A Wildlands Anthology

PLACE *of the* WILD

Edited by

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Contents

The Quality of Wildness: Preservation, Control, and Freedom

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Thoreau began talking about wildness as the preservation of the world in a lecture he gave at the Concord Lyceum on 23 April 1851 entitled "The Wild." In June of the following year he combined it with another lecture on walking and published the two as the essay "Walking, or the Wild" in *Atlantic Monthly*. This essay remains the most radical document in the history of the conservation ethic—and "how we understand that ethic depends on what we think Thoreau meant by *wildness*."[1]

Thoreau understood wildness as a quality: wild nature, wild men, wild friends, wild dreams, wild house cats, and wild literature. He associated it with other qualities: the good, the holy, the free, indeed, with life itself. By freedom he meant not rights and liberties but the autonomous and self-willed. By life he meant not mere existence but vitality and life-force.

Thoreau's famous saying, "in Wildness is the Preservation of the World," asserts that wildness preserves, not that we must preserve wildness. For Thoreau wildness was a given; his task was to touch it and express it, and he believed that myth expressed it best. Success was due not to political action or scientific study but to personal effort. *Walden* was his myth.

After Thoreau, our conservation ethic shifted from wildness to the preservation of wilderness, then biological communities, and, re-

cently, to biodiversity. Wildness as a quality and its relation to other qualities is now rarely discussed.[2] This shift was broadly materialist—a move from quality to quantity, to acreage, species, and physical relations. The privileged status of classical science and its technologies in our culture virtually entailed this materialism. The world of classical science and its mathematics could not describe qualities like wildness, and what could not be described was ignored.

The shift was also reductive. By preserving things—acreage, species, and natural processes—we believed we could preserve a quality. But collections of acreage, species, and processes, however large or diverse, no more preserve wildness than large and diverse collections of sacred objects preserve the sacred. The wild and the sacred are not the kinds of things that can be collected. Historical forms of access and expression can be preserved, but one cannot put a quality in a museum. At the same time, wildness cannot disappear. It can be diminished in human experience, but it cannot cease to exist. The world contains many things that cannot be collected or preserved and put someplace—the set of complex numbers, gravity, dreams.

Apart from any relation to wildness, there are excellent reasons to preserve wilderness, biotic communities, and biodiversity, reasons that are thoroughly covered in our environmental literature. But the materialist and reductive shift in our conservation ethic has diminished the wildness of the places, species, and processes we have managed to preserve by diminishing their autonomy and vitality. And our conservation ethic tends to ignore this loss.

We continue to see the museum and its extensions—parks, wilderness, zoos, botanical gardens—as our models of preservation. In the past, political and aesthetic criteria selected the samples of acreage, the fauna and flora; in the future, one hopes, biological and ecological criteria will be foremost. But no matter how large the selection, the samples are rendered artificial by the process of selection. The environments (and their occupants) are managed according to human goals—the preservation of scenery, of resources, of wilderness, of biodiversity. Our artifice fundamentally alters their order by uprooting them from the context of interconnectedness that created that order. As Anthony Giddens says in discussing the consequences of modernity, "the end of

nature means that the natural world has become in large part a created environment consisting of humanly structured systems whose motive power and dynamics derive from socially organized knowledge-claims rather than from influences exogenous to human activity."[3] This is just as true of parks and designer wilderness as it is of Disneyland.

Created environments have about them the aura of hyperreality so common in modern life. They are, says Jerry Mander, "all updated forms of Cain's desire to return home by remaking the original creation. The tragedy is that in attempting to recover paradise we accelerate the murder of nature."[4] Nature ends because it loses its own self-ordering structure, hence its autonomy, hence its wildness, hence its life. The stuff of museums exists, but it has no life.

