

# Religious Naturalism and Three Scientific Revolutions

If we choose to let conjecture run wild, then animals—our fellow brethren in pain, disease, death, suffering and famine, our slaves in the most laborious works, our companions in our amusements—they may partake from our origin in one common ancestor, we may be all netted together.

—Charles Darwin<sup>1</sup>

## Introduction

Religion has many faces. There are the great world religions and the different modes of interpretation and practice within each of them. There are the pervasive religious motifs, rites, and undergirdings of tribal cultures. There are monotheistic religions, religions of two deities, and religions of multiple deities. The deities can be perceived as radically transcendent, radically immanent, or somewhere in-between. In some quarters there is even the covert worship of Satan or other powers of evil. There are also religions in which there are no deities or in which deities are subordinate to some more ultimate principle or power. And there is a movement of thought and action called religious naturalism, of which I and a growing number of persons, especially in the United States, are adherents and proponents. This book

will concentrate on an extremely important and demanding aspect of wholehearted commitment to religious naturalism, that is, the import of such a commitment for attitudes and actions of human beings in their relations to other forms of life here on earth.

Religious naturalism, as I and many others interpret it, has no belief in or devotion to God, Goddess, gods, or goddesses. For it, nature in some shape or form is all there is, ever has been, or ever will be. Nothing else lies before it, behind it, or beyond it as its ultimate ground, source, sustainer, or guide. Nature exists and persists by virtue of its own inherent, self-contained potentialities, principles, and laws. There is no alleged independent realm of the supernatural and no special, higher revelations of truth or value coming from such a realm. There is no avowed supernatural basis for help in time of need, for transformation of life, or for coping with the threats and exigencies of finite existence.

In at least some of the forms of religious naturalism, the present state of nature, or nature natured (*natura naturata*), is produced and underlaid by the irrepressively creative (but also by this same token perennially destructive) presence and power of nature natur-ing (*natura naturans*) that gives rise to all that has been, is now, and ever shall be, and that transforms what has already been into what is yet to come. Nature is thus not a static system but a restlessly dynamic one, undergoing radical changes over long periods, its creations and its destructions going hand-in-hand. A massive star exploded, for example, enabling our solar system to be born, and the prolific biological evolution here on earth that has given rise to us humans and diverse other forms of life has littered its waysides with extinct species.

In the perspective of religious naturalism, human beings are integral parts of nature, one particular species of life amid the vast numbers of such species and their members that presently dwell or have previously dwelt on this planet. Humans are linked with all other creatures in a common evolutionary history based on a common DNA template, and they are bound together with them in intimate, crucial relations of ecological dependency. For religious naturalism, there is no promise of a blissful continuing life for individual humans beyond the grave. Individual humans must eventually die just as members of all other species of life on earth must. They have no immortal souls; their mental and spiritual capacities are functions of their complex

living bodies. And there is no credible basis of hope for the future resurrection of their bodies.

Despite these and other features that sharply demarcate it from the theistic religions so familiar to us in the Western world, religious naturalism strongly supports and urges a fundamental type of distinctively religious commitment, namely, commitment to *nature itself* as the fit focus of profound religious awe and devotion, and as the ultimate source of religious assurance, demand, and empowerment. It is neither *pantheistic* nor *panentheistic*, however, because there is no *theos* or deity of any sort involved.

I have developed and defended a version of religious naturalism and its implications for thought and life in other writings,<sup>2</sup> but I want now to address the meanings it can have for the character and comportment of our lives in communion with nonhuman lives, the profuse lives we are privileged to have surrounding us on every side and for whom in the perspective of my own version of religious naturalism—or what I shall henceforth term *Religion of Nature*—we humans have urgent and compelling responsibilities. These responsibilities, as properly acknowledged, challenge us to experience, conceive, and put increasingly into practice far-reaching changes in our present typical modes of relation to the living creatures of our natural environment. The responsibilities constitute a significant part of the *demand* aspect of Religion of Nature but I shall argue that they can also contribute profoundly to its other two central aspects of *assurance* and *empowerment*.

