

Can Humans Respond to a Long-term Shortage of Renewable Resources?

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It is not necessary to change. Survival is not mandatory.

W. Edwards Deming

When we are no longer able to change a situation, we are challenged to change ourselves.

Victor Frankl

Faced with the choice between changing one's mind and proving that there is no need to do so, almost everyone gets busy on the proof.

John Kenneth Galbraith

Oh, would that my mind could let fall its dead ideas, as the tree does its withered leaves!

Andre Gide

If humanity continues business as usual, it must learn to adapt to the consequences of climate change and the decreased availability of renewable resources. Some illustrative consequences follow.

- (1) Agricultural productivity is suffering a reduction.
- (2) Diseases and pests that damage crops and livestock are increasing in range.
- (3) The world's oceans are becoming more acidic from carbon dioxide.
- (4) Sea levels are rising.
- (5) The probable release of billions of metric tons of stored carbon will produce runaway climate change.
- (7) Increased anthropogenic greenhouse gas emissions are adversely affecting the Biosphere that produces renewable resources.

Climate Change and the Human Population

Responding to rapid climate change requires scientific evidence gathered by credentialed scientists. However, will this evidence be produced in adequate amounts if climate change is described as a hoax that was drummed up by scientists looking to make money (Sheppard 2011)? The US Chamber of Commerce has published a position paper on adapting to climate change (<http://www.uschamber.com/issues/environment/climate-change>), which does not discuss how the millions of species that collectively comprise the Biosphere can adapt to climate change. Since the Biosphere is the source of the renewable resources essential to the human economy, this omission is surprising.

Climate change (e.g., drought that results in food scarcity) is producing increasing numbers of environmental refugees. These refugees desperately need food and potable water; however, in Mogadishu, Somalia, "Thousands of sacks of food aid meant for Somalia's famine victims have been stolen and are being sold at markets in the same neighborhoods where skeletal children in filthy refugee camps can't find enough to eat . . ." (Hourfeld 2011). This situation is far from successful adaptation to food shortages.

Revkin (2011) has called attention to the problem of linear resources and exponential demand raised by Thomas Malthus in his famous "Essay on the Principle of Population" first published in 1798: ". . . the populations of the world would increase in geometric proportions the food resources available to them would increase only in arithmetic proportions." Malthus is right — his detractors are wrong; however, nothing has been done to stabilize the

human population within Earth's carrying capacity for it. Even if humanity has a clear explanation of an issue (e.g., exponential population growth), response is rejected for ideological or emotional reasons.

Ecological Debt/Overshoot Day

Ecological debt/overshoot day is the point in time when the total renewable resources consumed by humankind exceed the capacity of the Biosphere to regenerate these resources. After that day, humankind uses natural capital for the remainder of the calendar year. Natural capital provides ecosystem services that constitute Earth's life support system. Ecological debt/overshoot is the ultimate in unsustainable living. Debt/overshoot data collection began in 1986, and the first ecological debt/overshoot day occurred in December 1987. In 2010, the ecological debt/overshoot day occurred on 21 August, and the overshoot was 150%. Using natural capital is similar to using the capital in a savings account instead of living on the interest. Using capital to live on is not sustainable, but living on interest is. Using natural capital to maintain an unsustainable lifestyle is suicidal — loss of natural capital reduces the quantity of renewable resources, which is fatal.

Economic Growth

The human economy is a subset of the Biosphere because natural resources are the raw materials that make the human economy possible. A human economy needs four types of capital to function properly (Hawken et al. 1999):

- *human capital in the form of labor and intelligence*
- *financial capital, consisting of cash, investments, and monetary instruments*
- *manufactured capital, including infrastructure, machines, tools, and factories*
- *natural capital, made up of resources, living systems, and ecosystem services*

The first three types of capital are related to humans, who are part of the Biosphere, or to human artifacts. All three depend entirely on natural capital, without which they would cease to exist. So why is economic growth always given priority over the Biosphere?

Conclusions

Earth contains fossils of millions of species that failed to adapt to new conditions or were out competed because the new conditions offered another species a competitive advantage. Some species persisted for millions of years — others lived briefly in evolutionary time. All species fill an ecological niche in the Biosphere, and prospects for survival are favorable when the health and integrity of the Biosphere are robust. Biospheric collapse threatens all the component species, including *Homo sapiens*; consequently, nurturing the Biosphere is a matter of enlightened self interest. An intelligent species should act accordingly.

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