Recently we have realized that our museums are too small and disconnected and artificial to preserve species and maintain their own structure and order. Our remedy for these island ecosystems and relic populations is to create even better created environments according to new knowledge about ecosystems and species. This leads to bigger and more complete ecosystems. It sustains some species, but it simultaneously diminishes their self-organization as the human influence and control mechanisms required for selection and preservation replace their own. The Wildlands Project is an example of this process and, if successful, could become the world's largest created environment. Its order and structure—the cores, corridors, buffers, and dense population areas—would undoubtedly be visible from space. I think of it as North America designed by Foreman, Noss & Associates.[5]

Many feel the pervasive Disneyesque and museumlike quality of wilderness areas, national parks, and wildlife preserves but continue to believe they provide a sanctuary from human artifice. This has always been an illusion. The national parks process millions of humans at the cost of natural processes. The wilderness of the Wilderness Act permits the state to control fire, insects, diseases, and animal populations, build trails for human use, graze livestock, and mine ore. These environments are not wild—they are too designed, administered, managed, and controlled.

Perhaps we need to imagine a new conservation ethic based on wildness. What we would come to mean by wildness could evolve from cur-

rent interdisciplinary efforts by feminists, mathematicians, philosophers, and physicists to understand control, prediction, dominance, and their opposites—autonomy, self-organization, self-ordering, and autopoiesis.[6] It would provide a new understanding of wilderness in its original sense of self-willed land.[7] And it would promote Thoreau's project of understanding the wild within us and within nature as being fundamentally the same because of its association, conceptually, with vitality and freedom.

CONTROL VS. AUTONOMY

To construct a new conservation ethic we need first to understand why we impose a human order on nonhuman orders. The gain is prediction, efficiency, and control. Faced with the accelerating destruction of ecosystems and the extinction of species, we believe this is our only option. So we fight to preserve ecosystems and species and accept their diminished wildness. This wins the fight but loses the war. In the process we simply stop talking about wildness.

For instance, we substitute "wilderness" for "wildness." In Richard P. Primack's *Essentials of Conservation Biology*, Thoreau is misquoted as saying "in Wilderness is the Preservation of the World."[8] This substitution is so commonplace we don't notice it. But most of our designated wilderness is not in fact wild: the Gila, for instance, is a pasture, not self-willed land. Thoreu did not claim that in pasture is the preservation of the world.

We also equate wildness with biodiversity. In *Reclaiming the Last Wild Places*, by Roger L. DiSilvestro, the second chapter is entitled "Biodiversity: Saving Wildness," and there are phrases like "wildness in nature, . . . is what we preserve when we protect biodiversity," and "protection of biodiversity, of wildness."[9] But wildness is not biodiversity. Indeed, wildness may be inversely correlated with biodiversity. In the memorable case of the two oases in Gary Nabhan's *The Desert Smells Like Rain*, the oasis occupied by the Papago had twice as many bird species as the "wild" one preserved in Organ Pipe National Monument.[10] Neither is wild in any meaningful sense of the term. (Wilder desert oases might contain even fewer species.) But is wildness any less important than biodiversity?

For these writers the key distinction is between "in captivity" and "in the wild," which now means a managed ecosystem. But if grizzlies are controlled in zoos and controlled in wilderness, then what was for Thoreau the central question—wildness as freedom—simply drops out of the discourse of preservation. We also ignore wildness when we define wilderness in terms of human absence. In "Aldo Leopold's Metaphor," J. Baird Callicott says that, with the exception of Antarctica, there was no landmass without human presence, so the wilderness of the Wilderness Act is an "incoherent" idea.[11] If we fail to incorporate wildness into what we mean by wilderness we simply define wilderness out of existence.

Some people deny the existence of wildness on the grounds that any human influence on a species or an ecosystem destroys wildness. And since human influence has been around a long time . . . again, no wildness. One wonders what Lewis and Clark, standing on the banks of the Missouri, would have thought of such talk. "This isn't wilderness. Why, there are millions of humans out there. And it isn't wild either. Why, human influence has been mucking up this place for ten thousand years." Something is wrong here. Influence is not control and does not preclude autonomy. Autonomy is often confused with radical separation and complete independence. But the autonomy of systems—and, I would argue, human freedom—is strengthened by interconnectedness, influence, elaborate iteration, and feedback. Indeed, such self-organizing systems create that possibility of change without which there is no freedom. Determinism and autonomy are as inseparable as the multiple aspects of a gestalt drawing.[12]