Three major developments in the history of the natural sciences have contributed greatly to the need for radical changes in conception and practice regarding the relations of human beings to other forms of life on earth for which I shall plead in this book—changes that are even at present only beginning to filter into our consciousness and to guide our actions. This fact is perhaps not really so surprising, for as environmentalist Andrew C. Revkin reflects, “it is not easy being the first life-form to become both a planet-scale force and—ever so slowly and uncomfortably—aware of that fact.”<sup>3</sup> The implications of these developments are articulated and reinforced, in turn, by the orientation and commitments of Religion of Nature.

The three major developments are familiar ones, but I want to bring them and some of their repercussions clearly into view as they relate to the themes of this book. They are as follows:

- The *cosmological* revolution initiated by Nicholas Copernicus, endorsed and elaborated by thinkers such as Johannes Kepler, Galileo Galilei, and Isaac Newton, and carried forward by the stupendous expansion in our view of the temporal and the spatial scope of the universe by natural scientists of the nineteenth and twentieth centuries.
- The *evolutionary* revolution, inaugurated by Charles Darwin and Alfred Russel Wallace, and expanded and refined by the researches of Gregor Mendel and his successors in the field of genetics, the achievements of Neo-Darwinism (or the Modern Synthesis), and the rise of molecular biology.
- The *ecological* revolution, set in motion by thinkers such as Ernst Haeckel, Frederick Clements, Charles Elton, and Aldo Leopold, and carried forward by others such as Eugene Odum, Barry Commoner, and Rachel Carson.

I want briefly to point out the significance of these three scientific developments for revisions of the prevalent view of the relations of humans to the natural order and to living beings within this order that held sway for millennia in Western culture. This view prevailed for so long largely because of the influence of pivotal ideas in Western religion and philosophy that predated both the dawn of the natural sciences and the three major developments I shall highlight here that have played central roles in the history of these sciences since the late sixteenth century.

### The Cosmological Revolution

Nicholas Copernicus and the scientists (then called “natural philosophers”) who came after him replaced an earth-centered cosmology with one in which the center is the sun, making the earth but one of the six then known planets orbiting the sun (Mercury, Venus, Earth, Mars, Saturn, and Jupiter). As the theologians and philosophers of the time were well aware, the implications of this shift in thinking for the place of human beings in the universe were profound. If the earth

as the dwelling place of humans is not the center of things, perhaps humans do not have the central, dominating role in the universe as a whole that had long been assumed. The cozy, relatively simple, three-tiered, band-box universe of prescientific thinking now had to give way to a much more complex and capacious one calling into serious question the ancient cosmological picture in which the sublime starry heavens cupping the earth from above and the raging fiery hell beneath were oriented toward the actions of human beings on the face of the earth, an earth that was assumed to be little more than the divinely appointed transitory stage for the saga of their creation, primordial fall, and final redemption. This earth and all that is in it, including all of its other forms of life, were thought to exist for the sake of human beings, wholly subject to their special needs, interests, duties, and destiny. Nonhuman forms of life constituted a significant part of the *instrumental* goods of the earth, things made good by their subservience to *intrinsic* human goods. But with the de-centering of earth in the cosmos—thought by most thinkers of the time to be confined to the solar system—the way was opened to an eventual de-centering of human beings themselves, since the focus was moving away from a near-exclusive attention to them and their problems and prospects toward increasing scientific interest in more encompassing aspects of the functionings of the earth and solar system.

Isaac Newton was able to unify terrestrial and celestial dynamics, showing that the same fundamental principles govern the solar system as a whole that we find to be operative here on earth. And he was able to put to elegant use his mathematical discovery (along with Gottfried Leibniz) of the calculus, as well as other sophisticated mathematical techniques, in doing so. Galileo Galilei had already announced that the language of physical nature is the language of mathematics, and this idea was increasingly accepted. To think with the language of mathematics was for Galileo to think God's thoughts after Him, to decipher the ingenious plan of the super-intelligent Cosmic Geometer, Designer, and Engineer for the creation and ordering of the world.<sup>4</sup> Johannes Kepler's earlier three precise mathematical laws of planetary motion provided impressive reinforcement for this view.

