
Ecological Science as a Creation Story

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Since at least the late 1980s, environmental writers have made growing use of the explicit Christian language of “the Creation.” Two 1990s books by environmental authors, for example, are *Caring for Creation* (Oelschlaeger 1994) and *Covenant for a New Creation* (Robb and Casebolt 1991). The magazine of the Natural Resources Defense Council describes the need for a greater “spiritual bond between ourselves and the natural world similar to God’s covenant with creation” (Borelli 1988). Natural environments isolated historically from European contact are commonly described as having once been an “Eden” or a “paradise” on the earth—similar to the Creation before the fall (McCormick 1989; “Inside the World’s Last Eden” 1992).

Such creationist language has also invaded mainstream environmental politics. During his tenure as vice president, Al Gore said that we must cease “heaping contempt on God’s creation” (qtd. in Niebuhr 1993). In a 1995 speech remarkable for its religious candor, Secretary of the Interior Bruce Babbitt said that “our covenant” requires that we “protect the whole of Creation.” Invoking messages reminiscent of John Muir, Babbitt argued that wild areas are a source of our core “values” because they are “a manifestation of the presence of our Creator.” It is necessary to protect every animal and plant species, Babbitt said, because “the earth is a sacred precinct, designed by and for the purposes of the Creator,” and thus we can learn about God by encountering and experiencing his creation.

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The American environmental movement has deep roots in and still depends heavily on the conviction that a person finds a mirror of God's thinking in the encounter with wild nature—or, in traditional Christian terms, that a person is in the presence of “the Creation.” Absent this conviction, many of the American environmental movement's basic beliefs and important parts of its policy agenda would be difficult to explain and defend.¹ The use of creation language also reflects an increased role that the institutional churches of Christianity are now playing in the environmental movement. This involvement has worked to narrow the previously large linguistic gap between traditional Christian creationism and what might be called a secular “environmental creationism”—the use of creationist language without the explicit Christian context.

In 2005, the Interfaith Climate and Energy Campaign issued a statement titled “God's Mandate: Care for Creation,” and Cassandra Carmichael is the director of the Eco-Justice Program at the National Council of Churches. In 2004, the council issued its first ecumenical theological statement on the environment, and in 2006 it distributed a report advocating “creation care” for the Chesapeake Bay (Lutz 2006). Carmichael declares that the council's program is “about justice for all of God's creation. Animals, plants and people are all connected and you have to make sure you are having right relationships with all of them.” Invoking the classical Christian formulation, Carmichael explains that “some people compare it to how they can get to know an artist by studying his painting,” and God, as one might say, painted the natural world at the beginning. By studying God's artwork in nature, she adds, “you come to know God both by God's written word and by walking in what God has created and being in relationship with it” (qtd. in Lutz 2006). Secular environmental creationists experience much the same sense of awe and inspiration in the presence of “the creation,” but they typically describe it as a “spiritual” experience and drop the explicit references to a Christian God.

Environmental Creationism and Darwin

Many secular environmental creationists face a substantial tension, however, between their religious way of thinking about protecting “the Creation” and their simultaneous

1. The contemporary environmental movement often dates its beginnings to the publication of Rachel Carson's *Silent Spring* in 1962. Carson does not use explicit creationist language in her writing, but she conveys the same powerful sense of awe and reverence in encountering nature, much like the religious experience of being in the presence of God's artwork, a sense that is implicitly of a creationist character. She writes:

What is the value of preserving and strengthening this sense of awe and wonder, this recognition of something beyond the boundaries of human existence: Is the exploration of the natural world just a pleasant way to pass the golden hours of childhood or is there something deeper?

I am sure there is something much deeper, something lasting and significant. Those who dwell, as scientists or laymen, among the beauties and mysteries of the earth are never alone or weary of life. Whatever the vexations or concerns of their personal lives, their thoughts can find paths that lead to inner contentment and to renewed excitement in living. Those who contemplate the beauty of the earth find reserves of strength that will endure as long as life lasts. ([1956] 1996, 24)

Darwinist understanding of the evolution—now considered to have been taking place for more than a billion years—of the plant and animal worlds. As modern science tells us, it was not God who created the present-day natural world, but the workings of Darwinist evolution, reaching a result that is not divinely inspired, but a random outcome of many billions of chance events. Even if God may have made the rules for evolution, the experience of Darwin's world of nature is less likely to inspire feelings of awe and reverence. Poets have long written about the beauty of the natural landscape, but, from an evolutionary perspective, as Thomas Dunlap comments, "Darwin made it difficult to find God's goodness in the smiling meadow" (2004, 38).

For many secular environmentalists, the simplest course is to ignore this disconcerting issue—to partake of strong feelings of religious inspiration in the direct presence of "God's creation" and then to go about their daily lives. Environmental creationism has not come under the same intense public scrutiny and criticism as Christian creationism. There have been fewer social and intellectual pressures for environmental creationists to work out their own precise thinking in this area. It may be best simply not to think about the matter, as sometimes in life it is necessary to avoid "paralysis by analysis."

Yet, for many environmentalists, blissful ignorance is not an option. They experience the sublime beauty of nature, and yet they believe in Darwinian evolution and in Darwin's way of studying and understanding the natural world. They are determined, therefore, to incorporate their own powerful religious experiences of the natural world into a Darwinist framework. This incorporation should not be a vague sense that Darwin and environmental religion can be compatible, but it should be a well-developed and—at least to their mind—defensible theory in rigorous scientific terms. In the modern age, science has had the greatest authority in understanding the natural world, and environmentalism should be able to draw on a legitimate scientific understanding of nature.

