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Author(s): Wallace Kaufman  
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Abstract:  

New ecologists contend that balance of nature does not really exist and that what man perceives to be the natural order of things is far different from what actually takes place. This theory makes the management of nature more complex since man has to modify his understanding of nature's ways.  

Full Text:  

A gaggle of "new ecologists" is debunking the sacred commandments of environmentalism and working to bring order to nature's chaos.  

History laughs at Denmark's legendary King Canute, who waded into the waves and ordered the tide to retreat. More and more ecologists aren't laughing, but they believe the conservation movement has been imitating Canute since its birth about 100 years ago.  

The ecologists are not talking about environmental Canutes trying to "stop progress." They're talking about campaigns to preserve forests, rivers, prairies, and lakes, and preserve the "balance of nature." Environmental groups go before Congress and state legislatures asking help to stop development for the sake of the "balance of nature." The President's closest environmental expert, Al Gore, writes, "Global warming, ozone depletion, the loss of living species, deforestation--they all have a common cause: the new relationship between human civilization and the earth's natural balance." He concludes his book, Earth in the Balance, by saying, "... we are now engaged in an epic battle to right the balance of our earth ..." Although the Vice President's knowledge of science is more sophisticated than his rhetoric, rhetoric from such a high office will have the larger impact on public debate.  

The idea of balance and stability in nature permeates our culture from the Garden of Eden to the poetry of Wordsworth and Frost, the journals of Thoreau, and the photographs of Ansel Adams. Yet, from Vice President to Podunk, environmentalists may be staking their fame, fortunes, and sacred honor on something that doesn't exist.  

Dr. Dan Botkin, a small man with a gentle manner, delivers the message of modern ecology with quiet patience, something like a UPS man delivering Pandora's Box. Nature's preference, if any, he says, seems to be change--and often change that is unpredictable and radical. There is no balance. There's no steady state or even a steady see-saw state with a constant center. Whole populations of plants and animals flourish and crash with a violence that would appall most environmentalists. Nature has no preference for life as we know it, or life in any form. Our beautifully balanced landscapes are the results of human preferences and creations. They can be saved only by very sophisticated, often high-tech intervention.
The message to environmentalists is that modern ecology demands action: If you do nothing, you'll get something you didn't expect.

Botkin poses a simple question that looms as the biggest challenge to conservation thinking in our time: "How do you manage something that is always changing?"

SCIENCE CHALLENGES HISTORY

Like environmentalists, Botkin talks about spaceship Earth. But in his flight plan there's no automatic pilot. God is not our co-pilot. We're on our own, and we have to decide if we want to be pilots. If we do, even before we chart the course, we have to invent instruments to monitor systems and install controls for steering. It is as if among all the world's life forms, the question suddenly arose, "Who's in charge here?" And the human animal answered, "I am." For many environmentalists, this suggestion verges on blasphemy.

Blasphemy insults the sacred, and the idea of a balance of nature has been a concept almost as universal as God. Thus the New York-based Natural Resources Defense Council reprints an article from the Toronto Globe in which a Cree hunter says, "The earth was created the way it was by the Creator, and changing it is unnatural and wrong." The idea of a balanced creation repeats a thousand ways in popular culture.

Environmentalists do not deny that nature changes, but except on the slow scale of geological movement and evolution, the changes they admit and admire are like the limited and predictable motions of a see-saw around an identifiable center. Nature's balance might be disturbed, but if nature could regain control, beautiful order would come again. A forest burned would go through a series of stages until climax growth returned more or less for good. If disease or hunters killed wolves, deer would over-populate, but if left alone, supply and demand soon would stabilize. Nature unshackled could be counted on to restore her balance. The "balance of nature" satisfied our wishful thinking and longing for more order and permanence than our tumultuous human history offered. Recently some environmentalists like Bill McKibben, author of The End of Nature (see the "Reviewing Resources" column in American Forests, January 1990), have proclaimed that Western culture has upset the balance forever. But most believe it exists or might be restored.

Most ecologists now believe such a balance didn't and doesn't exist. "The idea makes good poetry but bad science," says one ecologist. At Ohio State University, Dr. Peter Chesson, a theoretical ecologist, says that as far as nature having an equilibrium, "We can say that idea is dead for most people in the scientific community." The University of Minnesota's Dr. David Tilman says that among ecologists, "balance of nature" is a term that "hasn't been used much in 20 years." The neat world in which wolves and deer, hawks and rabbits, bees and flowers kept each other's populations in balance and the world in harmony has gone to the old-age home of quaint ideas, to rest alongside spontaneous generation and astrology.