As a consequence, the universe came to be regarded as a vast mathematical system or mathematically describable mechanism, running smoothly but blindly on its own without the need of any—or at most only occasional, exceedingly rare—divine interventions. There

was thus a sense in which not only humans were pushed to the periphery of the inexorable runnings of the cosmic machinery; God himself was made relatively peripheral to that machinery once he had set it in motion. After he had created it, God was no longer required to sustain the universe moment by moment, as had formerly been assumed to be the case. The roles of both God and humans with their respective forms of consciousness and subjectivity were thus in a significant sense marginalized and thrust into the background; the central stage in the new cosmology was given over to the unconscious machinery of nature.

This implicit de-centering of humans was to proceed apace into the nineteenth and twentieth centuries, when both the assumed small age of the cosmos and its limited spatial extent underwent a spectacular expansion. Now, rather than the universe being regarded on the basis of biblical chronology as a few thousand years old, it came to be viewed as nearly *fourteen billion* years old and perhaps as only one of multiple concurrent or successive universes. And the tidy little solar system of earlier scientific thought came to be replaced with a universe believed to have about one-hundred billion galaxies, each containing somewhere around one-hundred billion stars, and no one knows how many planetary systems orbiting at least some of those billions of stars. Such a vision of the cosmos can have the effect of making human history, human cultures, and human affairs seem rather insignificant in the whole scheme of things. The earth itself can appear to be only a fleck of dust in a far-flung, indescribably immense universe.

The seventeenth-century French philosopher René Descartes and others concluded from the emerging scientific world picture of his time that the only exception to the cosmic machinery on earth is human beings, who he thought—in accordance with long-standing philosophical and religious belief—to possess immortal, immaterial souls now seen as somehow residing and operating in machine-like bodies.<sup>5</sup> Thus humans with their conscious souls were contrasted with the whole of nature, *including all of its other life-forms*, as the sole exception to nature's thoroughgoing mathematical and mechanistic character. In one sense, this picture places humans at the margins of nature, as it were, peering at it from the isolated booths of their subjective, qualitative awareness but no longer central to its operations and no longer as easily to be regarded as its principal reason for being.

The other side of this picture is that all nonhuman life-forms are now to be seen as mere objects, devoid of interiority or subjectivity,

amenable to manipulation and use in the same manner as inorganic features of the earth such as liquids, metals, and rocks, and in whatever fashions humans might determine or devise. In the utilizations of mere machines, moral considerations do not enter in—except as these utilizations may affect human life and human affairs. Nonhuman life-forms are not deserving of moral considerability or respect for their own sakes, but only, if at all, for the sake of human enterprises, wants, or needs.

So, paradoxically, the earth's de-centering and the implied relegation of humans to the periphery of the solar system and to what was later to be regarded as a universe of countless galaxies also seemed to give humans *carte blanche* for any treatment of nonhuman life-forms human beings decided to inflict upon them.<sup>6</sup> With their capacity for such things as feeling, sensing, imagining, reasoning, and self-awareness, and their assumed possession of immortal souls, humans were viewed as radically distinct from everything else in nature. Nature was envisioned as devoid of quality or inwardness and seen as complex machinery containing nonhuman life-forms as many different kinds of machine.

Thus, once again, though for a different reason, nature was rendered wholly subordinate to the interests, preferences, and needs of human beings. The cosmic *de-centering* of humans had the curious effect for Descartes and other mind-body dualists of a terrestrial *re-centering* of them as the solely conscious overlords of a totally mechanized nature here on earth. They were somehow at the periphery of nature as a whole—the sole, seemingly anomalous exception on earth to earth's and the cosmos's pervasively mechanistic, quantitative character—but were also granted by implication the warrant for a new kind of continuing unbridled dominance, mastery, and control of the natural order on their own planet. These ideas would be called into serious question, however, from two other quarters of a still emerging science: those of the evolutionary revolution of the mid-nineteenth century and the ecological revolution that was to follow.