The field of "ecological science," or "ecology," is a response to these tensions. Its beginnings roughly coincided with the rise of Darwinist thinking in the mid- to late nineteenth century. In the twentieth century, interest in ecological subjects increased gradually until the 1960s. Since then, with the rise of the environmental movement, ecology has become an important field of study in U.S. universities, attracting numerous students and large amounts of funding from public and private sources. The field of ecology has not been as successful scientifically, however, as it has been in terms of growing popular interest (Sagoff 2007). In a review of the history of the field of ecology in the United States, Eugene Cittadino observes that "ecology, then, is a highly derivative science, one that by its nature relies on language fraught with meaning beyond the science" and thus may lend itself to implicit religious and other expressions of values. Although ecologists have often made strong claims to a scientific status, Cittadino points out, and ecology may be a "science" in some classificatory sense, it certainly does not fall in the same category

with the “hard” sciences, such as physics, chemistry, and molecular biology (2006, 73). Reviewing the development of U.S. ecological science, Cittadino observes:

Discussions of ecology and its history always emphasize the great diversity of its subject matter, the extreme differences in methods and approaches depending on the type of environment one is studying or the level of organization (from single-species populations to communities, ecosystems, and the biosphere itself), the lack of consensus on the meanings of terms, the proliferation of empirical generalizations of limited applicability, the paucity of broad general principles, and the prevalence of national and regional styles owing to both environmental and cultural differences. (73)

Indeed, the outward scientific appearance of ecology masks a strong underlying religious content. The powerful religious element is not necessarily a problem in itself, but in the case of ecology, at least, the presentation of religion in the guise of a value-neutral science creates major tensions and even contradictions. Ecological science develops a new creation story that differs in some respects from the original biblical version but also exhibits basic continuities. The result is often both poor science and poor theology, as judged from a rigorously analytical viewpoint based in either area.

From Species to Landscapes

Darwin’s theory of evolution deals with a competitive struggle among individual plant and animal species—or for any competitive group in nature, sometimes smaller than a species, that shares common genes. In considering any given species, it is possible to marvel at the ways it has adapted to its surrounding environment. The giraffe is capable of reaching high into African trees where other shorter animals tied to the ground cannot go. The internal workings of plants and animals—for animals, their digestive systems, their sensory organs, their bone structures, and so forth—also make up an astonishingly intricate network of interrelated parts. To study the human body is to marvel that such a large and diverse set of organs can come together to form such a complex and well-functioning whole.

Until the modern age, all these things were attributed to the omnipresence and the omnipotence of God in the world. After Darwin, God was often pushed out of the picture. (He might have started the ball rolling, but a billion or more years of evolution had occurred since he did so). Even without God, however, many species’ internal physical workings can evoke awe and wonder. In this realm of the individual species, it may be possible for one person to revere the evolutionary record of history almost in the manner of another person reveres the biblical story. Secular and traditional religions are often surprisingly similar in their messages and their powerful religious effects on true believers. Marx, for example, substituted the evolutionary laws of economic history for God, and the Marxist faithful exhibited attitudes no less

reverential, even showing themselves willing in some cases to be martyrs for the Communist cause, like their Christian predecessors in Rome and elsewhere. Indeed, the modern age would be filled with examples of secular gospels that had a deeply religious effect on their followers, as much as the Jewish and Christian religions grounded in the Bible historically inspired the faithful.

When John Muir—the founder of the Sierra Club in 1892—went to the high Sierras, he was enthralled in the presence of an individual sequoia tree and individual members of other plant and animal species, but his inspiration had a perhaps equally or even more powerful source: he was seeing a divine harmony of all parts of the natural world as they served their appointed and interrelated purposes (Muir 1979). For Muir, everything about the Sierra Nevada—their very existence, their support of sequoia trees and other plant and animal species, the marvelous way in which one part of nature seemed interrelated and coordinated with every other part—seemed to evince God’s handiwork. The complete spectacle of the Sierras reflected a divine inspiration, a landscape painted by none other than the hand of God, providing a window into the workings of God’s mind that rivaled the Bible in religious importance (and, for Muir, the world of nature was the more important window).

Darwinist theory had a great deal to say about the evolution of species and the marvelous results manifest in nature at the individual species level. It had much less to say, however, about any powerful ordering forces involving the full set of interactions among a large number of plant and animal species—interactions that we now describe as those of an “ecosystem.” Moreover, it had almost nothing to say about any lasting harmony of nature at the landscape scale that in itself would be a product of the workings of evolution. Darwin’s theory was about the evolutionary survival of the fittest individual species, not the fittest landscapes. Indeed, in a Darwinist framework of thought, the overall results in terms of the species that survived and those that died out might well be simply a random accident.

Or, as one might say, Darwinism was a concept of enormous power at the level of the evolution of individual species, so powerful in fact that it transformed thinking about the entire natural order, but it was not a theory of competition among ecological systems. Darwin posited no mechanism by which one ecosystem would emerge triumphant over another ecosystem. He did not know precisely about genes, but his evolutionary theory, as is now known, has a genetic basis. This fact raises the question of how, even in concept, one ecosystem, lacking any genes, might be said to compete in evolutionary terms with another. What would the evolutionary triumph of an ecosystem represent, and how would it be known? How might a certain ecosystem be said to show order, logic, and permanence, whereas others are seen to lack these qualities?

Clements, Succession, and the Climax State

The scientific field of ecology was established to answer such questions. Its first great American theorist was Frederic Clements. In a comprehensive history of the field of

ecology, the distinguished environmental historian Donald Worster says of Clements (who died in 1945) that in the first four decades of the twentieth century, “no individual had a more profound impact on the course of American as well as British ecological thought” (1994, 209). Clements’s great ecological contribution was his view that natural systems are constantly moving toward and often attain a “climax state.” This process might also be described as their assured evolution toward a natural “equilibrium” state. Clements thus offered a theory of how ecosystems evolve, something missing in standard Darwinist thinking about the evolution of species.

