Nurturing Nature

Long-Term Management of Life's Evolution

by Roger Harris

Synopsis

The author presents a previously unpublished model of possible scenarios for the global decline of biodiversity. This provides the basis to evaluate trends in biodiversity loss. Given the strong interconnections of our biosphere's components, the impact of unfettered economic growth presents dire prospects for living systems. The capitalist ethos of wealth generation without considering natural resource limitations cannot be expected to sustainably benefit a significant proportion of the world's population. Continued exploitation of natural resources to generate wealth is having profoundly negative impacts on ecosystem composition and function. An alternative paradigm incorporates environmental costs of human activities into estimates of global carrying capacity. This leads to the notion that prosperity is best measured as overall quality of life, rather than in terms of material wealth.

Highlighting conflicts between the competing interests of economics and ecology, and to resolve these, the author proposes the Managed Evolution Manifesto. This is based on the logical argument:

1. Resources are finite and outstripped by human resource demands.
2. Excess demand for resources threatens the capacity of Earth to sustain life.
3. It will be necessary to consciously manage the direction of evolution over the long-term to ensure life's continued existence.

This is a pragmatic salve to the painful realization that loss of several major life groups is inevitable. The view argues that the conservationist ideal of preserving biodiversity carves a static monument that is unrealistic as a strategy to conserve life in perpetuity. The only worthwhile future will have to include a proactive intentional approach to managing the evolution of life throughout the biosphere. The Manifesto's proposals run counter to a purist conservationist doctrine, but it may resolve dilemmas presented by the notion of endless development. Only by responsibly managing all of Earth's life on epochal time scales, can we hope to

achieve short-term goals of directing economic development in culturally, ethically and ecologically sound directions.

The future of biodiversity

Future generations will inherit a world vastly different from the one into which readers of this article were born.

Armageddon or Utopia? Whatever comes to be, one huge difference will be the variety of life—biodiversity (see Box 1). Human beings are a mass extinction event on a par with those of the geological past.

Box 1 What is biodiversity?

Biodiversity is the number of species in a given area during a specific period. First used publicly in 1986 at the National Forum on Biodiversity in Washington D.C., by the early 1990s, the word was still not in broad usage. (It is absent from the 1993 *American Heritage Dictionary*.) A decade later, it is all over the popular press. Awareness of a problem is the first step to solving it. Yet, what is the magnitude of the problem? It is big, according to Harvard University's E.O. Wilson in *The Diversity of Life*. He estimates that worldwide 27,000 species per year are going extinct because of human activity. This number depends on global biodiversity of 10 million species—probably a severe underestimate. Tropical ecologist Terry Erwin cites a figure three times higher. More recently, Erwin himself has suggested global biodiversity may be as high as 100 million species, increasing Wilson's estimate ten fold. That is, we may be losing over one quarter of a million species per year.

Few of us contemplate the consequences. But we must. It is certain that we are losing species at unprecedented rates. Thus, some day in the future, there will be an insignificant number of species left on earth. Will humans be among them? Will humans still exist on Global Extinction Day (GED, see Figure 1)?

Figure 1. Schematic representation of possible future trends in global biodiversity under different scenarios (a = biosphere collapse, b = steady decline, c = best hope, d = strict conservation). Note how the initial loss of species could be higher with

the strict conservation scenario than with the steady decline scenario, although the latter ends up with many fewer species. GED = Global Extinction Day.

