Ecosystem Moral Considerability: A Reply to Cahen

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Appeals to science as a help in constructing policy on complex issues often assume that science has relatively clear-cut, univocal answers. That is not so today in the environmentally crucial fields of ecology and evolutionary biology. The social role of science has been as a source of information to be used in the prediction and domination of nature. Its perspectives are finely honed for such purposes. However, other more conscientious perspectives are now appearing within science, and we provide an example here in rebuttal to the claim that there is no warrant from within ecology for ecosystem moral considerability.

INTRODUCTION

As often happens in our society, Cahen[1] appeals to science to illuminate a social problem and implies that an established discourse within a science provides the only perspective coming from that science. While the scientific establishment itself seems largely to justify this move, caution is required. In some sciences some of the time univocal agreement is far from a reality, and that is the case today in evolutionary biology and ecology. From this standpoint, it is clear that Cahen has presented a highly biased assessment of possible attitudes within evolution/ecology with regard to whether ecosystems can be viewed as bonafide individuals that might be imputed to have perspectives, which he denies. Thus, though he cites Engelberg and Boyarsky against ecosystem individuality, he fails to note that the same journal published no less than five rebuttals two years later.[2] He has taken the line that what we find in science will limit our choice of possible attitudes, talking as though only one answer can come from ecology concerning his question of whether or not ecosystems can be viewed as being

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[1] Harley Cahen, "Against the Moral Considerability of Ecosystems," *Environmental Ethics* 10 (1988): 195–216.

[2] J. A. Wiens, "Single-Sample Surveys of Communities: Are the Revealed Patterns Real?" *American Naturalist* 117 (1981): 90–98; S. J. McNaughton and M. B. Coughenour, "The Cybernetic Nature of Ecosystems," *American Naturalist* 117 (1981): 885–900; R. L. Knight and D. P. Swaney, "In Defense of Ecosystems," *American Naturalist* 117 (1981): 991–92; C. F. Jordan, "Do Ecosystems Exist?" *American Naturalist* 118 (1981): 284–87: B. C. Patten and E. P. Odum, "The Cybernetic Nature of Ecosystems," *American Naturalist* 118 (1981): 886–95.

goal directed. We argue that this is not so in this case. When we use biology to bolster our political actions, we have to make choices between possible attitudes *within* this science first.

PLURALITY WITHIN ECOLOGY

In ecology, there are two major contending schools—systems ecologists and community ecologists. Cahen has been informed by the latter only, and they have been openly hostile toward systems ecology discourse. Community ecology, with its focus on interactions between populations of organisms (e.g., predation, competition), comes out of a confluence of Gausean studies of competition between populations of different species and Darwinism, with some input from Alfred J. Lotka's contributions on population growth and predation. Its approach to ecosystems may be said to be nonexistent insofar as it never actually deals with them, confining its inquiries to questions about how there can be so many kinds of organisms living in a given place, and to how, in detail, these organisms have achieved stable associations by means of inter- and intraspecific competition. Its concerns have been entirely with the biotic components of ecosystems. It is a particularistic approach, putting communities together conceptually piece by piece, by accidental immigration and/or natural selection. Its major theoretical concept, the ecological niche or way of life, is defined (in the Hutchinsonian version used by most community ecologists) in such a way as to emphasize the differences between the adaptations of populations of different species.

Systems ecologists, on the other hand, virtually ignore the specificities of organismic adaptations and concern themselves with the overall organization of the flows of matter and energy. The objects of their studies are salt marshes, ponds, ravines, and the like. They have looked for similarities between systems as well as differences. Their major tool, the flow diagram, can be constructed so as to reflect one or the other. Only these ecologists have taken on the problem of determining the boundaries of ecosystems, and so only they can even confront the possibility of such a system being an individual entity. We note that Cahen does not cite any of these works—those of, say, C. S. Holling, or of the Odum brothers, or of Timothy Allen and Robert O'Neill, or of Bernard Patten or Robert Ulanowicz.[3] We are not imputing any global attitudes to these workers concern-