Disturbances frequently occur in nature, and therefore no climax state can endure for long without change. Clements maintained, however, that in the aftermath of a disruption, the ecosystem would tend to move back toward the original equilibrium, or climax, condition. As Worster explains, in Clements’s view “nature’s course . . . is not an aimless wandering to and fro but a steady flow toward stability that can be exactly plotted by the scientist” (1994, 210). This idea closely resembles the idea of a market equilibrium employed in the discipline of economics—an idea that was achieving its height of influence in neoclassical economics at about the same time that Clements was writing. In economic equilibrium as well, unexpected disruptive events may occur, but the workings of supply and demand will move the market back to its natural equilibrium price and quantity. God had seemingly made the world, ecologists and economists were saying, to exhibit a happy harmony of all its parts (Nelson 1991).

According to Clements’s view, the initial physical parameters that set the stage for the natural system’s subsequent evolution toward the “climax community” include such variables as temperature, rainfall, wind, elevation, and soil type. Once such environmental factors are in place, explains Worster, the natural system’s evolution “begins with a primitive, inherently unbalanced plant assemblage and ends with a complex formation in relatively permanent equilibrium with the surrounding conditions, capable of perpetuating itself forever” (1994, 210). Clements was particularly interested in the North American plains, with their wide expanses of grassland in Nebraska, Kansas, and other midwestern states. He believed that on the plains the “prairie climax has been in existence for several millions of years at least and with most of the dominant species of today,” even though it had occasionally even been massively disturbed by ice ages and other large climatic disruptions (qtd. in Worster 1994, 216).

Thus, unlike Darwin, who had focused on individual species, Clements, writing in 1916, pioneered the scientific study of natural systems, each of which “is a unified mechanism in which the whole is greater than a sum of its parts and hence it constitutes a new kind of organic being with novel properties”—with these scientific properties of the ecological “organism” serving as the objects of study by the field of ecology (Clements 1916, 124–25). By 1939, Clements, as Worster describes his views, would be arguing that the climax state was a “superorganism created through

[the processes of] developmental succession,” part of the workings of a natural world in which “all living organisms are united in one communal bond” throughout an ecosystem (1994, 214–15).

Clements was vague, however, about why his fundamental laws of natural succession existed. Evolutionary theory offered no clear answer to this larger question. As noted previously, the very concept of a “natural system” plays little role in Darwinist thinking, other than perhaps as a descriptive term referring to a setting in which the evolutionary struggles among individual plant and animal species take place. Indeed, it is difficult to say what constitutes a “natural system.” Unlike a species, a natural system has no common genes or other clear basis for composing a part of nature under a common identity. Where, for example, are the boundaries between one natural system and another? Such a system might range from my backyard to the whole earth. Besides a natural system’s tendency toward a climax state—at least as Clements vigorously asserted, and as many other ecologists of the time largely agreed—what internal forces (or external forces, for that matter) drive the evolution of natural systems? What assures a single “natural” outcome to the workings of ecosystem processes?

In truth, these questions have no good answers. Rather, as Worster comments, Clements had an “underlying, almost metaphysical faith that the development of vegetation must resemble the growth process of an individual plant or animal organism” (1994, 211). Viewed retrospectively, Clements’s thinking was thus closer to religion than to science. If natural landscapes exhibit a marvelous order that inspires a powerful sense of admiration for the workings of larger forces in the world, these forces are not those of Darwinist evolution or of anything else that is well grounded scientifically. This design might have come from only one place. Indeed, although Clements never said so explicitly, the implication of his work is that God must have sculpted the natural landscapes of the earth in such a marvelous fashion.

Thus, despite Clements’s preeminent status in the field of ecology at the time, it has become apparent that his whole enterprise has surprisingly little scientific content. Reflecting this problem, by the mid-twentieth century, climax theory was coming under severe criticism among ecologists and would soon be disavowed by the professional mainstream, at least with regard to the language Clements used. By the last few decades of the twentieth century, the standard view among ecologists would be that natural systems manifest no automatic tendency toward equilibrium. Indeed, their normal movement arises only from one isolated disturbance followed by another in somewhat unpredictable and even random fashion.

More religion than science, the theory of the climax state also includes a moment when original sin arrived in the world. Human beings were not part of the original ecological order, as Clements described it, but a foreign element. At the beginning, Clements’s nature thus exhibited a harmony much like the harmony that Adam and Eve initially encountered in the Garden. Uniquely among species, however, human beings could alter the natural harmony of the Creation. Indeed,

their actions might disrupt the ecological equilibrium entirely and permanently, warping and destroying the otherwise strong tendency to reach the one climax state, as in the Jewish and Christian accounts of events in the Garden. This new presence of human sinfulness in the world would again result from humans' quest to know more than they should. Many evils would subsequently spread across the earth, as happened at an accelerating pace in the modern era. Only if human beings renounced their false pride and arrogance and humbly accepted a lesser place within creation, leaving the climax state to evolve undisturbed, would there be any hope for the future. So far as practically possible, nature should be left untouched by human hands.

This ecological creation story would be repeated many times in many forms over the twentieth century. Indeed, it is still being heard. In a 2004 editorial on the future of the environmental movement, *The Economist* magazine comments that in the movement's typical vision, "there is a Garden of Eden (unspoiled nature), a fall (economic development), the usual moral degeneracy (it's all man's fault), and the pressing sense that the world is enjoying its final days" ("The End of the World" 2004, XX). Only a spiritual renewal across the world will preclude environmental calamities on a biblical scale. Clements, in short, had authored an ecological creation story in a new Darwinist language better suited to the first half of the twentieth century, a time when traditional Christian understandings faced severe challenges. For the new secular believers in environmental creationism, Clements's climax state—the one true nature unaltered by human actions—could be as religiously awe inspiring, as powerful a source of deep spiritual values, as the experience of the natural world had been earlier for Ralph Waldo Emerson, Henry David Thoreau, John Muir, and many others.