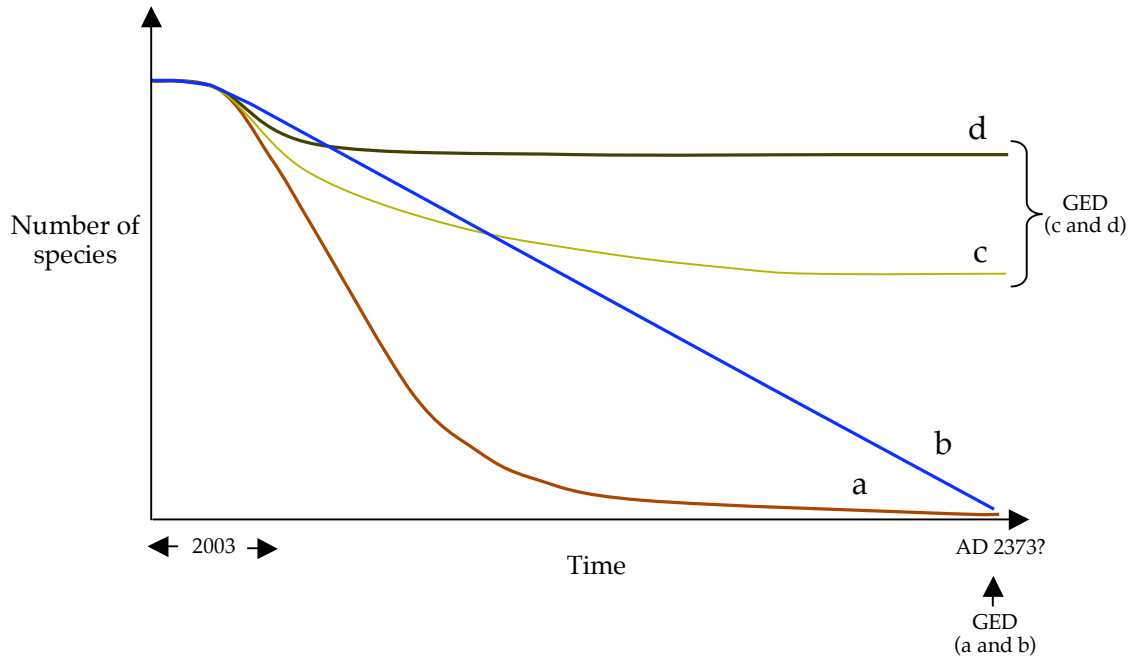

Figure 1 represents alternatives for global biodiversity:

a. Biosphere collapse

In the most pessimistic scenario, Earth's life support systems are stressed to the point where ecosystems fail rapidly. Most species are lost early in the period of collapse—consistent with Paul Ehrlich's well-known "rivet popper" model (see Box 2).

Box 2 The rivet popper model

A certain number of rivets can pop out of an airplane's structure and it will keep on flying. After a critical number of rivets are lost, the airplane falls out of the sky. This shows how a complex system can remain operational until a critical number of its components are removed, whereupon rapid collapse is inevitable —what may happen as species are lost from the biosphere. According to chaos theory, a complex system can jump between stable states. The biosphere may rapidly shift from a high-diversity stable state to a low-diversity state—the "biosphere collapse" scenario (see text).

b. Steady decline
Current extinction rate estimates (Box 1) assume a linear loss of species over time. Extrapolating these numbers, all species will be extinct in about 370 years, or 2373. But global biodiversity estimates are little more than educated guesses—a problem emphasised by Robert May, one of the UK's most distinguished scientists. Without accurate figures, predicting GED will be impossible; but that day *will* come unless humans choose a different future.

c. Best hope
Active management of biodiversity may be the only tenable outcome. Needs of conservation are balanced with those of population growth and economic development.

d. Strict conservation
The momentum of population and economic growth renders this outcome unlikely. Yet, strict conservation results in higher biodiversity, even though initial losses might be greater. It is better to act late than not at all.

Biodiversity's steady decline (b) ends the same way as biosphere collapse (a). Under alternative scenarios (c, d) we may lose more biodiversity initially but GED is delayed to some distant time in the future.

Humans and nature are competing. Survival instinct demands that we guage our prospects. This raises tough questions: how likely is a more prosperous future for the poor in developing countries? Can wealthy and industrial nations preserve the values, ideals and wealth they already possess?

The future of prosperity

The developed world's populace enjoys the highest standard of living ever. Capitalism and humanism agree that this good fortune be shared with

developing countries. But motives differ. Multinationals are looking for new markets and resources, while ethics guide the altruists.

Since Adam Smith's *The Wealth of Nations* (1776), government policies have insisted on continual (and implicitly infinite) growth. Their economics assume limitless resources.

Aligning theory with reality requires a more pragmatic approach. The relevant question is what standard of living is available to what number of people, given the Earth's finite resources? Ecologists call this the carrying capacity (Box 3).

Box 3 Carrying capacity

In contrast to economic models, carrying capacity assume resources limit factor growth (Joel Cohen, *How many people can the earth support?*, 1995, Norton, New York). Carrying capacity measures how the pie is divided: total resources divided by per capita use. Example resources are green plant production or availability of food or energy. Multi-dimensional approaches highlight accounting for environmental effects of resource extraction to assess cumulative impact of human activity. Gretchen Daily and Paul Ehrlich (1992, *BioScience* 42: 761-771) ask, "Can human beings lower their per-capita impact at a rate sufficiently high to counterbalance their explosive increases in population?" A realistic estimate of global carrying capacity will include the ecological costs of each human living a specific lifestyle.