[3] C. S. Holling, "The Resilience of Ecosystems: Local Surprise and Global Change," in W. C. Clark and R. E. Munn, eds., *Sustainable Development of the Biosphere* (Cambridge: Cambridge University Press, 1986): E. P. Odum, "The Strategy of Ecosystem Development," *Science* 164 (1969): 262–70; H. T. Odum, *Systems Ecology: An Introduction* (New York: Wiley, 1983); R. V. O'Neill, D. L. DeAngelis, J. B. Waide and T. F. H. Allen, *A Hierarchical Concept of Ecosystems* (Princeton: Princeton University Press, 1986); B. C. Patten, "Environs: The Superniches of Ecosystems," *American Naturalist* 119 (1982): 179–219; R. E. Ulanowicz, *Growth and Development: Ecosystems Phenomenology* (New York: Springer-Verlag, 1986).

ing the moral considerability of ecosystems. We merely note that if ecologists are to be consulted about this question, these, and not those of the community school of Hutchinson and MacArthur, are the appropriate consultants. At the very least, their existence ought to be noted rather than ignored altogether.

It is curious, and probably related to Cahen's bias, that the major environmentally oriented journal coming from ecology, *Conservation Biology,* is run by and caters almost entirely to community ecologists. Their interest appears to be centered on saving the world's biotic diversity (much as in the old Audubon Society approach). The point seems to be that they are fighting to save the objects of their own largely Darwinian studies.

GENERAL SYSTEMS VERSUS CYBERNETICS

Systems talk does inform part of Cahen's text, as we can see by the crucial focus he makes on "goal directedness," which he fails to find evidence for in ecosystems. This calls for a brief sketch of the history of general systems. It was initiated in the 1920s in Germany by, among others, the organicists von Bertalanffy and Paul Weiss, who also brought it to North America. Anyone perusing their works (see, e.g., papers in the collections of von Bertalanffy and Koestler and Smythies[4]) will find a richness that was soon to fall away with the postwar rise of cybernetics—explicitly a narrower study of machines. It was in this context that goal directedness (first invented for guided missiles) entered systems discourse. Working from this base, it was at last possible to carry the program of mechanistic materialism into the realm of complex systems. Our point here is that Cahen has evidently been influenced by this discourse about machines. His central criterion, goal directedness, is a criterion allowing the discrimination of machine behavior. Is it any wonder that he fails to find evidence for moral considerability in, for example, *either* rusting automobiles *or* ecosystems?

We should note in passing that those wishing to consult scientists about issues like these had better realize that most of nineteenth and twentieth-century science (what might be called the Baconian/Newtonian/Darwinian/Comtean version) has attempted to construe the world and its inhabitants as machines. That program has been associated with a social role of prediction and an imagination of control.[5] That this has heavily infiltrated the way we think even about ourselves is easily realized when we consider the social status of allopathic medicine, whose ultimate logo would seem to be the artificial heart. From this point of

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[4] L. von Bertalanffy, ed., *General Systems Theory* (New York: George Brazillier, 1968); A. Koestler and J. R. Smythies, eds., *Beyond Reductionism: New Perspectives in the Life Sciences* (New York: Macmillan, 1969).

[5] Carolyn Merchant, *The Death of Nature: Women, Ecology and the Scientific Revolution* (New York: Harper & Row, 1980).

view, it seems to us it would be difficult to construe moral considerability even for people! And, indeed, the blatantly legalistic mode of *that* discussion today (see for example any issue of *The Hastings Center Report*), shows that the moral standing of human persons is a concept that is even now becoming harder to feel or deal with. We are therefore not surprised that in Cahen's particular study the allocation of moral considerability failed for ecosystems.

