide is substantial. However, postponing remedial action will only exacerbate an already dangerous situation. A more probable scenario is chaos verging on anarchy as humankind faces a situation that was inevitable on a finite planet with finite resources.

It is platitudinous to state, but this situation is fraught with risk. The risk is present, regardless of its causes. The fact that the situation exists justifies preparedness. Both global warming and the end of inexpensive, abundant energy will result in worldwide disruptions of human society. In some parts of the world, anarchy is increasingly likely. Water shortages are increasingly common for the entire planet (*e.g.*, Blanchard, 2006), although some parts of the planet will receive more than normal amounts. Since 1,000 tons of water are needed to produce a ton of grain, a temporary solution would be to ship grain to water-short areas. However, this temporary solution assumes areas exist with a grain surplus – an increasingly unlikely scenario in an era of energy transition and climate change. Still, some areas might have a surplus. Since partnering is essential to sustainable use of the planet, attempts must be made to partner. This strategy is based on both sharing in a time of scarcity and reducing the size of national and individual ecological footprint sizes so more of the finite resources can be available to more deprived people. Recipients must be responsible for stabilizing their population size to match the biocapacity (carrying capacity) of their region.

An alternative is to make each ecoregion or nation a resource fortress in which local interests dominate and strong measures are taken to ensure that the regional carrying capacity is not exceeded. A major problem with this approach is how to manage the global commons (*e.g.*, air and water) that transcend political boundaries. This alternative also lacks compassion for humans outside of one's ecoregion or nation and, arguably more important, the fate of the biospheric life support system. If the latter malfunctions, sustainable use of the planet by humans will remain a vision. Finally, many life forms are migratory and do not live in a single ecoregion or nation. Resource wars are a predictable outcome of this strategy if it results in a perception of unfair and inequitable distribution of resources. Successful sustainable use of the planet will involve a mix of local/regional and global strategies. Perhaps even some national/oceanic interest groups will become established. Conflict resolution will be an important component of all these systems.

Almost certainly, the transitional period will include a mix of nation/state and regional systems. Many nation states do not have the degree of citizen trust essential for a successful transition to sustainable use of the planet during a period of catastrophe. This situation is not viable, so the regional approach will probably emerge.

The Role of the Superpowers (United States and China) :

China is already an economic superpower (*e.g.*, Coonan, 2006),

surpassing the United States in resource consumption. It does not appear to have the massive financial debt that the United States does, but it does have a large ecological debt; so does the United States. China does not have the highly technical weaponry that the United States does, but such weapons do not work well in resource wars. China's gross domestic product is estimated to overtake that of the United States by 2045. More important, China's increased energy use, coupled with increasing economic power, will affect oil prices worldwide. Of course, Japan remains the major driving force of the Asian economy, but China has 1.3 billion people and the world's fastest growing economy, quadrupling its gross domestic product from 1980-2000. China and the United States would do the planet and posterity a major favor by showing how scarce resources can be shared peacefully. India seems to be emerging as an important source of educated people, and its population may exceed that of China in this century.

A crucial issue in an area where catastrophes occur or are highly probably is how many nations will choose to partner with other nations or regions to achieve sustainable use of the planet. Inevitably, some will profess the intent to do so without actually implementing this stated goal. Others may covertly or openly engage in resource wars rather than choose the difficult path to sustainability. War expends resources on destruction and is a major obstacle to sustainable use of the planet. Therefore, the nature and shape of the inevitable resource wars is a matter of considerable interest since resource wars have been troublesome even in the absence of catastrophes. Adapting to a changing environment quickly and effectively requires a particular set of skills and technological innovations. For most of human history, innovations were few and far between; at present, they appear with incredible frequency and complexity. At some point in history, every nation/state or culture was "backward" and, therefore, likely to be dominated by groups with minimal conscience and ethics. Under these circumstances, the opportunity to evaluate the probability that war ensures political goals being met will be trivialized or eliminated. If the primary political goal is not to live sustainably, resource wars will intensify and further increase the disparity in distribution of resources. The historian and "philosopher" of war, Carl von Clausewitz, noted that war is an act of force with no logical limit to the application of that force. Since opponents must follow suit or lose, conflict escalates. Resources will be diverted to war rather than to the goal of sustainable use of the planet. Diseconomies resulting from conflict over resource distribution are difficult to estimate, especially since, as Clausewitz wrote, "all war presupposes human weakness and seeks to exploit it." The well publicized September 11 terrorist attacks in the United States on the World Trade Center buildings and the Pentagon demonstrated how fear can alter perception of risk. The insistence on exponential economic growth after decades of ecological overshoot demonstrates the power of greed. Humankind's unwillingness to leave a habitable planet for posterity in order to fulfill perceived present "needs" for material possessions is appalling.

