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The Gaia Hypothesis and Earth System Science

The following is an excerpt from "Scientists on Gaia" by Stephen Schneider and Penelope Boston (MIT Press):

"For more than a century students of the evolution of the living and nonliving parts of the Earth have known that life influences the physical and chemical characteristic of the planet. Nevertheless, the dominant paradigm in earth sciences has been that inexorable inorganic forces, such as changing energy output from the Sun, collisions of the Earth with extraterrestrial bodies, continental drift, or other orbital element variations have been the principal driving forces behind climate twenty years ago. James Lovelock and Lynn Margulis coined the phrase the Gaia hypothesis to suggest not only that life has a greater influence on the evolution of the Earth than is typically assumed across most earth science disciplines but also that life serves as an active control system. In fact, they suggest that life on Earth provides a cybernetic, homeostatic feedback system, leading to stabilization of global temperature, chemical composition, and so forth.

When first introduced in the early 1970s the Gaia hypothesis attracted the most attention from theologians interested in the possibility that the Earth controlled its environment on purpose (i.e., teleological implications), from those looking for "oneness" in nature, and from those defending polluting industries, for whom the Gaia hypothesis provided a convenient excuse whereby some collective set of natural processes would largely offset any potential damages from human disturbance to earth systems. Although none of these aspects was underlined in the scientific work of Lovelock and Margulis, these nonscientific side issues diverted attention in the scientific community away from a serious analysis of the Gaia hypotheses and its implications. By the mid 1980s, Gaia advocates and detractors began a series of critiques and counter critiques, often carried out through third parties such as television documentary producers One of us (Schneider) having been party to such a debate came to realize the absurdity of the situation in which an interesting and controversial idea like the Gaia hypothesis was being debated largely in nonscientific forums, if at all"

Earth System Science is not entirely equivalent to the Gaia Hypothesis, although both take an interdisciplinary approach to studying systems operations on a planetary-scale. Earth System Science seeks to understand the mass and energy transfers among interacting components of the Earth System (biosphere, hydrosphere, geosphere, atmosphere, and anthrosphere), which is not entirely synonymous to the the Gaia principle which purports that for practical purposes it may be useful to consider the earth as if it were a living organism. For the student interested in the scientific debate of the Gaia hypothesis, an excellent treatment is provided in "Scientists on Gaia", edited by Stephen Schneider and Penelope Boston, The MIT Press, Cambridge, MA, 1991.

Schneider, S.H., and P.J. Boston (eds.), 1992: Scientists on Gaia, Cambridge, MA: MIT Press, 443 pp.