The important point is that whatever kind of autonomy is in question—human freedom, self-willed land, self-ordering systems, self-organizing systems, autopoiesis—all are incompatible with external control, not external influence. To take wildness seriously is to take the issue of control seriously. And because the disciplines of applied biology do not take wildness seriously, they are littered with paradoxes: wildlife management, wilderness management, managing for change, managing natural systems, mimicking natural disturbance—what we might call the paradoxes of autonomy. Collections of paradoxes are usually bad news for paradigms.[13]

CONSERVATION BIOLOGY

Since Aldo Leopold, the biological sciences have played an increasingly imperial role in the conservation ethic. If that ethic is about preserving ecosystems and species, then one goes to the experts on ecosystems and species—ecologists and biologists. During the past twenty years it became obvious that the individual disciplines of applied biology were insufficiently comprehensive to achieve preservationist goals, especially biodiversity, and that they needed to be integrated with the newer disciplines of population biology and ecology—thus conservation biology. Conservation biology has become the dominant voice for preservation in this country, if not the world.[14]

Conservation biology is also about control. It is metamanagement. It integrates the controls available in the biological, physical, and social sciences. Since biodiversity is understood in the model as a scarce resource, the preservation of biodiversity becomes a problem in resource management.[15] In the face of biodiversity loss (and there surely is such a crisis), conservation biology demands we do something now in the only way that counts: more money, more research, more technology, more information, more acreage. Trust science, trust technology, trust experts; they know best.

This position mirrors the mode of response to crisis familiar from Michel Foucault's studies of insanity and crime. Like penology and criminology, conservation biology seeks control to pursue a mission: to end a crisis it has moralized. Although the maladies addressed by these disciplines have always been with us, and have been handled by other cultures in more imaginative ways, they are exacerbated by the conditions of modernity: overpopulation, urbanization, and pathological social structures. These disciplines strive to control symptoms, however, instead of striking at causes. Their controls are directed at the Other, not at social pathologies. Instead of remaking our societies they set about remaking the world and diminishing its autonomy.

The multiple meanings of *discipline* here are not accidental. The controls are always disciplinary in nature. They involve: capturing (shooting, darting, netting, trapping, apprehending, arresting); numerical identification (tattooing—from concentration camp inmates to grizzlies); technological representation (photography, X rays); chemical

manipulation (of the brain in the mentally ill, of fertility in predators); surgery (lobotomies for the mad, and for predators the implantation of radioactive plaques to make their feces visible from satellites); monitoring (radio collars on animals, ankle monitors on prisoners); and constant surveillance to accumulate ever more information. Having inflicted all this upon the insane and the criminal, we now tend to inflict these manipulations on plants and animals. The forecast in Ecclesiastes—"For that which befalleth the sons of men befalleth beasts"—is confirmed.

Justified in the name of normality and equilibrium (or peace in our time), disciplinary technologies tend to develop into grand wars of salvation. Like the great wars for civilization, economics now wars against poverty, criminology now wars against crime and drugs. Despite pockets of success, the wars fail. Prisons create more criminals, the war on drugs creates more drugs, poverty and hunger have increased; but the failures neither discredit the disciplines nor halt their wars. Like Avis, they just try harder.

Conservation biology is in this tradition of grand salvation. It wants to conduct a war for biodiversity—hence its missions and strategies (from the Greek word for army—*stratos*) to remake the natural world according to its own vision. It will fail for the same reason the other disciplines fail: it does not strike at the causes of the malady but remains therapeutic. Its fondest hope is to arrest symptoms, and it presumes, desperately, that the malady is acute not chronic. Change comes from alteration of structure. The structure that a radical (*root*) position should focus on is the positive feedback system comprising overpopulation, urbanization, outrageously high standards of living, outrageously unjust distribution of basic goods, the conjunction of classical science, technology, the state, and market economics that supports the high standard of living, and the utter absence of a spiritual life. To *preserve* wildness, wilderness, and biodiversity is to attack that system of social pathology. And let's face it, most of us turn chicken in the face of such a challenge.