The Economic Downside of War :

Wolk (2006) has described the economic cost of the Iraq war to the United States. The US Congressional Budget Office, as of January 2006, counted US$323 billion in expenditures for the war on terrorism (which includes military action in Iraq and Afghanistan). In March 2006, the US House of Representatives approved another US$68 billion for military operations in Iraq and Afghanistan, which would bring the total allocated to date to approximately US$400 billion. The cost of repairing the infrastructure of Iraq alone is estimated at many billions more. Brinkley (2006) notes that the US State Department has produced a draft document saying that, after any future conflicts, the United States should not immediately begin a major rebuilding program. This strategy will undoubtedly delay achieving sustainability, especially if it causes young people to join the insurgency in significant numbers. Usually, reconstruction refers to industrial and societal infrastructure rather than ecological infrastructure (Cairns, 2003), which is an essential component of sustainable use of the planet. If the goal of any war is acquisition of resources, it is not likely to be cost effective, even in the short term. Visualize the benefits of investing US$400 billion in alternative sources of energy, such as wind and solar power, and this amount is just the cost of the war on terror thus far. Sustainable use of the planet focuses on long-term sustainability practices as well as accumulation of natural capital.

The Transition Period :

If catastrophes persuade humankind to take decisive action on sustainability, the transition period will still be challenging. One major issue will be the reduction in the disparity in resource use, both at the individual and national level. In the United States and other countries, where per capita and national resource consumption are the world's highest and where a high resource consumption and large material possessions are societal norms, convincing people of a problem in resource distribution will be difficult. Also, eliminating the existing 20% ecological overshoot will require a dramatic reduction in resource consumption worldwide. This situation will be exacerbated if an additional 3 billion people are added to the planet's present over 6 billion population.

The energy crisis will pose unique problems for humankind. As costs of gasoline and other energy sources increase, the poor will suffer disproportionately. In thinly settled areas, a significant number of people commute many miles to work. Often, both husband and wife work, but not in the same geographic area or with the same time schedule. If no extended family lives in the area, employing people to care for children can be a problem.

If material possessions remain the important criteria for "happiness" and "success," stresses will increase markedly as the human population and expectations of affluence increase. Social norms must change markedly if humankind is to achieve sustainable use of the planet. It is a sobering thought that once almost Earth-sized Venus may have been a tropical paradise with ample water. A European space agency probe was sent to Venus in mid-April 2006 to attempt to determine what happened. The probability is high that Venus had oceans, but their fate is not known. At present,

Venus' atmosphere is 97% carbon dioxide and surface temperatures hover around 900°F (Gugliotta, 2006). Could this fate be Earth's if greenhouse gases accumulate at the present rate?

One means of beginning to address these environmental problems is environmental taxes (Brown, 2006b), which would target environmentally destructive activities such as burning fossil fuel, including coal. Citizens do not like tax increases, but might accept them if taxes were lowered in areas that were not environmentally damaging. Sweden and Germany are among the European leaders in environmental tax reform. For example, a four-year plan adopted in Germany in1999 shifted taxes from labor to energy. By 2001, this plan had lowered fuel use by 5%. Arguably, an even more important effect was that the tax accelerated growth in the renewable energy sector, creating 45,000 jobs in the wind industry alone by 2003. The Swedish shift of $1,100 per household, which was levied on cars and trucks, was accompanied by a heavier tax on electricity. These and other countries with similar plans will be better prepared for the peak oil crisis and, thus, will suffer less economically.

Agriculture vs Transportation :

Most of the agricultural products that can be converted to biofuels (*e.g.*, corn) can also be eaten by people. Many populous nations are already importing foodstuffs so that affluent people with automobiles will be able to outbid the impoverished people for agricultural products that can be converted to automobile fuel. With 3 billion more people expected to be added to the global population by the middle of the 21st century, this situation will be a major test of spiritual and ethical values. The outcome will be a defining moment for human society. If China and the United States continue on their present paths, they will be consuming over half the world's resources. Of course, if the trends do continue, natural law will play a major role in resource allocation. If disease and starvation stabilize the human population, mass deaths and starvation are inevitable. Surely, an adaptive species with a large brain can avoid such an outcome. These outcomes are but some of many 21st century resource allocation problems.

Conclusions :

Humankind is now faced with ecological and societal tipping points unprecedented in human history. In essence, tipping points previously isolated in regions are now global. The key question is whether world leaders are prepared to take action quickly enough to avoid the disequilibrium that results from passing a tipping point, which will produce catastrophic consequences. The evidence at present is not reassuring. The 11 February 2006 issue of *Time* asks on its cover "Is American Flunking Science?" Any transitional period will require continued scientific development. The evidence on present global problems is complex, but scientific knowledge is adequate to determine the changes necessary to avoid tipping points if remedial measures are taken quickly; however, continual improvement of science is essential. The primary obstacles are the lack of will to change and the leadership to activate needed changes. Cheap, abundant energy has shaped 20th and early 21st century civilization, but is becoming increasingly expensive as supplies dwindle.

Earth is no longer the vast cornucopia of endless resources it was once thought to be. Neither humankind's behavior nor its quest for perpetual economic growth on a finite planet has responded to this reality. As a consequence, catastrophes have become not merely possible, but probable. Will humankind respond by sharing scarce resources more equitably and fairly with both other humans and other life forms or will resource wars increase in frequency and intensity? War wastes resources (*e.g.*, oil), hastens resource depletion, and is a major generator of diseconomies.

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