### The Evolutionary Revolution

The quotation from Charles Darwin's 1837 *Notebooks* that I have used as the epigraph for this chapter reveals his exciting conjecture of the "netting together" of humans with all the other life-forms of earth

in a long process of evolutionary development from relatively simple primitive forms. It was a mind-boggling conjecture or intimation for his time that he brought to fruition by providing for it carefully reasoned justification and explanation—largely by means of the central notion of “natural selection”—in his books *The Origin of Species* (1859) and *The Descent of Man* (1871). Darwin supported his theory of evolution through natural selection with painstaking references to copious pertinent examples of animal forms, behavior, and relationships, much of this material having been collected on his five-year circumnavigating voyage as a naturalist on the HMS Beagle but supplemented with the results of his lifelong empirical studies.

The upshot of Darwin’s work and that of those who continued to think and explore in the evolutionary vein is that humans differ from other life-forms on earth not so much in *kind* as in *degree*, that is, in the possession of distinctive traits defining their species but stemming from a common origin and from common processes governing that origin. These life-forms can now be seen as “kinfolk” to human beings, as fellow adventurers on the long journey of biological evolution, and as variations on basically similar patterns of emergence, structure, behavior, and need. We are all joined together in a shared history and heritage. Instead of being viewed as external lords over nature and warranted masters of its other kinds of life, humans can now be regarded as one spinoff of a mutual evolutionary history reaching into the distant past, one branch of an evolutionary tree with multiple, ever growing branches thrusting in many different directions.

Darwin used this imagery of the tree of evolution with its numerous branchings over an immense past. Some branches have died and fallen off the tree in the form of past extinctions, while new branches have continued to sprout, live, and flourish.<sup>7</sup> This image is not one of linear progression toward any sort of goal—for example, that of the emergence of human beings—but one of undirected, wildly prolific shoots of life bursting out in many different directions, some of them eventually to become dead ends, others giving rise to new branchings of life-forms. And human beings are no longer to be regarded as outliers or aliens set over against internal cosmic and terrestrial processes radically different from their own essential substances or characters. Instead, humans are natural products of those processes and intimate participants in them. Humans are at one with nature, bone of its bone and flesh of its flesh. By implication, the dualistic wall between their



inward, subjective, qualitative life and the rest of the world was broken down, meaning that such things as conscious emotion, thought, purpose, and volition could no longer be confined unquestionably to human beings. The way was opened to a new way of envisioning the relations between human and nonhuman forms of life.

This evolutionary narrowing of the gap between humans and other life-forms was furthered and abetted by the nineteenth-century Augustinian friar Gregor Mendel's researches into laws regarding recessive and dominant genetic factors as these affect the inheritance through sexual reproduction of certain traits in pea plants. The significance of Mendel's laws was not recognized until the turn of the twentieth century, when they were independently rediscovered and Mendel's pioneering work newly brought to light. Natural selection as a drive toward evolutionary change could now be complemented with a new and informative perspective on changes occurring in the genetic structures of organisms. This idea lent credibility to the notion that certain random variations in the genetic makeup of some organisms within a species might prove to be more adaptive to the organisms' environments and favor the survival and reproduction of groups of those organisms in which the favorable genetic variations had taken place. Over time, such incremental changes can in this manner lead to the origination of new species. Thus the evolution of a new species can be explained as the result of internal genetic changes guided by the environmental influences of natural selection.

This melding of genetic variations with natural selection, and an accompanying direction of attention to statistical analysis of the inheritance and prevalence of genes within populations of organisms, are at the heart of Neo-Darwinism or the Modern Synthesis. Since the twin factors of genetic variation and natural selection are believed by evolutionary biologists to have been operative in the evolution of hominid and human populations as well as in that of other kinds of populations, the types of population are in this way drawn more tightly together in a common conceptual net.

The last important stage of development in this evolutionary outlook took place with the rise in the mid-twentieth century of molecular biology. This discipline came into its own with the discovery of the structure of the DNA molecule by Francis Crick and James Watson in 1953. The discovery provided dramatic physical evidence of how genetic inheritances take place and also of how genetic mutations

