

WHATEVER HAPPENED TO ECOLOGY?

By Edward Goldsmith

Thomas Kuhn, in his celebrated “Structure of Scientific Revolutions”, demonstrated perhaps more convincingly than anyone before him ⁽¹⁾ that a scientific theory was adopted not because it had been “proved” to be true on the basis of some serious objective test (assuming that there can be such a test) but because it fitted in with that pattern of scientific “wisdom” on the subject —the “paradigm” as he referred to it — that happened to be in vogue at the time.

The more credible epistemologists of the last decades, such as Imre Lakatos, Paul Feyerabend and Harold Brown, have largely accepted this thesis and have generally come to agree that scientific knowledge has no special status — contrary to what logical positivists and many scientists still maintain — that distinguishes it from common or garden knowledge.

Though Kuhn himself later abandoned the use of the term paradigm (the philosopher Margaret Masterman showed that he used it in at least twenty different ways), this has not prevented it from coming into general use, nor even from being applied to “cognitive frameworks outside the field of science.

At the same time, it has also become clear that, since scientists do not live in a closed scientific community, but are also members of a society with whose world-view, together with the values it reflects, they have, like everybody else, been imbued, and which the scientific paradigm which they entertain also tends to reflect.

Consistency with the reigning social paradigm is thus, in effect, the ultimate criterion of scientific truth. A perfect example is the almost unquestioned belief among the scientific community in the Darwinian and today the neo-Darwinian thesis, according to which evolution proceeds by natural selection from random variations (or genetic mutations for the neo-Darwinists) – a crude mechanistic process (the biological version of Adam Smith’s invisible hand”) that somehow has the mysterious ability to transform random variations (or mutations) into the highly integrated and perfectly coordinated parts of that most sophisticated of all creations, the ecosphere.

If Darwinism was so attractive to scientists it is that it was above all seen as providing the only coherent “naturalistic” or “scientific” explanation of evolution, the only alternative being some airy-fairy theory making use of supernatural concepts like Driesch’s “entelechy” or Bergson’s “elan vital”. In this way, it marked the victory of science over metaphysics and religion. Another attraction of Darwinism was that it could explain evolution without recourse to Lamarck’s theory of the inheritance of acquired characteristics which was not reconcilable with the mechanistic paradigm of science. For one thing mechanical systems do not inherit acquired characteristics, for another, they are passive, and do not evolve as a result of their own efforts, as living things were seen to do by Lamarck. Clearly they require as well an operator to make them function. ⁽²⁾ Hence Darwinism was consistent with the management ethic so critical to the very notion of progress as a scientific, technological, and industrial enterprise.

It was, and remains, attractive too because it provides a reductionist approach to evolution, one that justifies the study of the living world by examining its components in isolation from each other. This too is important as science, since Bacon, ⁽³⁾ Descartes and Galileo, is above all an enterprise designed to transform and dominate the world, and to do so it must be reductionistic, the contemplation of totality having little role to play in this suicidal endeavour. The postulate of randomness is also critical in order to make it appear that what order there is in the world is a product of this transformation. ⁽⁴⁾

All of this was clear to the great geneticist and embryologist C.H. Waddington. “Since Darwin’s time and in particular since the rise of Mendelian genetics” he wrote “the emphasis has been placed on the discreteness of the individual genes, the randomness and non-relational nature of the mutational process and the unimportance of the reaction of the organism to its environment.” ⁽⁵⁾

In the 1940s and 50s Julian Huxley, George Gaylord Simpson and others developed the “Modern Synthesis” which seemed to be an advance on the neo-Darwinism of William Bateson and August Weissmann, in that it replaced the vague notion of “the survival of the fittest” by that of “differential reproduction”. That meant

that those who survived the terrible competition that was seen to be a necessary feature of the living world were not just the “fittest”, a vague concept, but those who succeeded in having the most offspring, something that could be accurately quantified and hence that was seen as being very scientific.

As already intimated the main reason why Darwinism was so attractive to scientists is that it served to rationalise the socio-economic trends brought about by the industrial revolution. Among other things it postulated the principle of perpetual change on “progress” as well as individualism, egoism and competition, the qualities most admired by the new industrial middle-classes, while ignoring the old values of tradition, cooperation, and sociality.

