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# Rachel Carson's Ecological Critique

JOHN BELLAMY FOSTER AND BRETT CLARK

Rachel Carson was born just over 100 years ago in 1907. Her most famous book *Silent Spring*, published in 1962, is often seen as marking the birth of the modern environmental movement. Although an immense amount has been written about Carson and her work, the fact that she was objectively a "woman of the left" has often been downplayed. Today the rapidly accelerating planetary ecological crisis, which she more than anyone else alerted us to, calls for an exploration of the full critical nature of her thought and its relation to the larger revolt within science with which she was associated.

Carson was first and foremost a naturalist and scientist. But she was propelled by her understanding of the destructive ecological forces at work in modern society into the role of radical critic. A recent biography attempts to capture this in its title: *The Gentle Subversive*. The principal causes of ecological degradation, Carson insisted, were "the gods of profit and production." The chief obstacle to a sustainable relation to the environment lay in the fact that we live "in an era dominated by industry, in which the right to make a dollar at any cost is seldom challenged."[1]

*Silent Spring* was directed against the chemical industry and its production of deadly pesticides. Carson combined the best scientific information then available with the skills of a great writer, and had an extraordinary effect in raising public concern over this issue. Yet, despite a number of victories, Carson and those who followed in her footsteps lost the war against synthetic pesticides, which she preferred to call "biocides." Although she conceded that there were some situations where the application of such chemicals might be appropriate, she strongly believed "the elimination of the use of persistent toxic

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pesticides should be the goal"—as stated in the 1963 report on pesticides of the President's Science Advisory Committee, which she regarded as a "vindication" of her views. Chemical control needed to be replaced wherever practicable by biological control (organic methods relying on natural enemies of the pests). She called this, in the concluding chapter of her book, "The Other Road." Nevertheless, except for the banning of a few of the most deadly toxins such as DDT, the chemical industry triumphed, seeing an expansion of the production of this class of chemicals.[2]

This growing use of synthetic pesticides had nothing to do with the rational application of science. Although the chemical industry and their allies attempted to demonstrate that Carson made mistakes and exaggerated the dangers of pesticides in her arguments, her research has generally stood the test of time. Moreover, the questions she raised about the accumulation of these dangerous chemicals in living organisms are today even more relevant. She was especially concerned about the long-term, widespread effects of such biocides, which were being used in ever greater quantities, were persistent in the environment, and drifted uncontrollably, often concentrating in organisms in areas far removed from the point of introduction. She accurately predicted that dependence on synthetic pesticides would result in a pesticide treadmill as organisms evolved rapidly into more resistant forms requiring either higher doses or new biocides. "The chemical war," she wrote, "is never won, and all life is caught in its violent crossfire." By the late 1980s the production of pesticide active ingredients, much of it destined for U.S. farms, had increased to more than twice that of the early 1960s when Carson wrote *Silent Spring*. In 1999 over 100 million U.S. households applied some type of pesticide to their homes, lawns, and gardens. Many such chemicals on the market today have not been adequately tested. Meanwhile U.S. agribusiness has continued to produce and export banned pesticides to other countries. Some of the food imported to the United States from abroad is grown using these substances.

In the last decade and a half, the main focus of concern with regard to pesticides and related chemicals has shifted from cancer and the potential for genetic mutations—both of which remain among the biggest dangers of these chemicals—to the disruption of the endocrine system, affecting a myriad of bodily functions. Numerous pesticides mimic the female hormone estrogen, and research has suggested that they can reduce fertility, produce testicular and breast cancer, and

malform the genital organs. Serious questions are being raised about the complex and still little understood effects of these chemicals on animal and human reproductive systems. Between the early 1970s and the early 1990s the incidence of testicular cancer in the United States increased by about 50 percent; while the last half-century or so has seen a drop worldwide in sperm counts by about 50 percent. Attention has also turned to other synthetic chemicals introduced into the environment in countless products. Over seventy thousand synthetic chemicals are used in commerce, while only 10–20 percent of these chemicals have been systematically tested. The failure adequately to test or limit the use of such chemicals more than forty-five years after the publication of *Silent Spring* makes Carson's book of continuing importance for that reason alone.[3]