THE HANDS-OFF ILLUSION

In many cases, "hands-off" environmentalists have been playing God as surely as Dan Quayle's former "God Squad," the giant timber companies, or the government managers they increasingly distrust. To demonstrate the unexpected results of letting nature "manage itself," Botkin sometimes uses a picture of Rutgers University's virgin Hutchinson Memorial Forest, a remnant of mid-Atlantic oak-hickory forests. During the 17th century, a Dutch naturalist said a horse and wagon could easily be driven between the large trees in these forests. Rutgers purchased the forest with great fanfare in 1954. Audubon and Life magazines celebrated with beautiful pictures. The same forest in Botkin's
contemporary picture has few large trees; even a trail-bike rider couldn't penetrate the thick undergrowth and vines. Letting nature manage the preserve meant allowing hurricanes to work their will and standing by while alien species like Norway maple and honeysuckle invaded. Where Native Americans hunted and cleared brush by burning, fire became rare.

Botkin and other new ecologists say that even when we choose to actively manage nature to maintain a "natural state," our definition of nature has little to do with the real world. If we were to ask what the natural state of the great Boundary Waters Canoe Area in Minnesota is, Botkin says, "I could argue that its natural state is pure ice."

THE MAKING OF A NEW ECOLOGIST

Botkin's refusal to sanctify one state of nature may upset some wilderness fans, but they would be far off target if they think he respects nature or a healthy environment less than they do. His first love as a child was rockets and exploring the universe. He and his sister plastered drawings of the planets around their room and designed spaceships and their life-support systems.

In college, not long after he began studying physics and its math, he realized, "My own interest was in what I could see around me." He left science briefly and majored in English, a move that gave him the perspective to understand the cultural assumptions that often guide science. During a Peace Corps tour in the Philippines, he served as head of a school English department but found himself teaching physics.

Back in the U.S., a job surveying country land with his father-in-law convinced him his future should be working outdoors. About that time, his sister gave him a book by Eugene Odum. Botkin began reading, and soon, "I knew [field ecology] was just what I was looking for." With this purpose in mind, he wrote to ecologist Paul Sears, took an assistantship at Rutgers, and three years later became a member of the forestry faculty at Yale. For his research, he says, "I always sought out wilderness areas. I wanted to know what nature is really like." He has since studied wolves on Michigan's Isle Royale, whales in the Pacific, salmon in Oregon, and tropical rainforests in Costa Rica. His early interest in math and physics led him to computer modeling to make sense of the large amounts of data that modern research tools accumulate.

The more his own views about nature began to diverge from tradition, the more he wanted to know about how tradition shapes social and scientific expectations. Why was it, he asked himself, that when his colleagues were asked to formulate public policy, they were often "giving advice contradictory to the evidence they knew?"

In 1978 the Woodrow Wilson Foundation paid Botkin to spend a year "to read what everybody from the Greeks to the 18th century said about nature." It was that year, together with his own work, that led Botkin to realize the growing gap between modern ecology and society's assumptions about how nature works.

REDEFINING NATURE

From remote sensing by satellite to the decoding of the genetic material in fossils, modern science and computers have rediscovered nature in a way that we can't afford to ignore.
An early casualty was the idea that wilderness is a model of nature's ways. The supposed virgin ecosystems of the past are the ideals that have driven environmental activism. "In wildness is the preservation of the world," Thoreau proclaimed, and the words have come to summarize a sacred commandment of environmentalism. They are the title of one of the Sierra Club's first and most durable books. They grace beautiful posters of wilderness scenes. Alas, the wildness that Thoreau saw in New England, that is captured in a library full of coffee-table books, and that we think we see in other areas of the world may not be wildness at all. New evidence from historians, paleontologists, archaeologists, and geneticists has clobbered the notion--common from George Perkins Marsh in the 19th century to Vice President Gore today--that Western materialism destroyed a natural paradise.

Much of the world's most admired "wilderness" may have been the intentional or de-facto creation of humankind. The great herds and predator populations of Africa's Serengeti savannahs, for instance, may owe their abundance to the primitive practice of using fire to maintain grassy fields for hunting. Amazonia's "virgin" rainforests have been extensively populated by humans for more than 10,000 years. These humans imported, planted, and transplanted a variety of plants and perhaps introduced new species of animals.

Dr. Lee M. Talbot of the World Resources Institute has worked in more than 100 countries and has come to the conclusion that, "In a real sense, human beings have been changing the face of the earth since their earliest times."

Yale historian William Cronon says Native Americans exerted a huge influence on the forests. Nature itself, Cronon says, brought "environmental changes on an enormous scale, many of them wholly apart from human influence." He concludes, "There has been no timeless wilderness in a state of perfect changelessness, no climax forest in permanent stasis."

The complexity and speed of change--even when humankind is not playing with bulldozers, chemicals, and fire--is illustrated in the story of scientists' observations of a simple weed. Recording the behavior of several plots of the midwestern pant creeper (Agrostis scaber), two University of Minnesota scientists showed that over a period of even a few years, the biosphere, like the stars of the universe, might tend more toward chaos than toward our present sense of order.