Not only the evolution of individual species, but also the evolution of whole landscapes were taken to follow scientific laws, and in these landscapes, some of which the federal government would eventually protect as wilderness areas, one might still find God's original artwork. Isaac Newton had shown important elements of God's design in the solar system and other physical workings of nature; Clements was now showing—or, at least, a scientific consensus among ecologists at the time took him to have shown—a similar divine order of nature at the landscape level, as manifested in a unique set of climax states preserved indefinitely by the workings of nature.

Aldo Leopold's Religion

The environmental philosopher Max Oelschlaeger regards Henry David Thoreau, John Muir, and Aldo Leopold as the three "giants" of American wilderness philosophy (1991, 205). Thoreau and Muir were products of the nineteenth century, but the events of the first half of the twentieth century shaped Leopold (Meine 1988). His signature work—he wrote less for a wide audience than did Thoreau or Muir—was *A Sand County Almanac*, published in 1949 (shortly after his death in

1948). Leopold here recasts Thoreau and Muir's environmental religion in the language of ecology. Whereas Thoreau and Muir said little about Jesus, but much more about "God," Leopold largely avoids any explicit mention of God.

This omission is misleading, however, because Leopold's writings and his message reflect a religious understanding of the world through and through. Indeed, much like Clements's ideas, many of Leopold's arguments would make little sense if the existence of a divine authorship of the natural world were not being implicitly invoked. If one appropriately injects God as a newly explicit factor, however, one converts what might otherwise be vague and incomplete into something both historically familiar and theologically well developed. Leopold thus offers, if not a rigorous science, a well-crafted theology, an environmental creation story newly adapted to ecological metaphors.

Over the course of his life, Leopold made the passage from true believer in economic religion (see Nelson 2001) to true believer in environmental religion—the most famous such "secular religious conversion" in American environmental history. Much of Leopold's working life, from 1909 to 1928, was spent with the U.S. Forest Service, for the most part in the southwestern United States. As famously applied by Gifford Pinchot to shape agency culture in the formative years, the Forest Service's religion was the Progressive "gospel of efficiency" (Nelson 1999). Later in life, however, Leopold lamented the sins against nature that he had once committed in the name of this false gospel. For example, he had once regarded wolves as predators to be eliminated in order to improve the prospects for other species, but he now saw how terribly mistaken he had been. As Oelschlaeger comments, Leopold increasingly concluded over the course of his life that "the human animal was no longer absolute ruler above the web of life but a biotic citizen who recognized that the very endeavour to perpetuate material progress—that shrine [of American life]—was an illusory and self-defeating goal" (1991, 238).

Leopold's mission in the later part of his life, culminating in the series of essays assembled in *A Sand County Almanac*, was to proselytize an environmental religion. In this effort, he drew on the work of Frederic Clements and other contemporary ecologists. As noted previously, Clements had said that in the end an ecological system would naturally reach a climax state. Cittadino comments, "Leopold, never a sophisticated ecological theorist, offered readers the promise of a 'land ethic,' grounded in a belief in the integrity of natural systems" (2006, 94). Over time, a host of other synonyms such as *healthy*, *stable*, *integrated*, *balanced*, and *sustainable* would be applied to describe what in essence remained early-twentieth-century ecology's climax state.

Owing to the "value-neutral" canons of science, Clements and many other ecologists were reluctant to condemn human actions in explicitly moral language. As Leopold's thinking evolved, however, he increasingly felt no such limitation. By the time *A Sand County Almanac* was published, he proclaimed the necessity of achieving a "land ethic [that] changes the role of homo sapiens from conqueror of

the land-community to plain member and citizen of it.” Each person must come to realize that he “is a member of a community of interdependent parts. . . . The land ethic simply enlarges the boundaries of the community to include soils, waters, plants, and animals; or collectively, the land” (1949, 203–4). Like the residents of any well-functioning community, members of the land community, including the humans in their interactions with the nonhuman living members and even the non-living parts, must live according to high ethical standards in mutual respect.

As Leopold wrote, human beings unfortunately often violated this ethical command. Events in the twentieth century had shown that “our tools are better than we are, and grow better faster than we do. They suffice to crack the atom, to command the tides. But they do not suffice for the oldest task in human history: to live on a piece of land without spoiling it” (Leopold 1991, 254). When Leopold speaks of “spoiling,” he shows his debt to Clements. To “spoil” here means in effect to become “unnatural” or “unhealthy”—to disrupt the climax state, or something akin to it, by human action. Oelschlaeger explains that for Leopold, as a self-professed disciple of Clements, the land ethic entails seeing “things steadily, and whole, particularly as this relate[s] to viewing the human species and nature as dynamically inter-related, and recognizing that society and land constitute a community of ongoing life—bound into one natural history” (1991, 230). As Clements had said, even a natural system can have an organic identity, almost as though it were itself a living thing, and each system has one correct ecological condition, which is the one that nature produces unaltered by human hand.

Many contemporary environmentalists find in Leopold’s writings the leading inspiration for their own ethical thinking; his work is the “bible” of their environmental religion. Oelschlaeger, for example, describes the gospel of *A Sand County Almanac*, which now attracts him and many other ardent admirers. The essays collected there

Are remarkable statements—Thoreauvian in their literary quality and much of their underlying philosophy. “Thinking Like a Mountain” (1944) is representative of the changes in Leopold’s outlook: a confession (in some ways almost Augustinian) that through his own short sightedness and human centeredness he had sinned against nature. As in “Marshland Elegy,” nature was animated through Leopold’s unique prose. “A deep chesty bawl echoes from rimrock to rimrock, rolls down the mountain, and fades into the far blackness of the night. It is an outburst of wild defiant sorrow, and of contempt for all adversities of the world.” Leopold’s intuition was grounded in a personal relation to the mountain itself, . . . a mountain which recognized in the cry of the wolf a “deeper meaning, known only to the mountain itself. Only the mountain has lived long enough to listen objectively to the howl of a wolf.” This statement metaphorically endows the mountain with sentience—the basis of an interconnectedness between

the massif and the timber and animals that inhabit its slopes. What in imperial ecology would be a mechanical equilibrium of the ecosystem had been animated and metaphorically personified, but not anthropomorphized. Crucially, the mountain has lived through the longueurs of geological and biological time: long enough to be free of the prejudice that taints human perception of the wolf.