For Polanyi, “neo Darwinism” is firmly accredited and highly regarded by science though there is little direct evidence for it, because it fits in beautifully into the mechanistic system of the universe,⁽⁶⁾ which is critical to the modern world-view.

The Austrian biologist – and founder of General Systems theory - Ludwig von Bertalanffy felt the same way. “That a theory so vague, so insufficiently verifiable and so far from the criteria otherwise applied in “hard science” has become a dogma” he writes “can only be explained on sociological grounds. Society and science have been so steeped in the ideas of mechanism, utilitarianism and the economic concept of free competition, that instead of God, selection was enthroned as ultimate reality.”⁽⁷⁾

What few people seem to realise is that precisely the same thing has happened to ecology. Ecology developed as an academic discipline when a few biologists realised that living things do not live in random aggregations but are instead the differentiated and interrelated constituents of larger natural systems that were originally referred to as ‘associations’ or ‘communities’ and that once they taken in conjunction with their geological substrate and atmospheric environment, were and are now referred to as “ecosystems”.⁽⁸⁾

For a long time communities or associations of living things were seen to be so closely integrated that they could be compared to biological organisms – and were even referred to as “super organisms” by early ecologists such as Clements and Shelford,⁽⁹⁾

who were particularly influential at the time, The ecologist Daniel Simberloff referred to the notion of the community as a superorganism as “ecology’s first paradigm”.⁽¹⁰⁾

It is important to note that the holistic ecology of the early days had much in common with the world-view of primal people. It was also reconcilable with the world-view of the natural theologians such as Ray, Kirby, and Paley in the 17th and 18th centuries, who interpreted the close interrelationships between the living things that made up the natural world and the extraordinary harmony that existed among them as proof of the existence of a divine creator.⁽¹¹⁾ It was also consistent with the world-view of the romantic poets such as Coleridge, Wordsworth, and Goethe, as it was with that of Thoreau and Aldo Leopold, the great precursors of today’s environmental or ecological movement for which it provided the necessary theoretical justification.

On the other hand real ecology could not conceivably serve to rationalize and hence legitimise the atomised and aberrant society that economic development gives rise to. It is necessarily holistic rather than reductionistic, it seeks to understand why things happen in their total context rather than apply statistical methods to the study of isolated cause and effect relationships. It is organismic or vitalistic rather than mechanistic. What is more, the concepts in terms of which it is formulated such as wholeness, the balance of nature, teleology, morphogenetic and behavioural fields and organized (as opposed to random) complexity, are very difficult to quantify, which in the eyes of modern science means that they lack precision, are very difficult to study in controlled laboratory conditions, and are thereby “unscientific”.

It follows that in the 1950s, when pressure developed to set up departments of ecology in US universities (they had been fairly rare up to that time) ecology had to undergo a radical transformation. This led to the revival of the reductionist and mechanistic ideas of the botanist Herbert Gleason,⁽¹²⁾ which had caused a big controversy thirty years before. The environmental historian Donald Worster in his brilliant book “Nature’s Economy” tells the story of this transformation. Though he obviously deplures it, he admits that if it had not occurred “ecologists might have disappeared as an independent class of researchers and would not occupy today such an influential position among the sciences.”⁽¹³⁾

Daniel Simberloff also describes how “ecology has undergone, about half a century later than genetics and evolution, a transformation so strikingly similar in both outline and detail that one can scarcely doubt its debt to the same materialistic and probabilistic revolution. An initial emphasis on similarity of isolated communities, replaced by concern about their differences: examination of groups of populations, largely superseded by the study of individual populations: belief in deterministic succession shifting, with the widespread introduction of statistics into ecology, to realization that temporal community development is probabilistic: and a continuing struggle to focus on material, observable entities rather than ideal constructs...” (14)

Robert McIntosh, perhaps the best known historian of ecological thought, also notes how “much of the revolution in ecology in the 1950s and 1960s took the form of increasing quantitative methodology, the introduction of diverse external bodies of theory into ecology and efforts to merge ecology with other bodies of biological theory, especially genetics and evolution” (both of which were and still are largely reductionistic). At the same time he tells us that “classical Clementsian, climax theory was reassessed and found wanting by plant ecologists”, while “the long submerged individualistic concept of H A Gleason became the ‘individualistic hypothesis’ and was incorporated into new general ecology textbooks” (15) and, he might have added, has now become gospel among modern ecologists.

