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GUEST COMMENT

The New Environmental Determinism

In the last few years, particularly with the collapse of communist regimes in Eastern Europe, much has been made of the so-called 'new world order'. This, Alistair Cook (BBC radio) recently referred to as 'new world disorder' because of the many internecine and intranecine battles that are currently razing *inter alia* much of the former Soviet Union, its satellites, and what was Yugoslavia, to rubble. Resource destruction and the creation of refugees go hand-in-hand to bring about disorder, in stark contrast to the comparatively rigid system that obtained pre-1989. The scene changes as life's drama is played on the world stage. However, there are other but no less significant ways of destroying resources and engendering refugees. Alterations to The Biosphere are a case in point. These have the potential of creating disorder on a grand scale in both society and the biota.

Recent news from the Mauna Loa observatory in Hawaii should allay any doubts there may be about the rapidity with which Earth's surface (including atmosphere) processes react to perturbation. It should also serve as a warning to governments world-wide. The continuous monitoring at Mauna Loa, since 1958, of atmospheric carbon dioxide concentrations, indicates an apparent decline in the growth-rate of anthropogenic emissions of the gas. However, this news is tempered by the fact that actual anthropogenic emissions of carbon dioxide have not in the least decreased. The apparent decline seems likely to be due to changing flux-rates between the various pools of carbon — particularly those in living matter, the atmosphere, and the ocean (Sarmiento, 1993). Indeed, the reason why such changes should occur may well be connected to the eruption of Mount Pinatubo in 1991, possibly *via* iron enrichment of the oceans by the volcano's ejecta. That a single, albeit substantial, event in Earth history could affect atmospheric composition to such an extent makes the living world of The Biosphere appear fragile and vulnerable on one hand, and remarkably dynamic on the other. This same dynamism and fragility are apparent in the terrestrial, ocean-sediment, and ice-core, records of the last 2 million years. Moreover, even politicians and policymakers are becoming increasingly aware of the role of heat-trapping gases in the atmosphere and the social implications of global warming.

The Old Environmental Determinism

Charles Darwin's discourses on evolution in the middle 1800s spawned many new and reformulated ideas on the relationship between society and its environment. One of these was *environmental determinism*, the basis of which is that Nature, particularly climate, is the most important arbitrator of Biosphere characteristics and processes. Several important contributions to the natural sciences were influenced by this notion of climatic control as well as elements of dynamism. The geographical cycle of William M. Davis (1850–1934), for example, which is concerned with landscape development, invokes an idealized landscape beginning with mountain uplift and terminating in lowland plains. Another example is that of Frederick E. Clements' (1874–1945), and others, theory of vegetation succession and climax. This envisages the progressive development of vegetation communities until a climax community is established which is in equilibrium with the prevailing climate. In addition, environmental determinism, under the title of social Darwinism, was considered to be a fundamental control on human activities. Such ideas, however, had fallen out of fashion by the 1950s when the focus shifted to the apparent ability of human economic and social development to 'overcome' the forces of Nature. Nevertheless, as a philosophy, environmental determinism contains much to commend it: covertly, it embodies the concept of The Biosphere and society as mutually dependent parts of an environmental system — a relationship termed 'the noosphere' by the Russian scientist V.I. Vernadsky. Implicit is the idea that the relationship could be self-perpetuating or self-destroying. Thus it contrasts with a notion of dualism, a construct dating from Classical times. *Dualism* separates people and place and bestows pre-eminence on people who, it claims, have an absolute right to tame Nature for society's ends.

The New Environmental Determinism

The new environmental determinism, although it is not referred to as such, embodies many of the same ideas as the old environmental determinism. This *neodeterminism*, as it should be called, is based on an understanding of global energy-flows and biogeochemical cycles. However, one major difference between the old determinism and neodeterminism is that the latter recognizes the reciprocal relationships between the oceans, the rest of The Biosphere, and climate. Thus climatic change can be generated within the system; it may be the result of the deliberate or inadvertent efforts of humans, and need not necessarily be caused by external factors. Neodeterminism includes the Gaia hypothesis, the basis of which is that the key to Earth's functioning as an environmental system is atmospheric composition. The long-term geological record from the Precambrian to the Tertiary provides glimpses of the relationships between life, its evolution, and atmospheric composition.

Recent Evidence for Neodeterminism

The relatively short-term record of the Quaternary period is providing increasingly a detailed chronicle of climatic change. One of the variables in the 10°C swing of global temperatures between an ice-age and an interglacial is undoubtedly atmospheric composition. What is not clear is how the astronomical features of the Earth's rotation around the Sun can translate into stadials (major ice advances during an ice-age), interstadials (short-lived warm periods between stadials), and interglacials. It is, however, obvious that the carbon-biogeochemical cycle is intimately involved. How it operates in terms of the pools and flux rates, what the thresholds are between one state and another, and what the negative and positive feedbacks are, require urgent elucidation. The fact that the switch from ice-age to interglacial was accompanied by a 25% increase in the concentration of carbon dioxide in the atmosphere, either as a forcing or reinforcing mechanism, underlines the role of atmospheric composition in climatic change. Implicit in neodeterminism, then, is the view that the additional 25% increase of carbon dioxide in the atmosphere since the onset of industrialization *c.* 1750, will inevitably cause some form of climatic change. As Gaia's originator, James E. Lovelock, suggests, this is likely to allow life to continue, but it may be along different pathways from hitherto and may include some pathways that do not favour the survival of humans. Both the stage and the cast will vary as they inevitably do in a dynamic system.

Thus the taming of Nature, espoused by dualism and facilitated to a large extent by the energy of fossil fuel, may turn out to be the ruination of the modern Biosphere and its human inhabitants. Although they still require much clarification, the lessons from the geological past that implicate the carbon cycle in climatic change should not be ignored, nor should the fact that, despite society's sophisticated technological achievements, it remains totally dependent for its survival on the Earth's green mantle. Agricultural systems provide food energy, while the remaining Biosphere provides an essential range of goods and services. It is ironic that the modern Biosphere may be endangered by the products of ancient biospheres. What Nature in the past so carefully sequestered from the actively circulating carbon cycle is now being released *con flagrante*. Just in case there is not enough carbon dioxide from this source, there is another anthropogenic input as a result of the deforestation that this Journal reports so well. If Jean-Paul Sartre were alive and involved with environmental issues, he would probably have described this as amoral environmental existentialism. For now let it suffice to record: environmental determinism is dead. Long live environmental determinism.

REFERENCE

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