But Carson's attack on synthetic pesticides is not her most notable achievement. Rather it is her wider, ecological critique challenging the whole nature of our society that is so important today. Carson is better understood if we recognize that she was not simply an isolated figure as is often supposed, but was part of a larger revolt among scientists and left thinkers in the 1950s and '60s arising initially from concerns over the effects of nuclear radiation. Alarm about aboveground nuclear tests and the harmful effects of radiation, coupled with fears of nuclear war, spurred scientists, emanating primarily from the left, to raise searching questions about the destructiveness of our civilization. From this work, the modern ecology movement emerged.

## Radiation and Ecology

Carson's discussions of the effects of pesticides on living things drew heavily upon earlier discoveries by scientists regarding radiation. She repeatedly referred in *Silent Spring* and elsewhere to the breakthroughs in the 1920s of U.S. geneticist H. J. Muller, who first discovered that exposure of organisms to radiation could generate genetic mutations. As she explained to the National Council of Women of the United States in October 1962, two weeks after the publication of her book:

> When I was a graduate student at Johns Hopkins University, studying under the great geneticist H. S. Jennings, the whole biological community was stirring with excitement over the recent discovery of another distinguished geneticist, Professor H. J. Muller, then at the University of Texas. Professor Muller had found that by exposing organisms to radiation he could produce those sudden changes in hereditary characteristics that biologists call mutations.

> Before this it had been assumed that the germ cells were immutable—immune to influences in the environment. Muller's discovery meant that it was possible for many, by accident or design, to change the course of heredity, although the nature of the changes could not be controlled.
>
> It was much later that two Scottish investigators discovered that certain chemicals have a similar power to produce mutations and in other ways to imitate radiation. This was before the days of the modern synthetic pesticides, and the chemical used in these experiments was mustard gas. But over the years it has been learned that one after another of the chemicals used as insecticides or as weedkillers has power to produce mutations in the organisms tested or to change or damage the chromosome structure in some other way.[4]

As Carson observed in *Silent Spring*, "among the herbicides are some that are classified as 'mutagens,' or agents capable of modifying the genes, the materials of heredity. We are rightly appalled by the genetic effects of radiation; how then, can we be indifferent to the same effect in chemicals that we disseminate widely in our environment?"[5]

Muller, who was to be awarded the Nobel Prize in physiology or medicine in 1946 for his discoveries, was a complex figure who had a long history as a socialist and a critic of capitalism. He had been a faculty adviser to the Texas branch of the National Student League in the early 1930s and helped in the sponsoring and editing of its publication *Spark*, named after Lenin's *Iskra*. Muller went to the Soviet Union in 1933 to work in the advanced genetic laboratories there, but came into conflict with the regime in the context of the Lysenko controversy and ran directly afoul of Stalin. He served in the international brigades in the Spanish Civil War and worked with the Canadian doctor Norman Bethune, later a hero of Mao's China.

Although Muller was to become a very strong opponent of the Soviet Union under Stalin (due to the closing down of the genetic institute he had helped set up and the murder of some of his close friends and colleagues), he retained many of his critical beliefs, including faith in socialism. He held on to his earlier fundamental dialectical understanding that emphasized "the complicated processes ('movements' in the Marxian sense) whereby…objects are interrelated to one another and undergo their development"; such a dialectical approach he argued was crucial to the "realization of the complex realities of matter, especially of living matter, of its inter-connectedness."[6]

The receipt of the Nobel Prize for work on the genetic effects of radiation shortly after the dropping of the bombs on Hiroshima and