One of the most influential promoters of this new reductionist ecology or anti-ecology as it would more appropriately be referred to, is William H. Drury whose last and posthumously published book is entitled “Chance and Change”. (16) Its very title could not of course be more revealing. Indeed it implies that the living world is constantly changing and in a totally “chance” or random direction. It goes without saying that such a world is by its very nature totally indestructible. Transnational corporations can thereby annihilate our forests, erode, desertify and salinize our soils, pollute the living world with tens of thousands of toxic chemicals and transform the chemical composition of the atmosphere to their hearts’ content. How can it degrade let alone destroy the ecosphere, if the latter has no necessary structure and is constantly changing?

Complexity and stability

It is worth considering to what extent the old ecological principles have been rejected. To begin with a well-established principle of ecology is that, as natural systems become more complex, so do they become more stable. But this principle became an embarrassment to scientific ecologists and had to be discredited so as both to justify the systematic replacement of complex forest ecosystems and traditional agricultural ecosystems with the endless stretches of monoculture required to satisfy the requirements of our modern economy. Drury makes no bones about it. He tells us that there was a time “when widely quoted ecologists were making the seductive arguments that species diversity is critical to the health of ecosystems. Diversity it was argued, leads to stability by adding connections in food webs. It seemed evident that when species diversity decreases, a community is destabilized. This in turn provided dire forebodings for the destabilizing effects of drastic reductions in species diversity by deforestation of the wet tropical jungles”,⁽¹⁷⁾ and such dire forebodings had of course to be dispelled if the scientific discipline of ecology could serve to justify economic development.

Succession to a climax

Another well established ecological principle is that of ecological succession towards a climax. Eugene Odum expresses the holistic view of succession in describing it as “an orderly process of community development that is reasonably directional and therefore predictable” and that “culminates in a stabilized ecosystem or a climax ecosystem.”⁽¹⁸⁾ This is totally unacceptable. For one thing it is irreconcilable with the individualistic concept since succession does not involve the action of but one, but the concerted action of all the living things that make up the community or the ecosystem. It is also a strategy geared to the achievement of a particular goal - a stable state – after which change comes to an end save for the purpose of maintenance and repair. This is also a teleological concept with all its scientifically unacceptable metaphysical and theological connotations. It is also irreconcilable with the principle of randomness as it is with that of perpetual change and thereby of progress and economic development, its most obvious manifestation.

The idea of succession seen as a strategy leading to an ecological climax is also irreconcilable with the gospel of neo-Darwinism. For Drury succession has to be no more than a series of ad hoc moves, for “random change” he writes “is consistent with Darwin’s theory of natural selection on the basis of which there would be strong selection pressures for favouring members of “early successional” species to suppress their successors, and strong selection pressures opposing those individuals that enhance the growth of competitors.”⁽¹⁹⁾

The reductionist ecologists of today do not seem to realize that ecological succession is only one specialized instance of sequential development that is a feature of all life processes at all levels of organization. This is true of the development of an embryo in the womb, as it is of day-to-day behaviour such as getting up in the morning, having breakfast, and going off to work. Each of these processes occurs in a specific order, nor is it a random one, for each is totally purposive, as indeed is ecological succession to a climax.⁽²⁰⁾

The balance of nature

The notion of the balance of nature is critical to holistic ecology. It is largely another way of expressing the principles of order and stability. For instance, in any ecosystem the balance must be maintained between the populations of living things at different trophic levels. If there are too many predators or not enough decomposers then the balance would be disturbed which could only result in instabilities. Similarly the balance must be maintained within our internal ecosystem, between man, for instance, and the populations of micro-organisms that necessarily inhabit him and without which his normal metabolic functions could only occur imperfectly. The balance too must obviously be maintained between the different chemical substances that make up our atmosphere. If global warming is occurring today it is precisely because we have not maintained this balance, the carbon dioxide content of the atmosphere having increased from the norm of about 288 parts per million to about 350 parts per million, and continues to do so. The principle of balance is so evident and so critical to an ecological world-view, that it is almost impossible to believe that any serious student of the world of living things could possibly reject it. Yet it was so rejected by Darwin himself and by his contemporary Alfred Russel Wallace, as it was by Charles Elton, one of the most distinguished British ecologists of the inter-war

years, and later by McIntosh, Simberloff, and just about every other modern ecologist of note today, with the exception as usual of Odum and Rowe.