In 1985 Dr. David Tilman and Dr. David Wedin sowed pant creeper in a variety of soils. By 1988, the pant creeper population in the most fertile plot showed a 6,000-fold explosion, then a crash to near zero. Other plots showed a variety of unexpected results. Dan Botkin says 20 years ago these results would have disappointed researchers and been dismissed as a failed experiment. Since then, a concept developed in physics and astronomy allows us to make sense--if not order--of such results.

Chaos theory holds that any small difference in initial conditions of a system will tend to be magnified. Natural systems, according to this theory, do not behave like a well-ordered machine. The relations of energy and matter in space or perhaps even life in a few cubic meters of soil undergo huge changes that seldom if ever repeat in an orderly pattern. There may be an underlying long-term order, but it is not determined by the attraction of some unwavering point of balance. But neither is it entirely random. If it's not entirely random, perhaps it is ultimately predictable, but not with our current tools.

Dr. Tilman's surprise at his findings are a scientist's miniature of the conversion that must happen among conservationists and society at large. "I never imagined I would find chaos," he told The New York Times. "I imagined it would grow up to equilibrium. This discovery has changed my world view, to be blunt about it." And the more species an ecosystem holds, he says, the more likely we are to find chaos.
instead of balance.

There are several reasons why we haven't seen the real dynamics of change in biological systems. Dr. William M. Schaffer, a pioneer in the application of chaos theory to biological systems, says the signs are obviously much harder to detect in a forest or ocean than among the stars and galaxies. Measurements of energy, gravity, and motion are relatively neat; the variables in an ecosystem are more numerous and much harder to observe and measure.

Scientists who see conservation from a Third World perspective have welcomed the recognition that humans have always played a role in nature as we know it. To them the ecology of change liberates environmental thinking from the elite urban fantasies of northern industrialized environmentalists.

In a recent issue of BioScience, botanist Arturo Gomez-Pompa and anthropologists Andrea Kaus argued that the high values placed on supposedly climax forests and their value as wilderness preserves "represent mostly urban beliefs and aspirations. All too often, they do not correspond with scientific findings or first-hand experience of how the world works."

THE CHALLENGE TO MANAGEMENT

The resistance to the new ecology is as strong among environmentalists as it is from industry and government. Industrial scientists would like to think the same forests can be planted again and again, that technology can offset pollution and restore the environment to a known natural state. Industrialists make products, and if the byproduct of their work must be protecting the environment, they want that byproduct to be just as definable as an automobile or a computer.

The conservation community seems equally hesitant to catch up with the new ecology. After Dan Botkin argued his case in a keynote address to AMERICAN FORESTS' November forum, "People as Positive Agents of Environmental Change," the panelists who followed him went on to talk about preserving the balance of nature. Botkin's plea for sophisticated studies of changes using earth satellites and computer analyses also met resistance; several panelists made it clear they still suspected computers were a trap. While Botkin argued that resource decisions have to be opened to users like loggers, fishermen, and hunters, panelists talked disparagingly of "Joe and Jane Sixpack" and of converting the unconverted, of getting industry's attention by hitting it with a figurative 2 x 4, and of making leaps of faith. They left the clear impression that for them nature was more a set of beautiful landscapes and things than a set of processes. The dominant idea of "People as Positive Agents" was keeping people away from nature and its management.

For the new ecologists, the realization that nature has no balance means that managing the biosphere is much more complicated than we ever imagined. To keep from making ever greater mistakes as human populations and powers explode, Botkin says, "We can no longer rely on 19th-century models of analysis for 21st-century problems."

Botkin and others say that while we may have the wisdom to act prudently, we are far from having the facts for solutions. Many claims that are passionately presented as fact are instead emotional biases or intuitive guesses. In the Pacific Northwest, for instance, despite the great cry that forests are being lost forever, no one has collected reliable data on how much forest is regenerating.
Botkin recently began studying the relationship between forests and salmon in Oregon. Despite claims that timber cutting is destroying the five species of salmon that frequent these rivers, Botkin says no one had maps of forest regrowth and no one had been tagging natural salmon populations. Little is known about the life cycles of these natural populations. Environmentalists assumed that a balance had been destroyed; industry assumed a balance would re-establish itself.

Oddly enough, though scientists have been watching and methodically recording changes in the heavens for centuries, no one has made the same careful observations of forests. Our inability to say how much forest is growing in the Pacific Northwest is but one small example of our ignorance about forests. With everyone talking about sustainable development, it would seem that examples would be easy to find, however local.

