Review of *Discordant Harmonies: A New Ecology for the 21st Century*

by Daniel Botkin (Oxford University Press, 2001)

Daniel Botkin's book aroused a lot of interest. For a book that purports to lead ecology into the 21st century, the tone conveys the unmistakable accents of the late 19th. As if transported back 100 years, one hears the voice of the Victorian Darwinians whose ideal of civilisation depended essentially on the vigorous conquest of nature by science and technology. *Discordant Harmonies* echoes this approach: "We have the power to mould nature into what we want it to be". "Nature in the twenty-first century will be a nature that we make". In North America, these messages resonate with the turn-of-the-century forestry philosophy of Gifford Pinchot: control, manage, and use resources wisely and prudently.

Botkin is a 'population ecologist,' meaning one who is primarily interested in tracking the ups and downs of species numbers while searching for their causes. When left to themselves in nature, populations do not multiply to some fixed equilibrium point. Rather their numbers fluctuate, not regularly but in a random fashion. Thus populations tend to be unpredictable, their periodic swings corresponding more closely to the numbers thrown up by chance, as in a game of dice, than to any optimum target.

If nature is inconstant, Botkin argues, then nature has no preferred state and offers humanity no fixed goals, no guidelines by which to navigate. Therefore people must take over the planet, wisely and prudently choosing the goals to be pursued in the interests of the master species, marshalling science and technology to the task of global management. Old myths and metaphors that stand in the way of this 'factual' view of the world must be discarded. Then progress can be made, civilisation can be advanced and the world made comfortable and pleasant for us all.

That Botkin sees the world through the lenses of a population ecologist is indicated by his simple equation of the behaviour of species and populations with 'Nature's' behaviour. But, when he thinks about it, he asserts that 'Nature' taken in its largest sense is the biosphere. The question is begged: How good a surrogate or indicator of 'Nature' (i.e. of the biosphere or ecosphere) are populations of animals and plants? Does the inconstancy of population numbers mean that the ecosphere is itself inconstant? This poses a more fundamental question: What is the relationship between populations and the ecosphere?

The ecosphere (which Botkin equates with biosphere) is the planetary life-filled system, the world as a material entity that has evolved for 4.6 billion years or so. It is a structured object: the gaseous air overlying liquid sea and solid land, with organisms clustered primarily at the gas-liquid-solid phase boundaries. All parts are interactive and symbiotic. The compositions of atmosphere, hydrosphere and lithosphere show unmistakable signs of organic contributions, just as organisms exhibit clear evidence in their bodies of endowments from air, water and soil. In order to understand the ecosphere it makes sense to divide it into volumetric sectors at various scales such as oceans and continents, and the latter into regions and landscapes. If these divisions are to be functional parts, they must have the same structure-composition as the ecosphere; i.e., air over water/land plus organisms. Each ecosystem is a three-dimensional object amenable to study; a life-filled piece of terrain, a water body, or a complex of the two.

More popular with ecologists than ecosystems are their less complex and easier to isolate organic parts: communities and populations of particular species. Ecology textbooks, by and large, focus on these assemblages of organisms. The question is seldom asked: are groups of organisms, as such, fit subjects for scientific study?

Erroneous acceptance

In the context of real Earth spaces (i.e. of sectors of the ecosphere), any population is a selection of similar organic objects abstracted from the functional ecosystem within which they dwell and without which they would perish. A population is a taxonomic category, usually defined as members of a particular species in contact with one another. It is an artefact of thought in the sense that no spatially associated cluster of organisms has an existence apart from the air-soil-water-food of the ecosystem that supports it.

The erroneous acceptance of populations as fit objects of study stems from the fact that they can be counted and graphed. Although populations are not structural-functional objects they do have compositional characteristics that are easily quantified and mathematiced. 'Wolf packs' or 'deer herds' can be tallied and analysed for patterns and trends, for constancy and inconstancy, and for correlation with selected environmental 'factors'. For the most part this has proved to be a fruitless academic

exercise. Botkin believes in better techniques of analysis, such as computer modelling. No studies of populations per se can enlarge understanding, unless accompanied by close attention to the "units of nature on the face of the earth" that support and sustain species, i.e. without a primary focus on the geographic ecosystems within which species have evolved and are sustained. Therefore reliance on population numbers as counted over time to prove or disprove nature's capriciousness is illogical. Populations are not proxies for nature and so the primary but unstated thesis of Botkin's 'new ecology' collapses.

In fact, Botkin's book lends support to the above argument, without recognising the subversive implications for his argument as a whole. Comparing the imminent extinction of the Californian condor with the recovery of the whooping crane, he points to the importance of 'habitat'. That of the whooping crane is "intact and self sustaining" in northern Alberta and along the Texas coast while the condor's habitat in California is virtually destroyed. We learn, he says, that "the condition of the habitat is more important than simple population numbers…Conservation of endangered species is…understood to depend on the idea of an ecosystem rather than on simple analyses of populations."