In ecology, the most powerful statement of a conservation ethic of controlling nature is Daniel B. Botkin's *Discordant Harmonies*.[16] Botkin presents graphic evidence of the devastation caused by unmanaged el-

ephants in Tsavo, one of Kenya's largest national parks. He argues trenchantly that our current ideas about nature are outmoded. He calls for more management, more information, more monitoring, more research, more funding for education about the environment. He argues for the preservation of wilderness primarily as a baseline for scientific measurement. It is a powerful book. He concludes that "nature in the twenty-first century will be a nature that we make; the question is the degree to which this molding will be intentional or unintentional, desirable or undesirable."[17]

"A nature that we make." For most biologists and ecologists, the autonomy of nature is now a naive ideal and we must accept our new environmental maturity. The notions of climax, equilibrium, and stability we used to associate with ecology have been dropped, and with them went any clear idea of what constitutes a healthy ecosystem. A recent volume of essays on the subject suggests that "there exists considerable basis for expanding consensus if the concept of health is given primary identity as a policy concept."[18] This approach removes the health of nature as a property of the world, reduces it to human policy, and virtually ensures that biologists and ecologists will go about fixing the world with treatments and remedial actions. The Other is subsumed into current social policy.

One would like to believe that the radical environmentalist can offer something more, and different, from what mainstream environmental thought can offer. This, however, is no longer obvious.

RADICAL ENVIRONMENTALISM

During the past five years, conservation biology has extended its influence to radical environmentalism by inverting themes that once legitimized its radical content. Science, technology, and modernity were once the problem. Now they are the solution, and I fear The Wildlands Project may reduce *Wild Earth*, our best radical environmental publication, to the political arm of a scientific discipline.

Again the key issue is control and autonomy, not science and technology. Recent issues of *Wild Earth* and *Conservation Biology* have run debates about the management of wilderness and wild systems, but they haven't penetrated to the heart of the problem. Writing in *Wild*

Earth, Mike Seidman concludes his exchange by saying, "It seems that the depth of my critique of management went unnoticed." Seidman was being a gentleman.[19]

The autonomy of natural systems is the skeleton in the closet of our conservation ethic, although it is recognized that no one is dealing honestly with the issue. It appears in many forms. It explains the growing discontent with our control of predators: the elk hunts in Grand Teton National Park, the slaughter of elephants for management, the trapping and training of the last condors. It explains the increasing discontent surrounding the reintroduction of wolves to Yellowstone National Park. For a decade environmentalists fought for an experimental population; now, faced with the biological and political controls on experimental populations, many people prefer natural recovery.

Biological controls are ubiquitous. Biologists control grizzlies, they trap and radio-collar cranes, they have cute little radio backpacks for frogs, they even put radio transmitters on minnows. And always for the same reason: more information for a better ecosystem. Information and control are indivisible, a point made in great detail in James R. Beninger's *The Control Revolution*. It is the main point, perhaps the only point, of surveillance.

Perhaps we don't need more information; maybe the emphasis on biological inventories, information for designing wilderness recovery, surveillance, and monitoring is a step in the wrong direction. And what could possibly be radical about it? The Nature Conservancy has been doing it for years and the Department of Interior is going to do it too. Trying to be radical about public lands issues is like trying to be radical about laundromats. Indeed, it seems to me that radical environmentalism has backed away from many of its original stances. Perhaps the obsession with roads and dams betrays a crude, industrial idea of destroying nature and has blinded us to modern control technologies that imply even more potent modes of destruction. But instead of a critique of control we have deep ecologists like George Sessions and Arne Naess supporting, in principle or in practice, genetic engineering.[21]

Perhaps we just need big wilderness, not more technological information about big wilderness. Why not just set aside vast areas where we limit *all* human influence: no conservation strategies, no designer wil-

derness, no roads, no trails, no satellite surveillance, no overflights with helicopters, no radio collars, no measuring devices, no photographs, no GIS data, no databases stuffed with the location of every stone on the summit of Mount Moran, no guidebooks, no topographical maps. Let whatever habitat we can save go back to its own order as much as possible. Let wilderness again become a blank on the map.