can be produced by “mistakes” in transcription and replication from an existing DNA molecule to the formation of another one. This system of genetic reproduction or alteration is now known to be operative in all types of organism on earth. Creatures such as fruit flies, worms, crabs, and humming birds—to say nothing of all species of plants—have genetic structures based on the DNA molecule. And through detailed analyses of their respective genotypes, animals such as chimpanzees can now be shown to share a large percentage (95%–99%) of their DNA makeup with humans, a result that shows their close evolutionary kinship to humans. There are still important differences in the last two species’ overall genetic functionings, including which and when specific genes are turned on or off for members of the two species’ developmental processes, but the close similarity of genotypes remains striking. It gives further convincing indication of a joint evolutionary descent of humans and other species. Veterinarian and animal ethicist Michael W. Fox provides a good summary of the revolutionary impact of evolutionary theory so far as the concept of humanity and its place in nature are concerned when he says of us humans: “Our bodies contain the mineral elements of primordial rocks; our very cells share the same historically evolved components as those of grasses and trees; our brains contain the basic neural core of reptile, bird, and fellow mammal.”<sup>8</sup> We are not set apart from nature but are one with it. We depend critically upon it at every turn, and it suffuses every aspect of our being.

### The Ecological Revolution

The ecological revolution takes its name from the Greek word *oikos*, which means house, household, domicile, or by extension a place of common dwelling. As historian Donald Worster points out in his excellent, highly detailed history of the origination and development of ecology as a branch of the natural sciences, the term *Oecologie* was coined in 1866 by Ernst Haeckel, a leading German disciple of Darwin. Haeckel conceived of this new type of science as the study of specific groups of organisms of many different types dwelling intimately together in a kind of household or family, in typical family relations of conflict as well as mutual dependency, and with close relations to their inorganic environments.<sup>9</sup> Such organisms and their

external environments are thus to be seen as complex, intricately interactive *systems*, not as mere aggregations of independent units of study.

Just as Darwin had earlier defended the notion that all organisms are netted together through *time* by their shared evolutionary origins, Haeckel was now arguing that they are also bound closely together by their relations in *space*, that is, by their here-and-now dynamic patterns of intimate cooperation and competition. Organisms do not live in self-sufficient independence and are not to be studied as though they do so or *could* do so. Instead, if organisms are to be fully understood, they need to be studied together, as parts of an interactive, interdependent family or household of creatures.

An important version of this idea was vigorously propounded by Frederick Clements, a Nebraska native whose most influential book *Plant Succession: An Analysis of the Development of Vegetation*, appeared in 1916. Clements stressed the dynamic and interdependent character of ecological communities and even went so far as to view these communities as whole organisms or super-organisms that function as such in their own right. He also contended that particular types of biological communities, despite their initial volatility, will over time reach a characteristic state of general stability, order, and balance that he characterized as a climax system. Once having reached this stage, the type of ecological community may be disrupted by external influences, principally by changes in the weather, but it will always tend back toward the equilibrium of its climax character.

The community will do so, Clements argued, in much the same way as an individual organism undergoes typical stages of change and development in progressing toward its mature state. Clements believed that since mature communities have this organismic, holistic, predictable character, they can be subjected to rigorous scientific analysis and explanation. The status of ecology as a natural science was enhanced by this idea, even though the notion of a natural and virtually inevitable terminal balance or stability of such systems was to be brought into serious dispute by later thinkers. The precise character and boundaries—if any—of an alleged ecological community or ecosystem also turned out to be not nearly as easily determined or agreed upon as Clements had believed.

A key figure in the development of ecological ideas was the Cambridge zoologist Charles Elton, whose first major work, *Animal Ecology*, was published in 1927. In his “account of the natural economy

as a simplified economy,” Worster writes, “twentieth-century ecology found its single most important paradigm.”<sup>10</sup> Elton, in conceiving of ecological systems as a type of “economy,” sought to analyze their existing forms and functions (rather than, as with Clements, their alleged processes of succession and climax) as the ways their members make use of the total amount of sources of food available to them within their environments. Two influential concepts emerging from his thinking along these lines are those of *food chains* and ecological *niches*. Elton reasoned that organisms within an ecosystem are linked together by their dependence on acquiring and eating types of food suited to and necessary for their particular modes of life and survival, and also by the lower and more numerous elements of the food chain—for example, krill, plants, and insects—providing food for the less numerous ones higher up in the chain—for example, whales, deer, and bats.<sup>11</sup> In participating in this food chain, each kind of organism occupies its own occupational niche within the environment, its own specific way of making its living. No two species can have the same niche in a single ecological community, according to Elton; all others are excluded from a niche by a particular species’ competitive success in gaining it. The two key ideas of food chains and ecological niches, and Elton’s model of ecosystems as integrated economies, lent itself to the view—brought into prominence by thinkers such as the Oxford botanist A. G. Tansley, of ecosystems as various ways of making use of the energy of the sun, starting with the photosynthesis of plants, algae, and cyanobacteria.<sup>12</sup>