In Botkin's lexicon, however, ecosystem is synonymous with 'complexity"; i.e. the vague communal food and shelter externalities of species and populations. He conceives the crane's summer ecosystem as an idea of complexity, not as the dependable calcareous wetlands in the boreal forest wherein the crane feeds and nests during the summer. Accordingly, the complex ecosystem that exists in the north woods, "intact and self-sustaining", merits no standing in the debate as to Nature's reliability, while the crane population—its migratory numbers fluctuating as it runs the gauntlet of guns and overhead wires—proves again nature's inconstancy.

More constant face

Nature conceived as the ecosphere and its sectoral ecosystems presents a different and more constant face than the populations of organisms assumed to be its surrogates. Consider any terrestrial ecosystem such as a tract of native grassland, resembling a gigantic terrarium. It is based on a superficial geological stratum, a landform whose surface layer is soil: slowly changing and, within a human lifetime, reasonably constant in the suite of organisms it supports internally and externally. Above the soil surface the day-to-day weather is changeable but the climate shows many regularities: evapotranspiration exceeds precipitation, rains generally peak in June, frosts come in September. True the floristic and faunistic composition varies in cycles of drought and of moisture, but though the ecosystem's populations of spear grass, gophers and hawks vary from year to year the densely complex system of hundreds of species of plants and animals survives as grassland, balanced between the fixed and the fluid. Phrased another way, the 'stage' of landform-soil and climate remains in place, the flora and fauna 'actors' move back and forth between stage and wings, the 10,000-year 'play' of the prairie ecosystem continues. Does the fact that June rains and a certain yield of grass cannot be exactly predicted a year ahead make nature inconstant and in need of engineering?

Botkin's answer to the above question is a resounding "yes!", conveying the strong impression that he is searching for reasons to justify the managerial philosophy: imperfect nature needs to be perfected by man. Under the guidance of science and using the tools of technology, humankind will astutely set the goals for the entire planet, managing it wisely and prudently for the advancement of civilisation. Thus the goal is omniscience and complete control in the sole interests of one species, Homo Sapiens. In this view, nature is inconstant because, so far, people have neither been able to predict—population by population, species by species—what numbers will be around next year nor to intervene successfully as managers to achieve set production targets.

A specific thesis of the New Ecology is that until very recently humankind has wrongly viewed the world as stable, as naturally in a state of equilibrium, as constant over time. Botkin is the latter-day prophet come to reveal the truth, exhorting the masses to reject the error of this static perspective. Although populations of animals are his chief examples, he also plots the ups and downs of various other phenomena to prove his hypothesis that nature is erratic and unreliable. For example, the patterns of temperature over the last million years show "no constancy or any simple pattern or regular cycle".

A counter suggestion is that the temperatures he graphs, fluctuating in the range of only six or eight degrees over the last million years, reflect remarkable stability. Again, Botkin reports that "the biosphere was assumed to be in a steady-state in regard to carbon (but) recent information shows—to the contrary—that the level of carbon dioxide in the atmosphere has varied over thousands of years". Maybe so, at the level of parts per million, but evidence is that the gross composition of Earth's atmosphere—the proportion of nitrogen, oxygen and carbon dioxide—has been extraordinarily stable for hundreds of millions of years.

As a third example he discusses the history of the post-glacial vegetation in the Boundary Water Canoe Area where paleo-botanical records show that the forest composition has changed half a dozen or more times since the ice withdrew. “If one’s goal were to return the BWAC to its natural condition, which of these (post-glacial) forests would one choose?” he asks. The answer is obvious: Choose the forest of the last 1000 years, for presumably it is the one better adapted to current climate and physiography than preceding forests. Botkin does not countenance this answer because it would destroy his argument that capricious nature offers no guidelines, and that management must therefore respond only to what people want.

False ideas

Botkin is criticising ideas of exact, fixed states of equilibrium in nature, a viewpoint that surely few hold today. The evidence that up to the present time humanity has been mislead by false ideas of stability, equilibrium and constancy is weak. The statement. “Until the past few years, the predominant theories in ecology either presumed, or had as a necessary consequence, a very strict concept of a highly structured, ordered and regulated, steady-state ecological system,” seems to overlook the dynamic emphasis that from the beginning has dominated American ecology. The idea that perturbations such as fire and flood are an integral part of natural ecosystems has been around for decades. Perhaps the explanation for Botkin’s repetitive sermon is that his chief targets are animal ecologists clinging to simple mathematical models of population growth: the logistic and Lotka-Volterra equations. But do improved models for predicting population growth constitute a sufficient basis for “A New Ecology for the 21st Century?”

“The reasons why we have failed to manage wildlife and other renewable resources lie not in facts alone… but in beliefs hidden from view”. Botkin claims that humanity is the victim of false myths and metaphors which have prevented everyone, including scientists, from facing the facts. The facts, he repeats, are that nature is inconstant, because, at all scales of space and time, everything keeps changing. Structures are ephemeral, only processes are constant. The old myths and metaphors, the false beliefs that prevent people from facing the facts, are Nature conceived as divinely ordered and static, and Nature conceived as a steady-state machine.