Leopold here verged on recapturing a Paleolithic consciousness of *nature in its order of operation*—escaping the prison of conventional categories and finding his way back to the green world from which his kind had come, becoming one with the mountain. (1991, 232–33, emphasis in original)

When Oelschlaeger, giving a reading of Leopold that he shares with many other equally inspired environmentalists, says that nature is “animated,” that the mountain has “sentience,” that the wolf’s cry “speaks of a deeper meaning,” he obviously is not saying that the natural world is literally speaking words that a person can understand. What, then, does he mean? From a strictly scientific perspective, it would be difficult to know; perhaps the words mean nothing at all; they may simply be empty phrases that sound good to many people. Seen in the historical light of Christian religion, however, Leopold’s message is more familiar. The workings of nature reflect the mind of God, as put there at the Creation, which has now been transposed to a much earlier time than the biblical story suggest. To encounter natural systems as they existed before human impacts, as found in the climax state, is to see into the universe’s deepest meanings, to discover a divine order there, to come to know God. If we were to state this idea in an old-fashioned Christian way, we would say that a person must still read the “Book of Nature” to discover there God’s essential truths. Leopold was simply the new reading instructor who understood that Darwin and other geological and biological discoveries of the nineteenth century must be included in the picture, as the ecological thinking of the first half of the twentieth century was doing.

Dunlap, an historian of environmental thought, commented recently that Leopold “did not use explicitly religious language, probably would have been skeptical of an environmental ‘religion,’ and surely would have been horrified at the suggestion that he was helping to establish one. Yet, his work spoke to the religious dimension of life and to ultimate questions and needs, and the public made him, deservedly, an environmental nature saint.” This public reaction was part of a broad historical phenomenon, as Dunlap observes, whereby “ever since Emerson, Americans who failed to find God in church took terms and perspectives from Christian theology into their search for ecstatic experiences in nature” (2004, 65). In the process, they established a secular environmental religion to justify and sustain the rise of the American environmental movement in the last few decades of the twentieth century.

Ecology as Physics

When the terrible wars and other experiences of the first half of the twentieth century showed that some very dangerous forces had been set loose in human affairs, one response was a new determination that the utmost care should be exercised to verify objectively any truth claims being made by the partisans of one worldview or another. In the late nineteenth and early twentieth centuries, many grandiose ideas—ideologies or secular religions or whatever one chooses to call them—had made great claims to scientific validity that in retrospect appeared to lack such validity. Indeed, the record of Marxism, national socialism, and other all-encompassing worldviews seemed to show that even in the twentieth century, human beings were remarkably susceptible to half-baked ideas and schemes that falsely claimed to explain everything significant about human existence in the world. It seemed to affirm that, as others have said, before most people will believe in nothing, they will believe in anything.

In this intellectual climate, the methods and the historical successes of physics, which had experienced a great wave of fundamental discoveries in the first half of the twentieth century, had great appeal. In economics, MIT economist Paul Samuelson (winner of the 1970 Nobel Prize in economics for his efforts) became the professionally most admired economist of the second half of the twentieth century by leading the charge to convert the practice of economics to the quantitative methods of physics. Similar methodological pressures were being felt in the field of ecology. The climax state and Clements's other ecological theories were increasingly criticized as portraying an organic and even metaphysical and mystical element in nature that lacked any objective scientific reality.

In the future, ecological systems would be precisely characterized in terms of the behavior of their components, and then the systems' functioning would be explained by mathematically working out the model results. As Worster notes, beginning in the 1940s, "words like 'energy flow' and 'trophic levels' and 'ecosystem' appeared in the leading journals, and they indicated a view of nature shaped more by physics than [by] botany" (1993, 159). The formal concept of an "ecosystem" in particular began to play a growing role in environmental thought. Ecologist A. G. Tansley had first defined it in 1935, borrowing the concept from Clements's work.

Many ecologists would soon be working to model and simulate ecosystem functioning. Large sets of complicated equations could be developed, high-speed computing capacities employed, and other "scientific" apparatus deployed. The ecosystem as an organizing theme for ecological study eventually proved so successful that by the 1990s the federal government would officially adopt "ecosystem management" as the guiding philosophy for public lands and other natural resources.

After World War II, the leading proponent of the ecosystem concept was Eugene Odum, who in 1953 published *Fundamentals of Ecology*—the equivalent in

ecology, one might say, of Samuelson's 1947 book *Foundations of Economic Analysis*. In both cases, the transition in professional methodology was admittedly considerably greater than the novelty of the disciplinary conclusions reached. Odum's ecosystems did not differ greatly from the natural systems Clements had described previously; they, too, inevitably and naturally gravitated toward a final equilibrium state, though one no longer described as a "climax" outcome.

Ecosystems, according to Odum and other ecologists of the time, still exhibited clear patterns of succession. This movement was "directed toward achieving as large and diverse an organic structure as is possible within the limits set by the available energy input and the prevailing physical conditions of existence" (Odum 1969, 266). The whole process was a manifestation of "nature's strategy," which tends toward "a world of mutualism and cooperation among the organisms inhabiting an area." As Worster comments, "Odum may have used different terms than Clements, may even have had a radically different vision of nature at times; but he did not repudiate Clements's notion that nature moves toward order and harmony. In the place of the theory of the 'climax' stage he put the theory of the 'mature ecosystem'" (1993, 160).