For Drury the balance of nature, or rather the “equilibrium conditions” that he equates it with, together with the climax that gives rise to it “seem to be direct descendants of the divine order of nature’s plan, which Western people inherited from their pre-scientific past”, which for him could not be a more damning indictment. “Equilibrium theory”, he also tells us, “the characteristic ecology taught in introductory textbooks, clearly provides the intellectual foundation of politically active environmentalists”.⁽²¹⁾ Here again he reveals the close connection between his ecological “science” and his socio-economic ideology.

Elsewhere he rejects the notion of balance because he says it separates humans from nature. “Environmentalists” he writes “continually assert that humans and their technological society have destroyed nature.” Before that occurred, of course, “nature was peaceful and harmonious. This is a distorted and unsubstantiated view”. It is “not realistic or helpful”, and “it leads to an unjustified pessimism among environmentalists”.⁽²²⁾

The whole is more than the sum of its parts

Even the most fundamental holistic principle that “the whole is more than the sum of its parts” has been rejected by modern ecologists. Arthur Tansley was among the first to deny this key principle “These wholes”, he wrote, “are in analysis nothing but the synthesized actions of the components.” A mature science, he insisted, must isolate ‘the basic units of nature’ and must ‘split up the story’ into its individual parts.”⁽²³⁾

However, to deny that the whole is more than the sum of its parts is to deny that there is such a thing as organization – a concept of course that scientists geared to quantitative methods cannot begin to deal with (though they have tried unsuccessfully to measure biological organization in terms of Shannon and Weaver’s⁽²⁴⁾ information theory). To deny organization, however, is to deny the most basic feature of the living world. All living things are made from the same materials, they simply differ in the way these materials are organized, As the French philosopher Edgar Morin notes “there

is no such thing as living matter only living systems” and he might have said “living organizations.”⁽²⁵⁾ However, this is conveniently ignored by the proponents of reductionism and mechanism.

Drury once again makes no bones about his motives. The reason why he considers “that nature works on the basis of one-to-one species interactions, variability and chance” he tells us, is that he is “uneasy with the repeated assertions that nature’s norm is balance, and that this balance is fragile, and that current human activities invite the collapse of entire complex ecosystems.”⁽²⁶⁾

It must be clear to all that as a result of this transformation mainstream scientific ecology no longer reflects the ecological or cosmic world-view of primal people, of the natural theologians, of the Romantic poets, of the early academic ecologists, nor of the environmental or ecological movement of today. Most people in the environmental movement of course still assume that ecology as a science, as it is taught in today’s universities, provides the theoretical justification for the war we are fighting against the multinationals that are destroying our planet – but quite the opposite is true. It is the destruction that the irresponsible activities of the multinationals are giving rise to that modern ecology serves to justify.

Significantly modern scientific ecologists bitterly decry the use of the term ‘ecology’ as it is applied to our subversive movement. An exception is again Eugene Odum of the University of Georgia, the doyen of the ecological world, whose textbooks (*Fundamentals of Ecology* and later *Basic Ecology*) were regarded for forty years as authoritative in American universities. He, on the contrary, welcomes this use of the term, and the reason is not difficult to gather. Odum, together with Stanley Rowe of the University of Saskatchewan, are about the only two prominent holistic ecologists left today, and their writings remain totally consistent with the aims of the ecological movement for which they provide a theoretical justification. We must be grateful to them.

Notes and references

1. Michael Polanyi said much the same thing in his seminal book “Personal Knowledge” in 1958. What Kuhn refers to as a “paradigm” Polanyi calls a “cognitive framework”

See Michael Polanyi 1978 edition. Routledge and Kegan Paul, London.