The new correct metaphor apparently is nature conceived as a computer, which Botkin labels an ‘organic’ model. For example, bacteria can exchange DNA and therefore “they can be regarded as resembling nothing more than memory bytes in a computer that operates at the planetary level…Computers are providing new metaphors not only for bacterial life, but also for our entire perception of life on Earth, from the way that we regard bacteria to the way we view ecosystems and our entire planetary life support system… In this and other ways, computers are revolutionising our concept of nature, our perception of our relationship with nature, and our ideas about managing nature.”

Here speaks a dedicated hacker, one who no longer sees a computer as a machine but as an organism! By conferring organic qualities on the computer, Botkin can have it both ways: he can renounce outmoded mechanistic industrial-age ideas while asserting that we need no longer oppose engineering and technologic progress. “Technology (read ‘the computer’) places before us a new vista!”

Serious flaw

Under this thinly camouflaged neo-mechanistic view of nature lies a more serious flaw. In his critical analysis of “nature as divine order”, Botkin examines the question of how science contributed to the idea of a wonderfully ordered universe and therefore to the theme of nature as divine order. His explanation is that religious beliefs about the character of biological nature infiltrated science. This idea of a mismatch between a ‘scientific age’ and myths with their “wrong perspectives” implies that only occasionally is science misled by deeply buried false beliefs and that most of the time science yields purely objective culture-free truths. This is simply false. Science is a social pursuit and scientists are never immune to the deep beliefs, the paradigms, of the culture within which they live. The classic oft-quoted example is the influence of the theories of Adam Smith and Malthus, in a milieu of burgeoning capitalism, on Darwin’s idea of the centrality of competition as an evolutionary mechanism.

The other side of the decisive influence of culture over scientific findings is the primacy of theory over fact, of ruling paradigms over what seems actual. Botkin is dismayed that people have not faced the facts but have instead been swayed by false theories. But all facts are theory-loaded—theory leads, facts follow. This is true at the most fundamental level of perception, where what we observe (factual vision) is conditioned by prior concepts, theories, beliefs. Psychologists tell us that “believing is seeing” not “seeing is believing.” The facts that Botkin adduces in support of his ‘new ecology’ are those he has carefully selected to agree with the theory of nature’s inconstancy that he has chosen to

embrace. Critics who find his theory and the implications he draws from it shallow and perilous can find plenty of facts to falsify it.

The cultural milieu from which Botkin's deep beliefs and myths are inseparable is the affluent consumer society of North America. As a card-carrying member, he has to reject the idea of an ordered and well-balanced universe because if "nature knows best" then humanity's role is to back off, let it be, do nothing or at least interfere as little as possible in the ecosphere—which is anathema to the managerial society. Adoption of such a radical idea would put applied scientists, technocrats and resource managers out of work. On the other hand, the idea of an inconstant and orderless Nature where chance plays the major role is in perfect harmony with the managerial society whose purpose is to control, exploit, manage and grow. In fact a changeable nature that exhibits no stable characteristics, no fixed equilibrium points, demands intervention everywhere. therefore Botkin's repetitive message is: embrace technology and prepare to manage the world, species by species. "Under the management", says Botkin, "one starts with the question, how many sea otters are enough?". Nowhere in the book does he ask the more fundamental question: how many people are enough? Nowhere does he entertain the idea that humanity's role might be to keep ecosystems healthy, ministering to them like sensitive gardeners, so that their creativity and productivity—for sea otters and everything else—can continue in the ancient proven way.

From the book's title to the last sentence beginning, "If nature in the twenty-first century will be a nature that we make," perceptive readers will recognise the goal to which Botkin would lead them—because everyone has seen it on Star Trek. It is called "the space and computer age", also known as the Age of Anthropocentric Techno-Control. That this vision of a brave new world can be spun off from the simple observation that populations fluctuate is a credit to Botkin's ingenuity.

Several of the goals for humanity that Botkin proposes are commendable, such as preserving biodiversity: "the real focus of our efforts is the maintenance of life"; and maintaining the ecosphere: "people living within nature, neither poisoning it nor destroying its reproductive capabilities". His opinion is factual that "Life and the environment are one thing, not two, and people, as all life, are immersed in the one system", though elsewhere, by pronouncing "Earth is not alive", he contradicts himself. His proposal that various kinds of wilderness should be preserved is praiseworthy, but the idea of environmental management keeps intruding with never a hint that the solution might be the management of humans, in both their numbers and wants. The admonition to "minimise the use of new technologies when these lead to novel alterations of the environment" is pertinent, particularly for those who would engineer the Earth. He is honest in admitting ignorance of how the "dense complexity" of crowds of species across Earth's surface persists and has persisted for so long. The reason—that through the entire history of the planet no one species has tried to manage all the rest—did not occur to him.

Let us hope for a far wiser 'New Ecology' in the 21st century, one that begins where Botkin ends with a commitment "to recognise the limits of our actions."

Stan Rowe

[Sadly, Stan, one of the Earth's true friends, died in 2004. Thankfully, there are two great collections of his writings which readers are strongly urged to study: *Home Place* (NeWest Pr., 2002) and *Earth Alive* (NeWest Pr., 2006). They really do deserve the widest circulation]