In order to achieve such "homeostasis," Worster explains, it would be necessary that "the living components of an ecosystem . . . evolve a structure of interrelatedness and cooperation that can, to some extent, manage the physical world—manage it for maximum efficiency and mutual benefit." When the ecosystem has achieved its resting equilibrium, "it expends less energy on increasing production and more on furnishing protection from external vicissitudes: that is, the biomass in an area reaches a steady level, neither increasing nor decreasing, and the emphasis in the system is on keeping it that way." A key feature of this end point is that there will be "more diversity in the community—i.e., a greater diversity of species" (Worster 1993, 160). Odum admittedly did not answer the key question of how all of this ecological order and structure came into being in the first place. Such an ordered landscape certainly had no genetic or other Darwinian basis. There was really only one good answer. Although Odum did not put it this way, he was implicitly describing the "natural" workings of the world as put there by some kind of god of ecology. The ecological god, moreover, apparently worked in ways surprisingly similar to the Christian God, who also had created an orderly and harmonious world.

Odum preached that the functioning of ecosystems, tending toward a desirable end state—a "natural," "healthy," "integrated," and "sustainable" condition—does and should work independently of a human presence in the ecosystem. Indeed, ecologists such as Odum saw human beings as representing a potential threat to the natural order and stability of the world's well-functioning ecosystems. Although seldom explicit about this view, post-World War II ecologists continued to assert a powerful value judgment. As Worster states, "Odum's view of nature as a series of balanced ecosystems, achieved or in the making, led him to take a strong stand in favor of preserving the landscape in as nearly natural a condition as possible," free of human alteration (1993, 161).

In *A Sand County Almanac*, Aldo Leopold had already said much the same thing in the less formal language of ecological poetry. Odum was now repeating Leopold's message of environmental creationism in the language of physics (with some of the interpretation in ordinary words, as already shown). The two efforts complemented one another. Leopold's writings inspired large numbers of ordinary Americans to experience the natural world religiously and to make a commitment to work for its protection. Odum and the many ecologists who followed after him provided scientific credentials and authority. A scientific status was especially important when government policy and management were at stake. Twentieth-century Americans believed that the government should not act on the basis of inspirational religious writing, but on the basis of valid professional and scientific knowledge. However, most Americans had not considered the possibility that fields such as ecology might write inspirational "scientific poetry" filled with mathematical equations.

Although environmental religion posing as ecological science won many new followers, the ecological models' scientific success was another matter. For the most part, as the retrospective judgment has now been rendered, Odum and other ecologists of the mid-twentieth century did not produce much that was substantially new or of major intellectual interest concerning the workings of the natural order. Indeed, much that Odum said is now considered to have been misleading or even outright wrong. As Worster explains, in the present ecological consensus "there is no such thing . . . as balance or equilibrium or steady-state [or climax state]. Each and every plant association is nothing but a temporary gathering of strangers, a clustering of species unrelated to one another, here for a brief while today, on their way somewhere else tomorrow" (1993, 163).

Robert O'Neill, the first president of the U.S. Society for Ecological Economics, suggested in 1996 that ecologists "must give up their favorite fiction: the natural world" (1033). Yet this fiction refuses to die. The religious attraction and power of the idea of nature as a physical "Book"—God's artwork in which his thinking is revealed—has proved virtually irresistible to many millions of Americans. Hoping to find greater meaning in the world, even many ostensibly tough-minded ecologists constantly revert back to such ideas as the "health," "balance," and "equilibrium" of nature in their policy appraisals and other public discussions (notwithstanding what is said and left unsaid in their scientific papers). As Cittadino comments, the science of ecology through most of its history

[h]as rested, sometimes uneasily and never without internal critics, on the notion of an ideal, stable, self-rejuvenating, primal nature, existing outside human influence, whose inner workings it is the ultimate goal of the science to reveal. This is a notion that has been difficult to discard for scientists and nonscientists alike, since it fits in so well with the earlier belief in a fundamentally beneficent and self-sustaining nature, with the

aspirations and the hopes of utopian regional planners, with the evangelical Protestant idealism of many environmentalists, and even with the hopes and dreams of more pragmatic, and secular, rational planners and managers. (2006, 105)

A Plant and Animal “Holocaust”

Harvard biologist E. O. Wilson, in the substantive content and the high literary quality of his writings (he has won two Pulitzer Prizes), follows in the path marked by Henry David Thoreau and Aldo Leopold. Substantively in terms of environmental religion, Wilson’s greatest departure has been to shift the focus of ecological study and interest in the natural world away from landscapes and to biological systems (Wilson 1988, 1989). The plant and animal world—now known to encompass many millions of species—interests him most. By the later part of the twentieth century, as described earlier, ecological language that portrays a physical landscape as virtually a living organism was increasingly being criticized, and it had become perhaps even scientifically untenable and embarrassing. By contrast, a biological plant or animal species had common genes and an otherwise clearer scientific basis for defining its existence (although demarcating the precise boundaries between species might raise complex issues).

Reflecting such developments, scientific concern grew by the 1980s and 1990s that the “wilderness” concept was no longer scientifically justifiable, however great the continuing appeal of wilderness values to the broader public. Given the pervasive human impacts on the earth, areas genuinely “untrammelled by man” (the language of the 1964 Wilderness Act) might not exist. Moreover, as noted previously, the existence of natural states of ecological equilibrium at a landscape scale, as long described by ecologists, was increasingly being questioned. Nature is apparently more chaotic. Hence, professional ecologists were making “biodiversity” their leading interest, giving less attention to the nonliving elements of the “land community.” The field of “conservation biology” was established in 1985 to build the requisite knowledge and to educate students. Wilson was perhaps the most visible ecological spokesman of the late twentieth century in communicating these developments to the broader public.