2. Descartes, the father of mechanistic science, remained a deist, so for him (officially at least) God was the supreme mechanic. Today, however, God has been abolished, so man and other living things that mechanistic science still sees as machines have neither a manufacturer nor an operator. They are very strange machines indeed.

3. Both Bacon and Descartes explicitly stated that the goal of science was to control the world and bend it to human requirements – as, in their ignorance, they interpreted them.

4. Significantly, Daniel D. Botkin, Professor of Biology and Environmental Studies at the University of California and Santa Barbara, who is highly influential in ecological circles today, denies that there is any order in nature. “If there is to be any harmony” he tells us “we must overcome this apparent discord”. Nature in the 21st century, according to him, “will be a nature that we make”.

As Worster points out, “Botkin thereby rejects nature as providing a norm or standard for human civilization.” This is the underlying theme of his well-known book “Discordant Harmonies” which provides “an assertion of the human right and need to give order and shape to nature.” In other words, Botkin’s book, and one might say modern ecology in general, explicitly, provides an “ecological” justification for economic development – the very process that is creating a global, ecological, “disclimax”, as Odum would refer to it, and thereby systematically reducing our planet’s capacity to support living things.

See Donald Worster, “The Shaky Ground of Sustainability

5. C.H.Waddington

6. Michael Polanyi, 1978, op.cit.

7. Ludwig von Bertalanffy
8. The Oxford ecologist, Arthur Tansley, coined the term in the 1930s.
9. See Frederic Clements and Victor Shelford, 1930, *Bio-Ecology*, Wiley, New York.
10. See Daniel S. Simberloff, 1980, "A succession of paradigms in ecology" in Saarinen Esa ed., *Conceptual Issues in Ecology*, D.Reidel, Dordrecht.
11. See
Their writings were influential even in the time of Darwin.
12. The reductionist approach to ecology is normally traced to the writings of Gleason whose article "The Individualistic Concept of the Plant Association" was first published in 1917. Significantly Gleason's individualistic theory was, to begin with, totally rejected by the ecological community for it simply did not fit in with the holistic ecological paradigm of the times. But as ecology became "scientific" and respectable it was revived with alacrity just as Darwinism was revived under the guise of neo-Darwinism with the rediscovery by the scientific world of Mendel's reductionist genetics that for a long time had been ignored.
13. Donald Worster, 1977, *op.cit.*
14. Daniel Simberloff, 1980, *op.cit.*
15. Robert P.McIntosh, 1975, "H.S.Gleason, individualistic ecologist: his contribution to ecological theory," *Bulletin of the Torrey Botanical Club*, vol.102.
16. William H. Drury, *Chance and Change*.
17. William H.Drury, *ibid.*
18. At the ecological level, it is the climax ecosystem that is the most highly organized, while it is the "pioneer" ecosystem – one that is in the earliest stages of development, after having been ravaged, for instance, by some discontinuity such as a volcanic eruption or an industrial development scheme, that is the least organized.

In a pioneer ecosystem there is little diversity as many of its constituent species will have been eliminated by the discontinuity in question. In addition, because the terrain is unprepared and inhospitable the species that first appear – referred to as pioneer species - are highly opportunistic, individualistic, and egoistic, and appear to be ranged in a disorderly or random manner. Such an ecosystem is also

highly unstable and punctuated by population extinctions and explosions, which are gradually ironed out as it develops towards a climax. In other words, a degraded, pioneer ecosystem or a “disclimax”, as Odum refers to it, which economic development necessarily brings about, displays precisely all those features that Gleason, Drury, and other reductivist ecologists of today attribute to ecosystems in general. In this way, such ecologists can pretend that the degraded world that development brings into being is the norm – which of course could not be further from the truth.

19. Drury, op.cit., p. 185

20. See Edward Goldsmith, “Ecological Succession Rehabilitated”, *The Ecologist*.

21. Drury, op.cit. p.193

22. See Donald Worster, 1977, *Nature’s Economy*, Sierra Club, San Francisco.

23. Drury, op.cit. p.1

24. S.M.Dancoff and H.Quastler, “The Information content and error rate of living things”, in Quastler, ed. 1953, *Information theory in Biology*, University of Illinois Press, Urbana.

25. Edgar Morin

26. Drury, op.cit.