Worster notes in passing that Elton viewed humans as outsiders, “not to be confused with the natural economic system and its workings.”<sup>13</sup> The notion that humans can be excluded from the natural workings of ecosystems, that they are not natural participants in ecological relations, is an old one, as we have seen. It was to be contested in later ecological thinking, although it continued well into the twentieth century under the moniker, attitudes, and practices of *conservation*. The notion is suggestive of the old assumption that human beings are somehow external to nature and the sole earthly exceptions to natural processes. They stand outside nature and look at it from the outside rather than being an integral part of it and having to view it from within. One ecologist who was to take issue with this persistent notion, what many ecologists and other thinkers now regard as a dangerous and destructive delusion, was Aldo Leopold.

However, Leopold was, in the early 1930s, greatly influenced by the main thrust of Elton's ecological thinking.<sup>14</sup>

Like Clements, Leopold was an American born in the Midwest. He emphasized two basic ideas in his widely read *Sand County Almanac*, published in 1949 shortly after his death. One is the radical interdependence of plants and animals in their natural environments; and the other is the notion that human beings, as one type of animal, are constitutive, dependent, and accountable members of those environments. In other words, humans are not exceptions to ecological principles but are tightly bound by them, and they are as much intimate parts of ecological relations as are all other types of organism. Leopold pled in this book and in the thought and activity of his later years for a replacement of the conventional anthropocentric orientation of an earlier conservationist movement, for which he himself had once been a strong advocate, with an outlook explicitly centered on nature, one in which humans are recognized to have a subordinate and participatory rather than a dominant and controlling role. He wrote that what he called a *land ethic* "changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it. It implies respect for his fellow-members, and also respect for the community as such."<sup>15</sup>

Leopold acknowledged that humans are entitled, as are all species, to make appropriate use of the resources of nature, but they are not entitled to endanger or despoil aspects of nature at will, simply to satisfy their own idiosyncratic demands. In fact, to the extent that they insist on doing the latter, they threaten not only the health and viability of nonhuman life-forms but their own well-being as a species critically dependent on those life-forms and the integrity of their complexly entangled patterns of relationship with one another and with their inorganic environments. Leopold's version of the ecological revolution thus has the effect—along with the cosmological and evolutionary revolutions—of shifting the spotlight away from humans and focusing it on the whole of nature of which they are only a part, but a potentially reckless and destructive part.

An ecologist who took a holistic approach to the flora and fauna of earth and their relations to the nonliving environment was the North Carolinian Eugene Odum. He was particularly interested in ecosystems, which he regarded as the basic functional unit in ecology. His most influential book is a textbook entitled *Fundamentals*

of *Ecology*, first published in 1953, going through many subsequent editions, and translated into many languages. Odum characterized an ecosystem as “any unit that includes all of the organisms . . . in a given area interacting with the physical environment so that a flow of energy leads to clearly defined trophic structure, biotic diversity, and material cycles (i.e., exchange of materials between living and nonliving parts) within the system.”<sup>16</sup> He held a view reminiscent in at least one way of Clement’s concept of climax systems, namely, that ecosystems in their very nature had already achieved, were well on their way to achieving, or were struggling to re-achieve a state of equilibrium he termed *homeostasis*.

An ecosystem is thus a complex of interdependent organisms, interlocked with the conditions of a particular sort of nonliving environment, which exhibits and is capable of maintaining a distinctive identity, balance, and character over long periods of time. It and its relations to other ecosystems should, according to Odum, be the principal focus of ecological science, a focus amenable to rigorous analysis and prediction. Unfortunately, the notion has turned out, to a significant extent, to be rather indistinct and vague when subjected to close empirical examination. That is to say, what precisely is to count as a particular ecosystem has in many cases been found to be elusive and not at all easy to determine. Nevertheless, the concept of an ecosystem and the need for a holistic, nonreductive, systems approach it implies has played and continues to play a significant role in ecological thought, and it has made a powerful impression on the popular mind.