Early in his career, Wilson made important scientific contributions to the biology of ants, and in the 1960s, with Robert MacArthur, he famously explored the relationship between island area and species diversity (studying how the smaller an isolated area of habitat, the fewer species will be found). Wilson is thus a distinguished scientist in his own right. Relying on his own and other biologists’ research, a Wilson book or article is usually crammed with lengthy biological explanations of the detailed workings of nature, as illustrated in the following representative passage:

Fast-growing, small in stature, and short-lived, [the gap-filling trees] form a single canopy that matures far below the upper crowns of the older trees

all around. Their tissue is soft and vulnerable to herbivores. The palmate-leaved trees of the genus *Cecropia*, one of the gap-filling specialists of Central and South America, harbor vicious ants in hollow internodes of the trunk. . . .

All around the second-growth vegetation, the fallen trees and branches rot and crumble offering hiding places and food to a vast array of basidiomycete fungi, slime molds, ponerine ants, scolytid beetles, bark lice, earwigs, embiopteran web spinners, zorapterans, entomobryomorph springtails, japygid diplurans, schizomid arachnids, pseudoscorpions, real scorpions, and other forms that live mostly or exclusively in this habitat. They add thousands of species to the diversity of the primary forest. (Wilson 1992, 47)

Although the vocabulary is more technical and detailed, and Wilson can appeal to his own high scientific standing for authority, his message in the end follows in a familiar path. Like Leopold for natural systems as whole, Wilson now speaks of a “community of species” about which human beings must understand that they are only one of the parts and have an obligation to respect all of the others (1992, 51). Still showing debts to ecological ideas as far back as Frederic Clements, Wilson sees the workings of the natural world as involving a series of “successional stages” that yield a biological process by which “every habitat, from Brazilian rain forest to Antarctic bay to thermal vent, harbors a unique combination of plants and animals” (47). This natural “dynamic equilibrium” in plant and animal habitats can be disrupted, even severely, but then comes a process of “succession that circles back to something resembling the original state of the environment” (51). The workings of biological systems reflect an “assembly of life that took a billion years to evolve. It has eaten the storms—folded them into its genes—and created the world that created us. It holds the world steady” (48). In other words, there is a biological equilibrium in nature to which plant and animal communities of species will continually return—in essence, a biological climax state.

Again in the vein of earlier ecological writers, Wilson sees one great exception to the stability and adaptability of the earth’s biological systems. Like Clements, Leopold, and most twentieth-century ecologists, Wilson thinks of and studies biological systems as independent of a human presence. Human beings, it would seem, are not a part of nature, but rather strictly outside it—unnatural beings with godlike powers. As Wilson writes, they are latecomers to the earth who “walked upright onto the stage, bearing Promethean fire—self-awareness and knowledge taken from the gods—and everything changed” (1992, 67). Human beings, eventually coming to think they were virtual gods themselves, have now challenged the original divine author’s authority, seeking to impose their own designs even on God’s original creations in nature and to put nature to human “use.”

Thus, the biological extinction of species is now being “pressed with a [new] vengeance by modern generations” against even insects, bacteria, and other tiny and

less visible members of the earth's natural community. For example, "the fungi of western Europe appear to be in the midst of a mass extinction on at least a local scale" (Wilson 1992, 67). Wilson labels current biodiversity declines as the sixth "great extinction spasm" (67) over the earth, this time caused directly by human beings rather than by giant meteorites, volcanoes, climate change, and other natural forces as in the previous five mass-extinction episodes. Scientific knowledge has now empowered human beings perversely in unprecedented ways, but "in the instant of achieving self-understanding through the mind of man, life has doomed its most beautiful creations. And thus humanity closes the door to its past" (67). Arrogantly abusing their new powers, humans are bringing about a "holocaust," as Wilson labels it, for the earth's other species. Human sinfulness is directed increasingly not only against fellow human beings, as in Nazi Germany, but also against the plant and animal creatures of the natural world.

Wilson thus has no doubts about an appropriate moral judgment with respect to current human actions that affect the other members of the earth's biological communities. He laments that so many people today have such narrow vision that they cannot "weep for the past, [instead thinking that] humanity is a new order of life[;] let species die if they block progress, scientific and technological genius will find another way" to serve human welfare without the presence of these species (1992, 68). In other words, a false worship of economic progress still too often triumphs over the higher truths of environmental religion. Complementing his purely scientific enterprises, Wilson's life crusade is to change all that.

Wilson's vision in fact amounts to a full-fledged environmental religion, dressed in yet another secular vocabulary that is Wilson's own special contribution to late-twentieth-century environmentalism. His writings evoke a powerful sense that nature testifies to the glory of God's creation. He achieves this result through the development of extensive biological metaphors in place of the landscape and other wider ecosystem imagery that Leopold and many other environmental writers used. Oxford University professor Alister McGrath, who holds doctorates in both molecular biology and divinity, thus says of Wilson that "though showing no signs of being [himself] aware of the fact, Wilson has simply smuggled in a belief system under the cover of legitimate scientific explanations." Wilson, however, denies the existence of God or other transcendent values outside the natural world, which, argues McGrath, leaves him "vulnerable to the charge of asserting moral values that are purely arbitrary or temporary human conventions that are dependent upon culture and historical location. How can morality have credibility in a world of mere fact, from which God, religion, and any form of transcendent values have been eliminated?" (2002, 181). In terms of a rigorous theological analysis, Wilson, in short, is seemingly confused and perhaps seriously misguided as he offers religion in the guise of a biological science.

Environmental historian Mark Stoll observes that Wilson's writings reflect his southern Baptist origins. His "is the voice of the evangelist, not of the priest or pope,

because while scientists will identify the biological origins of [an environmental] ethics, they will not operate like bishops or priests” who instruct the people in their convictions. In Wilson’s thinking, the new “universal code of ethics will be worked out in good Baptist fashion: democratically” (2007, 11). His large body of popular writings is designed to educate the masses in the ethical imperative of biological species preservation.