MANAGING NATURE

There are two senses of preservation, and most preservationist efforts have followed the first—preservation as dividing, remaking, and moving nature according to our own desire for order. Doug Peacock presents the second sense with great clarity, calling biology "Biofuck" and saying, "Leave the fucking bears alone."[22] This echoes Abbey's "Let being be," which was a quote from Heidegger, who stole it from Lao Tzu, who put it nicely:

> Do you want to improve the world?
> I don't think it can be done.
>
> The world is sacred.
> It can't be improved.
> If you tamper with it, you'll ruin it.
> If you treat it like an object, you'll lose it.
>
> The Master sees things as they are,
> without trying to control them.
> She lets them go their own way. . . .[23]

Although most of the public believes this *is* the conservation ethic, leaving things alone is definitely the new minority tradition. But consider carefully the lines, "If you tamper with it, you'll ruin it. / If you treat it like an object, you'll lose it." What if the effect of scientific experts creating environments, treating ecosystems, and managing species is as bad, or worse, than the effects of unmanaged nature? In short, how well does managing nature actually work? Ecologists tend not to talk about this issue for fear of giving aid to the enemy.

In a recent essay entitled "Down from the Pedestal—A New Role for Experts," David Ehrenfeld presents several examples of predictive failure and the unfortunate consequences for natural systems.[24] Consider, for instance, the introduction of opossum shrimp into lakes in northwestern North America to increase the production of kokanee salmon: "The story is a complicated one, with nutrient loads, water levels, algae, various invertebrates, and lake trout all interacting. But the bottom line is that the kokanee salmon population went way down rather than way up, and this in turn affected populations of bald eagles, various species of gulls and ducks, coyotes, minks, river otters, grizzly bears, and human visitors to Glacier National Park."[25] Indeed, Ehrenfeld goes on to say that "biological complexity, with its myriad internal and external variables, with its open-endedness, pushes ecology and wildlife management a little closer to the economics . . . end of the range of expert reliability."[26] And this comes from the dean of conservation biologists. Do we really want to entrust the management of nature to experts whose reliability is akin to that of economists? This removes a bit of the glitter from the remaking and treating nature agenda. Ecologists are compared with economists because of their problems with prediction. Prediction, some think, is the essence of science: no prediction, no science; lousy prediction, lousy science. Unless, according to this view, the biological sciences can produce accurate, testable, quantitative predictions, they are well on their way to joining the dismal science. Well, if your idea of good science requires accurate prediction then all the sciences are looking a bit dismal, especially ecology.[27]

Historian of ecology Donald Worster, in an essay entitled "The Ecology of Order and Chaos," notes that "despite the obvious complexity of their subject matter, ecologists have been among the slowest to join the cross-disciplinary science of chaos."[28] This is not quite fair, but their lack of honesty on the subject probably has something to do with the unsettling consequences for the practical application of their discipline and hence their paychecks. They keep hanging onto the hope of better computer models and more information. As Bertolt Brecht said in another context, "If you're still smiling, you don't understand the news."

CHAOS AND COMPLEXITY

Most of the rapidly growing literature on chaos and complexity is either journalistic or extremely technical.[29] Of greater importance in this context are the philosophical implications of chaos and complexity. An excellent examination of these subjects can be found in Stephen H. Kellert's *In the Wake of Chaos*. Kellert suggests, as does Ehrenfeld, that the problems facing the practical applications of ecology and biology are more formidable than the disciplines are willing to admit.[30]

What emerges from recent work on chaos and complexity is the final dismemberment of the ideology of the world as machine. In its place is the view of the world characterized by wildness, vitality, and freedom, a view that goes well beyond Lao Tzu and Thoreau but one they would no doubt find inspiring. Most of nature turns out to be dynamic systems—not unlike a mean eddy line in Lava Falls, where the description of the turbulence (a nonlinear differential equation containing complex functions with *free* variables) prevents a closed-form solution. Such systems are unstable; they never settle into equilibrium. (Kayakers know this in their bodies.) They are aperiodic; like the weather, they never repeat themselves but forever generate new behavior, one of the most important of which is evolution. Life evolved at the edge of chaos, the area of maximum vitality and change.

