



“Summary of article by C.S. Holling: An Ecologist View of the Malthusian Conflict” in Frontier Issues in Economic Thought, Volume 6: A Survey of Sustainable Development. Island Press: Washington DC, 2001. pp. 131-134

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### “Summary of article by C.S. Holling: An Ecologist View of the Malthusian Conflict”

Ecologists and economists often have different points of view of issues of population growth and the carrying capacity of the planet. In part this arises from different theoretical paradigms, but there may also have been misunderstandings on both sides of the argument. This article attempts both to establish some areas of agreement and also to explain the basic principles and some of the subtleties of the ecological approach.

#### **Economic and Ecological Perspectives**

At a recent meeting of economists and ecologists sponsored by the Beijer Institute of the Royal Swedish Academy of Sciences, participants were able to overcome stereotypes regarding the limitations of each others' fields and discover elements of convergence between the disciplines. In particular, both economists and ecologists agreed that current problems often had a similar profile in the following respects:

- Human influences on air, land, and ocean trigger threshold effects which can threaten health and environment.
- There is an increasing globalization of biophysical phenomena accompanying the globalization of trade and large-scale movements of people.
- Problems emerge suddenly in several different places, rather than locally at a speed which allows for a considered response.
- Both the ecological and the social effects of these problems are novel and unfamiliar, and thus are inherently unpredictable.

The perspective of ecologists on these developments can be understood by examining three questions:

- why are ecologists so gloomily Malthusian?
- why has the world not collapsed long ago?
- why worry about the negative impacts of growth in human populations and activities?

#### **Why Ecologists are Gloomy Malthusians**

Ecologists generally accept two axioms: populations have the inherent propensity to grow exponentially, and the environment sets ultimate limits to growth. The survival strategies of species of organisms can be divided into two: those that specialize in growth, often colonizing recently disturbed habitats, and those that can outcompete the growth specialists and persist for long periods. Populations of both types encounter limits, giving rise to the theory of ecological succession, according to which a particular set of "climax" species form a stable assemblage which remains until some disturbance allows new "pioneer" species to establish themselves and restart the succession process.

Mathematical ecology, initiated by A.J. Lotka (1925), uses differential equations to establish the relationship between exponential growth and environmental limits, often generating population oscillations around a stable point. If time-lags are introduced into a system of predator-prey relationships, the oscillations can become destabilized, leading to the extinction of species. This highly deterministic formulation, however, must be modified by a third axiom: the continual propagation of variability and novelty, which is the basis for the theory of evolution. The interaction of this third axiom with the first two gives a more subtle picture of continual experimentation in a changing environment.

### **Why has the World Not Collapsed Long Ago?**

Given the possible instability of predator-prey interactions as well as external physical variability, the key to system persistence lies in spatial heterogeneity and biotic diversity. These characteristics can make an ecological system *resilient* -- able to withstand internal imbalances or external disturbances.

Ecological models show a very wide range of complex behaviors, with multiple stable states, boom-and-bust cycles, and even chaotic behavior. Plant and animal species fluctuations on a local scale interact with geophysical variables on a much larger scale to generate robust and resilient ecosystems. Human population growth and economic activity affects the local-scale relationships in ways which can profoundly change overall ecosystems.

The resource management concepts of maximum sustained yields (e.g. of fish populations) and fixed carrying capacities (e.g. of terrestrial herbivores) have been discredited by these more sophisticated views of broad ecosystem function. The very success of achieving management yield goals tends to reduce variability and damage ecosystem resilience.

Part of the answer to the question: "why has the world not collapsed?" lies in the resilience of ecosystems. The other part lies in human creativity and adaptive behavior. Human adaptability is the key to economists' optimism about our ability to substitute for scarce materials and develop successful responses to environmental problems. However, the resilience of natural systems is not unlimited, and human adaptability is limited by specific environmental contexts.

### **Why Worry about Negative Impacts of Growth in Human Population and Activities?**

Studies of ecological management and policy have shown that human exploitation of ecosystems decreases resilience, making the system more vulnerable to surprise and crisis. Resilience

decreases due to loss of species diversity and increase in spatial homogeneity. Management institutions which are economically efficient are often rigid and unresponsive to resource dynamics. For example, short-term success of spraying programs to control spruce budworm has led to more extensive outbreaks over larger areas. Use of fish hatcheries for salmon spawning has resulted in a precarious dependence on a few artificially enhanced stocks. Both ecosystems and local timber and fishing industries are thus endangered.

Such problems are now widespread. "Increasing human populations in the South, and the planetary expansion of their influence, combined with exploitative management in both North and South, reduces functional diversity and increases spatial homogeneity not only in regions but on the whole planet." (p. 93.) Critical attributes of ecological resilience are now being compromised at the planetary level.

Negative impacts of human activities on a global scale include increases in climatic variability, possible climate warming, increasing soil aridity in large areas, and increased UV radiation damaging plankton productivity in the oceans. Less well-known examples include:

- Increasing costs of natural disasters. This results from: more people moving to more vulnerable places; loss of resilience as a result of human construction such as dikes, dams, and drainage canals; and increased climate variability resulting from deforestation and fossil fuel emissions.
- Decline in migratory bird populations. Habitat fragmentation in temperate regions and landscape transformations caused by human pressures in neo-tropical regions have led to a decline of almost 50% since 1965 in migratory bird flights between North and South America. This in turn increases insect outbreaks which affect forest ecology.
- Emergence of new human diseases. There is growing evidence that new infectious diseases are initiated by environmental change. Viruses such as AIDS, Ebola, Marburg, Rift Valley fever, and the Hantaan virus, all of which have recently appeared in human populations, have existed in other hosts or benign forms for centuries. Recent human landscape disturbances have created opportunities for these viruses to cross over to humans, and extensive human movements have then spread them on a planetary scale. HIV, for example, may have existed in isolated populations for centuries, causing little illness. But rapid urbanization and the global movements of people created the conditions for the emergence of a much more lethal virus, and a resulting global pandemic.

Population growth and greater land use contribute to the intensification and expansion of these and other destructive trends. The resulting destabilization of global ecosystems will have inherently unpredictable consequences on a global scale.