The Book of Ecology

For people who regard ecology as a value-neutral scientific field, the large role of such religious and other subjective elements often comes as a surprise. University of California ecologist Daniel Botkin thus explains that he wrote his 1990 book *Discordant Harmonies* because of what he saw as the wide neglect of valid scientific results in public decision making, even among many ecologists themselves. As Botkin explains an original mystification, “in the mid-1970s, I confronted several curious contradictions that I attempted to explain: decisions about managing nature were based on ideas that were clearly contradicted by [the] facts” of ecology. Most surprising was that this neglect of the facts was common even among his fellow ecologists: “in my own field of ecology, those same ideas dominated, yet the facts that contradicted them were gathered by ecologists. We repeatedly failed to deal successfully with our environment, and [as ecologists] we seemed to ignore the very facts that could most help us” (1990, vii).

Even when ecologists were not directly responsible themselves for making policy and management decisions based on misleading or even erroneous ecological information, they often either encouraged or, at a minimum, refrained from criticizing in public the government policymakers who did so. As a result of such disconcerting experiences, Botkin undertook a “search for an explanation [that] led down many paths and required peeling back layer after layer of impression and observation. At the surface were the activities of our society: scientists doing research; legislators signing bills; government officials dealing with policies.” However, the absence of a valid scientific foundation did not stem solely from the practical limitations of existing governing institutions. Botkin found that in the development of environmental policy, “underneath there was a layer of belief, myth and assumption, of symbol and metaphor. . . . [At issue was] the character of nature undisturbed,” as ecologists presented this image to the wider public. Ecologists were being asked and giving answers to questions as old as Adam and Eve: “What is the proper role for human beings in nature?” As Botkin came to believe, the religious stakes had become so large that previous ecologists had too often acquiesced to public demands for an appealing imagery of “metaphor, myth, and assumption,” transcending simple knowledge of the actual physical workings of ecological systems alone (1990, vii). Ecologists were simply accommodating the overwhelming public desire to find a deep religious meaning in the workings of the natural world—to encounter the

handiwork of God there, although Botkin himself does not make the point exactly in this way.

As Botkin observes, many of his fellow ecologists advocated additional wilderness designations, even though it was no great mystery that “there is no longer any part of the Earth that is untouched by our actions in some way, either directly or indirectly.” As a result, objectively speaking, “there are no wildernesses in the sense of places completely unaffected by people” (1990, 194), despite frequent assertions to the contrary in the rhetoric of environmental policymaking. Indeed, for many environmentalists, the idea of a genuine wilderness unaffected by human action—places on earth where the Creation still exists unaltered—is virtually a necessary benchmark of their own faith. Without it, they might even lack a sense of purpose and direction in their lives. In late-twentieth-century terms, it would be as though “God is dead” or, if he does exist, as though he has become inaccessible to human understanding (McKibben 1989).

As a scientist, Botkin is unhappily aware of this religious element, and he acknowledges the psychological disorientation that many people would feel in the face of an accurate understanding of natural world’s disorderly and chaotic realities—what Botkin knows to be the actual scientific conclusions of the technical literature in ecology. As Botkin explains, “To abandon a belief in the constancy of undisturbed nature is psychologically uncomfortable. As long as we could believe that nature undisturbed was constant, we were provided with a simple standard against which to judge our actions, . . . providing us with a sense of continuity and permanence that was comforting. Abandoning those beliefs leaves us in an extreme existential position: we are like small boats without anchors in a sea of time; how we long for safe harbor on a shore” (1990, 188–89).

In the face of this “extreme existential position,” many people seek comfort in ecological stories, fictional or not. A Darwinian universe, whatever its scientific merits, seems to many people to provide no larger purpose for human existence. That is to say, it is a world without God or creation. They may therefore find it necessary to reject more scientifically accurate depictions of the natural world, as some Christian creationists deny the reality of dinosaurs. Many environmental creationists, Botkin points out, have their own set of uncritically accepted scientific myths, which give greater meaning to their universe as well (see also Tarlock 1996).

Conclusion

For many years beginning in 1983, Ed Marston edited the biweekly *High Country News*, then the leading news source for information on environmental matters in the western United States. As he states, “environmentalism is still and never more than today, a moral movement: It is telling humanity, with a thousand voices, that we are destroying what we should be cherishing, that we must change our ways,

and that unless we change, we will make of the earth a hell for all living things” (1989, 15). If human beings were to reform their sinful ways, however, the future might hold a bright prospect because, “like any moral movement, environmentalism holds out a paradise. In our paradise, the air is clear, the water pure, and the wildlife plentiful” (15).

Whatever the story’s scientific validity, ecologists told and retold a creation story over the course of the twentieth century. Despite the large differences in language, this story was surprisingly similar to the older biblical version, which was also growing in popularity among traditional Christian creationists during much of the same period. Even the moment of the fall was surprisingly close: for a literal creationist, in the Garden of Eden about six thousand years ago, and for an environmental creationist, beginning with the rise of organized agriculture and then civilization about ten thousand years ago.

Given the close parallels, one might describe the religion of ecology in one of three ways. It might be seen as a new way of stating an historical Judeo-Christian message, disguising the origins in an updated, allegedly scientific vocabulary in order to attract more followers in a secular age. Or, for many true Christian believers, the ecological gospel might instead be seen as a great Christian heresy, all the more dangerous because of the many close similarities to the original. A third alternative would be to see the ecological creation story as part of a new environmental religion, much like Islam, both being offshoots from and drawing heavily on earlier Christian messages.

The religious underpinnings of ecology are not only of theological interest, however. Many government policies today are grounded in the tenets of ecosystem management, allegedly derived from the scientific principles of ecology. If these principles are also deeply religious, yet this religious aspect cannot be formally acknowledged and explored in public, widespread policy confusion in government agencies is likely to result. Surprising as it may seem, the key to improved government performance in dealing with issues of the human relationship to the natural world may lie in an improved theological understanding.

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