A quarter of a billion people in the United States together use a quarter of the entire energy output of the planet. Thus, the Earth could support about four America equivalents—one billion people living the American lifestyle. With over six billion people on the planet, we need six Earths to raise everyone's standard of living to that of the average American. Thus, exporting values of consumerism, convenience and instant gratification to developing countries is risky. Most expectations will never be met—depressing but inescapable. Much of the world's population is doomed to a low standard of living.

Synergistic effects of human population growth further dampen hopes for sustainable prosperity. The AIDS and SARS epidemics hint at effects of simple overcrowding. Increasing weather extremes and rising sea level due to global

climate change diminishes habitable and arable land, and reduce global carrying capacity.

Population growth combined with increased resource consumption exacerbates these dangers. The threats will undoubtedly be felt once the world's most populous countries exploit resources on a par with those of developed countries.

Our economic mindset inversely relates prosperity with sustainability. The challenge is to reverse this relationship. To do so we cannot measure prosperity in purely material terms, because resource consumption decreases sustainability (by disrupting the biosphere, atmosphere and lithosphere).

An alternate measure of prosperity is quality of life. This is intuitive. Although "quality of life" means different things to different people, essential aspects include clean air and water, a reliable food supply, and resources to provide housing and transport.

Economists increasingly recognise that these ideals are unachievable without healthy, intact ecosystems. Encouragingly, recent attempts have been made to assign a dollar value to "ecosystem services"—processes that maintain natural cycles and life support systems. Such economic models help us measure how development affects quality of life. In this view, prosperity is synonymous with quality of life.

Thus, to maximise prosperity with minimal risk to Earth's ecosystems we must manage the long-term health of ecosystems and the life they support.

Hence, we must actively guide life on Earth at grand scales of time and space. We are already directing evolution. But humans are not thinking big enough. Our effect on evolution is ad hoc—extinctions are arbitrary, and conservation is reactionary: save a species here, a habitat there. If we manage evolutionary processes, we maximise the long-term chances for life's survivability and continued species diversification.

Must tigers have stripes? Do elephants need to be big? The desire to conserve life exactly as we envisage it ignores a basic property of life—to adapt to change. We have to overthrow the stagnant dogma of life preserved in stasis. To manage evolution we must factor in our own priorities for environmental quality, education, health care, retirement and other key quality of life indicators. Future alliances of conservationists and planners will explore this paradigm, and make decisions on its basis.

The future of conservation

Humans compete with nature for resources. A globally applicable resource management model is vital to provide a framework within which to make meaningful decisions—the Managed Evolution Manifesto. Considerations include:

1. For managing biodiversity, a simple ledger of species is not enough. We must learn how to manipulate sustainable evolutionary mechanisms that enable plants and animals to respond to changing conditions.

2. Economic growth within the framework of the management model will require loss of some evolutionary flexibility (i.e., of genetic information). The aim is to minimise this loss. Geneticists will help build the program of directing evolution.

3. The idea of altering entire planets has long existed in science fiction, yet we are unwittingly terraforming right now. Let us do this consciously and intelligently.

4. We will manipulate entire biotas and accept our manipulations as part of life's heritage. The alternative is a vulnerable status quo—a fragmented hodgepodge of parks and reserves with the rest of the world devoted to humanity.

The Managed Evolution Manifesto empowers humans to make profound, far-reaching decisions about shaping life's future. Opponents may argue we are usurping God's role. Will they acknowledge that we already have God-like powers—the power of life and death over the planet?

Managing evolution requires new ideas, new technology and progressive investment. Conceptual frameworks will need to be developed. For example, along the lines of models developed by Harvard professors Robert Kaplan and David Norton, we could apply the balanced scorecard approach to key performance indicators to ecosystems.

A new paradigm is needed to rein in the combined juggernauts of population growth and economic expansion. Yet, we must accept some ecosystem degradation and loss of species. This is happening anyway, as development goes ahead and environmentalists are forced to compromise.

Biology teaches that we are intimate with nature. To paraphrase a biological argument, "nature *is* nurture." Nature nurtures our bodies, minds and spirits. In return, we are obliged to manage nature in ways that best suit our purpose, or at least to understand what we will lose.

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