Dynamic systems marked by chaos and complexity do have an order, and the order can be described with mathematics. They are deterministic and, usually, we can calculate probabilities and make qualitative predictions about how the system will behave in general. But with chaos and complexity, scientific knowledge is again limited in ways similar to the limits of incompleteness, uncertainty, and relativity. That does not end science. All that drops out is quantitative prediction, and that only affects most science in one way: control.

What happens to the rationality of managing species and ecosystems without accurate prediction and control? If the subsystems of an ecosystem (from vascular flows to genetic drift plus all the natural disturbances to ecosystems—weather, fire, wind, earthquakes, avalanches), if all these exhibit chaotic and complex behavior, and this behavior does not allow quantitative predictions, then isn't "ecosystems management" a bit of a sham and isn't the management of grizzlies and wolves

at best a travesty? Why don't we just can the talk of health and integrity and admit, honestly, that it's just public policy? Why don't we just fire the Inter Agency Grizzly Team forthwith and let them do something useful?

Much of the best intellectual labor of this century has led to the admission of various limits of science and mathematics—the limits of axiom systems, observation, objectivity, measurement. This admission should have a humbling effect on all of us, and the limits of our knowledge should define the limits of our practice. The biological sciences should draw the line at wilderness—core wilderness, Wilderness Act wilderness, any wilderness—for the same reasons atomic scientists should accept limits on messing with the atom and geneticists should accept limits on messing with the structure of DNA. We are not that wise; nor can we be. The issue is neither the legitimacy of science in general, nor the legitimacy of a particular scientific discipline, but the appropriate limits on any discipline in light of limited knowledge. Accepting these limits and imagining a new conservation ethic based on wildness, vitality, and humble, careful practice would unite Thoreau's insight—"in Wildness is the Preservation of the World"—with ancient wisdom, the intuitions of our most radical wilderness lovers, the ecofeminists, and the cutting edge of mathematics and physics. The prospect is as consoling as it is charming.

Wildness is out there, the most vital hangs out at the edge of chaos, the wild Earth is radically free. Since God plays dice with everything, He must be a connoisseur of chaos. Perhaps we should join Him in this. The next time you howl in delight like a wolf, howl for unstable, aperiodic behavior in deterministic, nonlinear, dynamic systems. Lao Tzu, Thoreau, and Abbey—perhaps even God—will be pleased.

Notes

1. Robert D. Richardson, Jr., *Henry Thoreau: A Life of the Mind* (Berkeley: University of California Press, 1990), p. 225.
2. The notable exception is Gary Snyder's *Practice of the Wild* (San Francisco: North Point Press, 1990).
3. Anthony Giddens, *Modernity and Self-Identity* (Stanford: Stanford University Press, 1991), p. 144.