AN ALTERNATE VIEW OF ECOLOGY

We would like to sketch a view of ecosystems from a modern general systems approach to biology. This approach is compounded of what is sometimes known as hierarchy theory (an unfortunate name for the study of levels of organization), some branches of the study of the origin of life, and much of the application of nonequilibrium thermodynamics to biology, as well as the original von Bertalanffy approach. First, it should be clear that any systems science is abstractive and tends to see different kinds of systems as models or metaphors of each other. A systems diagram could be constructed (e.g., with inputs, flows of information and energy, feedbacks and outputs) which would apply equally to ecosystems or organisms. That is the very point—to learn some things from systems where they are accessible in order to try applications to others where they are not, and reciprocally. From this point of view, it *has to be the case* that there are large similarities between any complex systems. The prejudice, then, concerning moral considerability could quite legitimately be in favor of generalizing it from this perspective.

This does not imply that in finding such system isomorphisms one is imputing exact equality of qualities across systems. Take sentience. The class of systems said to have sentience (wherever one draws the line) is necessarily a subclass of a yet larger class of systems with some more general characteristic of which sentience is a more highly specified condition. That quality has general properties in common with sentience (in fact, it has much of whatever is necessarily implied by sentience); otherwise it would not be the appropriate superclass in which to embed *sentience*. We need not expect to find a name for this class—sentience will do. We can, therefore, argue that ecosystems, for example, being autonomous energy dissipative structures, just as organisms are (a contribution from systems ecology), may be imputed to have in a more general condition any characteristic we take to be essential for the moral considerability of humans.

Indeed, since the development of any system appears to be a kind of passage from more general to more highly specified states (see, e.g., von Baer's law in biology[6]), this is formally the very move being made by right-to-lifers in

[6] E. S. Russell, *Form and Function: A Contribution to the History of Animal Morphology* (London: John Murray, 1916); S. J. Gould, *Ontogeny and Phylogeny* (Cambridge: Harvard University Press, 1977).

asserting that fetuses have a right to moral considerability (this points to another potential moment for conflict between deep ecology and feminism). We will now show how it is the case that the "sentience" of ecosystems is most appropriately taken to be an earlier stage in a developmental trajectory of which a later stage would be human sentience. It can be shown that ecosystems and organisms, as well as the Earth itself, show the same phenomenological behavior when viewing them thermodynamically as developing systems. These all progress from an immature condition of intense energy throughput and relatively chaotic behavior, through a mature period of greater range and power, to a senescent phase of declining energy throughput and rigidity of internal predisposition coupled with increasingly unpredictable overt behavior that leads ultimately to recycling.[7]

At this point we can bring in scalar hierarchy theory and note that individuals of different scale behave and change direction at really quite different rates. Larger scale systems are slower to develop and change direction; smaller scale systems much faster.[8] This means that a cogent moment for these systems is quite different, requiring many moments of a smaller scale system (like ours with a cogent moment of about a second) to make up a single one of a larger scale system—that of an ecosystem perhaps on the order of many months tallied by us in our moments. The film *Koyaanisqatsi*[9] provides opportunities for the viewer to experience moments of different scale visually. The point here is that if ecosystems are in a developmental trajectory leading toward sentience, they do it so slowly that most of them are disturbed and set back to earlier stages long before they reach anything like that quality full-blown. Like fetuses, they have only a potential for sentience. Unlike fetuses, it may only rarely be realized. Unfortunately, whether or not even the most highly developed ecosystems on Earth—tropical rain forests and coral reefs—have arrived at something close to a true sentience remains for now a moot point because of the formal difficulty of communication between entities of such radically different scale as humans and ecosystems (consider the problems a few red blood cells would have in attempting to communicate with one of us). Study of complex systems may one day lead to opportunities in this direction.

Notice what has been done here. Taking a combination of approaches from general systems, hierarchy theory, thermodynamics, set theory, systems ecology, biology, and a number of approaches originating in Europe going under the rubric self-organization, we have sketched what is in effect a basis for a

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[7] S. N. Salthe, "Self-organization of/in Hierarchically Structured Systems," *Systems Research*, forthcoming.