Odum gave special attention throughout his life to the place of humans in nature and their relations to the ecosystems of the earth. He wanted humans to accept the responsibility of doing what they can to keep what he called “Space-Ship Earth” in as natural a state as possible, that is, to preserve the natural balance and equilibrium of the earth’s complexly entwined ecosystems. Far from being separate from nature, humans are integral parts of it, both crucially depending upon and also crucially affecting its health and well-being. In viewing earth as nothing more than a storehouse of external resources for human exploitation and use, humans are in danger, Odum persistently argued, of destroying their own life-support system on Space-Ship Earth. Thinking and arguing in this way, Odum made a marked contribution to reformist environmental movements and environmental ethics.

Barry Commoner and Rachel Carson are two examples of other scientists who had an important effect on public consciousness and environmental politics. Commoner called attention to the destructive effects of nitrate-based chemical fertilizers on the public's water supply and on the body's ability to transport oxygen in the blood. He also vividly described the rank pollution of Lake Erie from the phosphates in household detergents. These were for him indications of how destructive such human practices could be when guided by nothing more than a relentless pursuit of profits. Carson's disturbing book *The Silent Spring*, published in 1962, was highly effective in bringing public attention to the destructive effects on organisms in the natural environment of the widespread use of the herbicide DDT. The message of her book was not only that humans are endangering the lives of other species by their reckless use of materials that can accumulate in the tissues of plants and animals and even alter their germ cells and reproductive capacity, but that humans are in this way mounting serious threats to their own lives and to their survival as a species in the process.

In other words, humans are part of ecosystems or patterns of ecological dependency. Human policies and practices that have deleterious effects on ecosystems will also have inevitable and perhaps in some cases irreversible similar effects on human lives. In highlighting such boomerang effects, Commoner and Carson—along with many others who issued similar warnings in the second half of the twentieth century and on into the twenty-first—showed how integral to ecological relations human beings are, and how little able they are to stand apart from the consequences of these relations in either the short or the long run.

Worster takes careful notice of the fact that ecology is still a young science and that its history is one of marked disagreements among ecologists about even some of its most basic concepts and contentions. For example, there are mechanists and organicists among them, the former seeking to treat ecology as a branch of physics and the latter arguing for emergent properties in organisms and their relationships that must be analyzed and explained in their own terms and in their own right. There are those who stress the general integrity and stability of ecosystems and those who emphasize their fluidity, vagueness, overlappings of supposed boundaries, and constant disturbances, even to the extent of doubting the meaning or usefulness of

the very idea of distinctive ecosystems. There are individualists who put emphasis on the characteristics and behaviors of particular organisms and holists who focus on whole systems and their patterns of interrelation. There are strict causal determinists and other ecologists who stress the role of chance in ecological processes. Finally, there are those who give a large place to chaos theory, complexity theory, and non-linear dynamics in their studies of ecological issues, and others who do not.

Worster shrewdly remarks that ecologists continue to be persons of faith, convinced that there must be a large degree of rational order underlying the daunting volatility and complexity of ecological systems and relations. Their continuing task is to uncover it, formulate it, and test it scientifically.<sup>17</sup> Seasoned botanist Richard Ward states in a personal note, however, that he is “doubtful that there will ever be any over-arching, ‘unified theory’ for ecology—the diversity, complexity, instability, uncertainty, etc. of nature, living and non-living, are together too great for other than restricted theories.” The spirit of his statement is echoed by Kuang-ming Wu in his evocative book on the Daoist text *Chaung Tzu*. “Anything that is observable, conscious, and objective,” Wu writes, “is static, abstract, and therefore an ossification. Life is, in contrast, always flowing, growing and self transforming; in a word, life is alive or nothing. And anything alive is difficult to classify accurately into the pigeon holes of abstraction and generalization.”<sup>18</sup>

Ward observes in another personal note that the probability of finding supposed ecosystems with precisely definable boundaries is extremely low at best. He prefers to speak of *gradients* of populations of plants in relation to particular locales and of *continua* or subtle mixings of such gradients from locale to locale rather than assuming or hoping to discover sharp distinctions among the gradients.