4. Jerry Mander, *In the Absence of the Sacred: The Failure of Technology and the Survival of the Indian Nations* (San Francisco: Sierra Club Books, 1991), p. 149.
5. Reed F. Noss, "The Wildlands Project Land Conservation Strategy," *Wild Earth* (Special Issue 1992):10–25.
6. Because of their interest in the issue of domination, much of the best work on control has been done by feminists. See Susan Griffin's *Woman and Nature: The Roaring Inside Her* (New York: HarperCollins, 1979), and Carolyn Merchant, *The Death of Nature* (San Francisco: Harper & Row, 1990). For the best discussion of autonomy, see Evelyn Fox Keller, *Reflections on Gender and Science* (New Haven: Yale University Press, 1985), pt. 2, chap. 5. On autopoiesis, see Humberto R. Maturana and Francisco J. Varela, *The Tree of Knowledge: The Biological Roots of Human Understanding* (Boston: Shambhala, 1992). On self-organizing systems see I. Prigogine and I. Stengers, *Order Out of Chaos* (New York: Bantam Books, 1984).
7. See the discussion of "wilderness" in Jay Hansford C. Vest, "Will of the Land," *Environmental Review* (Winter 1985):321–329.
8. Richard B. Primack, *Essentials of Conservation Biology* (Sunderland, Mass.: Sinauer, 1989), p. 13.
9. Roger L. DiSilvestro, *Reclaiming the Last Wild Places: A New Agenda for Biodiversity* (New York: Wiley, 1993), p. 25.
10. Gary Nabhan, *The Desert Smells Like Rain* (San Francisco: North Point Press, 1982), chap. 7. See also the introduction to Peter Sauer, ed., *Finding Home* (Boston: Beacon Press, 1992).
11. J. Baird Callicott, "Aldo Leopold's Metaphor," in Robert Costanza et al., eds., *Ecosystem Health* (Washington, D.C.: Island Press, 1992), p. 45.
12. John Biggs and F. David Peat, *Turbulent Mirror* (New York: Harper & Row, 1989), p. 74.
13. See Paul Hoyningen-Huene, *Reconstructing Scientific Revolutions: Thomas S. Kuhn's Philosophy of Science* (Chicago: University of Chicago Press, 1993).
14. Primack, *Essentials of Conservation Biology*, chap. 1.
15. See the diagram linking conservation biology and resource management in Primack, *Essentials of Conservation Biology*, p. 6.
16. Daniel B. Botkin, *Discordant Harmonies: A New Ecology for the Twenty-First Century* (New York: Oxford University Press, 1990).
17. Ibid., p. 193.
18. Robert Costanza et al., eds., *Ecosystem Health* (Washington, D.C.: Island Press, 1992), p. 14.
19. Mike Seidman's original letter appeared in *Wild Earth* 2(3) (Fall 1992):9–10. Responses to his letter by Reed F. Noss, W. S. Alverson, and D. M. Waller appeared in *Wild Earth* 2(4) (Winter 1992/93):8–10. Seidman's reply is in *Wild Earth* 3(1) (Spring 1993):7–8.
20. James R. Benninger, *The Control Revolution: Technological and Economic Origins of the Information Society* (Cambridge: Harvard University Press, 1986).
21. Ariel Salleh, "Class, Race, and Gender Discourse in the Ecofeminism/Deep Ecology Debate," *Environmental Ethics* 15(3) (Fall 1993):233.
22. Rick Bass, "Grizzlies: Are They Out There?" *Audubon* 95 (September-October 1993):66–79.
23. Stephen Mitchell, trans., *Tao Te Ching* (New York: HarperCollins, 1988), chap. 29.
24. David Ehrenfeld, *Beginning Again: People and Nature in the New Millennium* (New York: Oxford University Press, 1993), pp. 148–50.
25. Ibid., p. 149.
26. Ibid.
27. For chaos and predictive failure in classical economics, see Richard H. Day, "The Emergence of Chaos from Classical Economic Growth," *Quarterly Journal of Economics* (May 1983):111–119.
28. Donald Worster, *The Wealth of Nature* (New York: Oxford University Press, 1993), p. 168.
29. The classic, of course, is James Gleick's *Chaos: Making a New Science* (New York: Penguin Books, 1987). See also M. Mitchell Waldrop, *Complexity: The Emerging Science at the Edge of Order and Chaos* (New York: Simon & Schuster, 1992). The most accessible introduction to the technical issues is Biggs and Peat, *Turbulent Mirror*. For discussions of chaos in fields ranging from ecology to quantum physics see Nina Hall, ed., *Exploring Chaos: A Guide to the New Science of Disorder* (New York: W. W. Norton, 1991).
30. Stephen H. Kellert, *In the Wake of Chaos: Unpredictable Order in Dynamical Systems* (Chicago: University of Chicago Press, 1993).