[8] S. N. Salthe, *Evolving Hierarchical Systems: Their Structure and Representation* (New York: Columbia University Press, 1985); R. V. O'Neill, "Scale and Coupling in Ecological Systems," in J. Roughgarden, R. M. May and S. A. Levin, eds., *Perspectives in Ecological Theory* (Princeton: Princeton University Press, 1988).

[9] Godfrey Reggio, *Koyaanisqatsi: Life Out of Balance* (Pacific Arts Corporation, 1982).

genuinely new mythology about life and the Earth. It is entirely different from that of the reductionist, particularistic approach that has characterized the analytic, positivist tradition which is refelected in Cahen's text. That tradition has come close to depriving even humans of anything but mechanical characteristics. This new one would put the uncertainty and mystery back into all of nature as a way of preserving the uncertainty and mystery of humans. However, it is not our purpose to promolgate such a view here, only to point out that it is possible to construct one like that from within the sciences today, and that such a perspective might possibly make room for the moral considerability of such entities as ecosystems. Admittedly this is not an establishment perspective, but it is well to realize that the problems ecosystems face (if they are things that can face problems) are generated by the same system that is being consulted when establishment science is asked to contribute to the solutions.

Goal directedness is a paradigm of the kinds of thinking that have come to us from the older tradition. How is it that we are not insulted when someone claims to ask whether we, or our cat, have this mechanical property? The discipline of self-organization is considerably, and consciously, much richer in what it will impute to living beings. Do living beings have goals? It turns out that they will be seen to have whatever goals are assigned to them by theory. Darwinian theory assigns to organisms the goal of maximizing fertility. To Darwinians they appear to behave *as if* they have that goal. It follows that if a different discourse can be constructed about living things, it could well construe a different goal. In fact, self-organization explicitly avoids dealing in goals at all, using concepts more like Sartre's "project" in this connection. Such a project emerges gradually from the activities of the systems. One way of getting that idea across, hit upon by Robert Ulanowicz[10] (using an idea of the physicist John Wheeler), is to think of a group playing twenty questions with one other person. The group decides to pick no name at all. The person's first guess (animal, vegetable, mineral) is said to be correct (or not) arbitrarily by the first respondent. The next respondent is also going to answer true or false arbitrarily, but must be bound by the first respondent's response, and so on. Gradually the item the group supposedly had in mind but really constructs—tornado, Mount Everest, chimpanzees—emerges without anyone having deliberately picked it.

Finally, in the spirit of what we have said here so far, we would like to point out that the tone, lacking in all humility, of Cahen's article was distressing to us. It implies throughout that we humans will be the ones who will decide the fate of worlds. James Lovelock falls into a similar trap in his discussions of Gaia, when he suggests that we have become the Earth's "nervous system."[11] From the

[10] Ulanowicz, *Growth and Development*.

[11] J. E. Lovelock, *Gaia: A New Look at Life on Earth* (New York: Oxford University Press, 1979).

systems approach it is clear that the general patterns of energy, matter, and information flow were present before life originated on Earth,[12] and that no particular species of organism is required to keep these systems and subsystems flowing. Organisms were, as it were, interpolated into a preexisting system, and their evolutionary elaboration was part of the development of the surface of the Earth. The fact of ecological vicarage across continents (similar but unrelated organisms plying the same ways of life) shows that no single species is required for a given role in an ecosystem to proceed. No matter what we do, ecosystems will continue to cycle, Gaia will continue her development. What is at stake for us is *our own share* in this development. That stake we could probably waste if we continue our arrogant practices of attempting to control nature in the style we are used to. For that reason we feel that if it requires a new creativity to break with older, established, ways of thinking in order to continue our adventures on Earth, it must be undertaken, even at considerable risk. If we fail here, we and ours will be replaced as a renewed system undertakes its development, perhaps along new lines because of a perturbation precipitated by our behavior, without us.

[12] J. S. Nicolis, *Dynamics of Hierarchical Systems: An Evolutionary Approach* (Berlin: Springer-Verlag, 1986).