Two things do seem to be common to all of the variations in ecological thinking at present, and they are of primary importance for my own ruminations in this book. They are (1) that organisms of various types are radically entwined with and dependent upon one another for their continual flourishing and survival as they make common if varied use of the energy of the sun; and (2) that human beings are among the creatures of nature so inexorably entwined and dependent. The precise details of this picture remain elusive and difficult to determine, and we will perhaps never have a completely satisfactory unitary



way of conceiving them. But the picture itself holds true. Humans have not only emerged from natural processes; they remain subject to them and responsible to them in fundamental ways that none of their technological and cultural achievements give them ability or license to avoid or annul.

It is true that, as Paul Colinvaux indicates, humans are not confined to a particular ecological niche as are other biological species in their natural states. Instead, humans have become, in the last nine thousand years, able “to change their niche at will.” They have done so by learning to domesticate and herd animals instead of hunting them and by inventing agriculture.

Herding increased our food resource, because it denied other predators a chance at the game we had corralled; it let us kill prime animals when we wanted them, and it let us waste less calories in the inefficient process of hunting. Agriculture increased our food supply still more, because with it went a plant diet that would let us move down the Eltonian pyramids of our lands one whole trophic level. . . . Herding and agriculture entailed the adoption of entirely new niches. For the first time an animal had adopted a new niche without speciating. It was the most momentous event in the history of life.<sup>19</sup>

But with this special ability comes the foolish temptation to view ourselves as somehow exempt from the larger contexts and relations of nature.

Succumbing to that temptation means failure to recognize the special responsibility that accompanies the special gift. Our ability to alter nature to a significant degree by our domestication and herding of animals, our increasingly sophisticated agricultural practices, and other highly developed technological discoveries, inventions, and cultural creations—to say nothing of our exponentially burgeoning human population—also allow us to introduce radical, unprecedented instabilities into aspects of nature; to interfere with its natural checks and balances; to threaten the very existence of many of its diverse species of organism; to pollute and despoil its land, oceans, and air; perhaps to bring about sudden phase transitions or major tipping points in its temperatures and patterns of climate; and the like.

### The Lesson of the Three Scientific Revolutions

When our crucial dependence on the nonhuman aspects of nature is forgotten or arrogantly ignored, we humans can wreak considerable damage and ruin not only on those aspects of nature but also on ourselves as part of the age-old systematic interconnections of all natural beings. "What we call the environmental movement of the post-World War Two era," Worster remarks, "has been essentially a reawakening to the realization that we must depend on other forms of life to survive; we have no other options. Progress has not made our condition different in this respect from that of our remotest ancestors."<sup>20</sup> This is a lesson of the ecological revolution that we neglect at our peril. Neglect of it would also be a callous forfeiture of the grave and urgent responsibility we owe to the whole community of natural beings to which we are privileged to belong. The lesson of human beings' cosmological, evolutionary, and ecological decentering as but one among myriad, ever-evolving, mutually dependent creatures of nature is a hard one to learn after so many centuries of sharply separating ourselves from the whole of the natural order and assuming that we have the right to master and manipulate it solely for our own benefit. But discoveries of the natural sciences impel us to take this lesson seriously to heart. The lesson is also drummed into us today by such fields of thought and action as philosophy of nature, environmental ethics, animal ethics, and religious naturalism (including Religion of Nature). And it is now being taken into account by increasing numbers of adherents of the major world religions.<sup>21</sup>

So far in this book, I have sought to highlight the demand aspect of Religion of Nature as that grows out of and is made explicit in the three scientific revolutions I have brought under discussion. The discussion up to this point has admittedly been quite general. But I shall endeavor to make this aspect more specific and detailed in subsequent chapters, particularly as it relates to our attitude toward and treatment of nonhuman forms of life. In addition, I shall seek to draw out the other two central dimensions of Religion of Nature already mentioned, namely, the dimensions of assurance and empowerment, and show how these dimensions as well are closely connected with the overall outlook on and orientation to nature I am developing here and calling the Thou of Nature.