Botkin says he has been trying unsuccessfully for 20 years to get a reliable set of statistics on sustainable use of a forest. He asks for a forest that has had three harvests, the third being equal to or greater than the first. He has been assured that forester Jones or Smith over in such and such a forest has the data. But each time he follows the lead, the data turn out to be inconclusive or nonexistent. As a practical matter, Botkin says, there was "no basis on which to have a discussion."

HOW TO ACT AMID UNCERTAINTY

Accepting the fact that nature constantly changes, often in unpredictable and undesirable directions, doesn't mean we have to accept all change. Botkin says, "We must focus our attention on the rates at which changes occur, understanding that certain rates of change are natural, desirable, and acceptable while others are not. As long as we refuse to admit that any change is natural, we cannot make this distinction and deal with its implications."

Looking for environmental solutions without understanding the kaleidoscope of changes is a futile task. It's the situation Botkin found recently at the beginning of his salmon and forests study. Trying to manage resources like these with existing data is "like suddenly being thrown into the cockpit of an airplane with no instruments," Botkin says. Until now, he says, public policy has been made on pitifully weak data.

To expand efforts to apply the new ecology's insights to environmental problems, Botkin in 1992 founded the non-profit group, The Center for the Study of the Environment. The Center's guiding principle is that, "Humans are an integral part of the ecology of the planet. The only lasting environmental solutions are those that take into account the dynamics of human society as well as those of natural systems." At the core of the Center's methods are computer projections that absorb data from satellites and field studies, then use the data to model likely consequences of political and business decisions.

This approach worked for Botkin in 1987 when he convened a blue-ribbon panel of scientists to study the impact of Los Angeles' huge water withdrawals from Mono Lake in the eastern Sierras. As a result, the Forest Service changed its plans for the drainage basin and Los Angeles took less water. At the invitation of the World Bank, Botkin and Lee Talbot demonstrated that sustainable-forestry claims had yet to be proven and made a case for testing proposed methods by computer simulation, with the best practices carefully tried and monitored. After hearing their argument, the Bank directed its lending divisions to stop making loans to projects that encourage deforestation.
Private industry can also use the new ecology's insights to insure its long-term survival. In Costa Rica, Botkin is working with a door manufacturer called Portico to put the company's forest lands on a sustainable-yield basis. The company has brought in forest scientists to study the natural fluctuations in forest growth and the interrelations between species in the ecosystem. Portico hopes its analysis and monitoring will establish a harvest pattern and evaluation process through which it can maintain a healthy forest as well as a constant supply of mahogany.

Since governments are practically the only institutions that can extensively monitor the global environment and deploy satellites, Botkin feels it is urgent that they catch up with ecological science. He points to satellite monitoring of oceans that can provide information on current and temperature fluctuations that cause big changes in fish populations. If fishing fleets had to use this information rather than abide by fixed quotas, we could approach sustainable management of our disappearing marine resources.

Botkin has made a proposal that should appeal to the new administration--a National Ecological Survey similar to the present Geological Survey. The new agency would assume the monitoring functions now scattered around in the Environmental Protection Agency, the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration, and other places. It would provide permanent monitoring of the environment and analyze its dynamics. Funding would come from user fees, recreation, and the sale of natural resources.

Using new technology to redefine nature has always been a scientist's riskiest work. Industry, government, environmentalists, and even churches bet a lot of prestige and money on their vision of nature. In some ways the philosophers of the environmental movement have functioned like the medieval church, opposing the idea that science can discover nature's secrets or manage the global environment. Many environmentalists argue for a "hands-off" policy on the grounds that we can never know how nature works. Others believe power and corruption have pushed government scientists and technicians to environmental sin. Nevertheless, the new ecologists follow in the tradition of Galileo. The first modern scientist to argue that we can know how the world works, he was condemned by the church for his arrogance, had to smuggle his last works out of Italy, and died under house arrest. Modern ecologists are not risking their lives or even their jobs, but the conclusions we must draw from their work are not always welcome.

One of the most important of those conclusions is that, except for human beings, all nature's creatures have been living on an unpredictable planet where changes are often swift and devastating. If you happen to be an elk looking for refuge from a forest fire or an anchovy in a suddenly cold ocean current, nature is neither compassionate nor wise. As far as we know, no creature but the human animal has been able to imagine things any differently. Now that we have fallen in love with our vision, we must learn how to intervene in nature's chaos to bring forth our preferred order. The changes we want in nature are quite grand and will get grander as our population grows.

Managing nature for the effect we want will have to be a hands-on effort. The great political question is, "whose hands?" The answer will depend on how well the conservation movement can catch up to and absorb the new ecology, and then how well it can communicate this message to the general public. When environmentalists talk about this final decade being a make-or-break time for saving the planet, they often talk of "converting" government, industry, and the public to a new way of thinking. Few realize that maintaining a healthy and beautiful planet may first depend on their own conversion.

Wallace Kaufman, a natural resources consultant and writer, authors American Forests' book reviews.
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