Nagasaki made Muller a public figure. He frequently warned of the long-term dangers of radioactive fallout from nuclear war (and also nuclear tests), helping to raise public concern in this area, and running into conflict with the Atomic Energy Commission, which saw him as an obstacle to the full expansion of nuclear armaments. Muller was later to be the most prestigious scientific defender of Carson's *Silent Spring*. In a review for the *New York Herald Tribune*, coinciding with the publication of her book, he called it "a smashing indictment that faces up to the disastrous consequences, for both nature and man, of the chemical mass-warfare that is being waged today indiscriminately against noxious insects, weeds and fungi." However, the real importance, he suggested, of *Silent Spring* lay in the profound understanding that it conveyed of the interconnections within nature and between nature and society: in "the enlightenment it brings the public regarding the high complexity and interrelatedness of the web of life in which we have our being."[7]

Muller was one of the eleven prominent intellectuals who signed the Russell-Einstein letter leading to the Pugwash Conference in 1957 addressing the control of nuclear weapons. He was a signatory along with thousands of other scientists of the 1958 petition to the United Nations initiated by the Nobel Prize-winning chemist Linus Pauling (with the support of biologist Barry Commoner), calling for an end to nuclear weapons testing.

When the cloud of secrecy surrounding the fallout problem lifted in 1954, the scientific community was able to study the extent of environmental degradation and contamination caused by nuclear weapons tests. Such work required the expertise of biologists, geneticists, ecologists, pathologists, and meteorologists, who explored the effects of radiation on plants and animals, as well as the movement of radioactive materials through the atmosphere, ecosystems, and food chains. Nuclear testing had joined the world's population in a common environmental fate, as radioactive fallout was distributed globally by wind, water, and living creatures. Human-made radioactive isotopes, such as strontium-90, iodine-31, cesium-137, and carbon-14, were introduced into the global environment, and from this point on, became part of the bodily composition of humans and all life. Different radioactive elements had distinct properties and posed unique threats to people and the environment. Plants and animals took up such materials, which were passed on through the food chain. Strontium-90 was built into children's bones and teeth, cesium-137 concentrated in

muscles, and iodine-131 was embedded in thyroid glands, each increasing the risk of cancer. Linus Pauling pointed to the myriad biological threats associated with carbon-14 lodged in all the tissues in the body.

In studying the effects of radioactive substances on food chains, the concepts of bioaccumulation and biological magnification were established—later to become intimately identified with Carson's *Silent Spring*. Bioaccumulation refers to a process whereby a toxic substance is absorbed by the body at a rate faster than it is lost. For instance, strontium-90 is a radioactive isotope that is chemically similar to calcium and can accumulate in the bones, where it can cause genetic mutations and cancer. Biological magnification occurs when a substance increases in concentration along the food chain. An example of this occurred when radionuclides discharged into the Columbia River in trace amounts from the Hanford nuclear facility in Washington State were discovered to increase in order of magnitude as they were passed along in the food chain. A number of variables influence such biological magnification, such as the length of the food chain, the rate of bioaccumulation within an organism, the half-life of the nuclide (in the case of radioactive substances), and the concentration of the toxic substance in the immediate environment. Ecologist Eugene Odum noted that due to biological magnification it was possible to release an "innocuous amount of radioactivity and have her [nature] give it back to us in a lethal package!" Carson herself pointed to how biological magnification resulted in dangerously high burdens of strontium-90 and cesium-137 in the bodies of Alaskan Eskimos and Scandinavian Lapps at the terminal end of a food chain that included lichens and caribou.

In the 1961 edition of *The Sea Around Us*, Carson, who was deeply involved in protesting the dumping of radioactive wastes in the oceans, raised the pregnant question, "What happens then to the careful calculation of a 'maximum permissible level' [of radioactivity]? For the tiny organisms are eaten by larger ones and so on up the food chain to man. By such a process tuna over an area of a million square miles surrounding the Bikini bomb test developed a degree of radioactivity enormously higher than that of the sea water."

The Castle Bravo hydrogen-bomb detonation at Bikini Atoll in March 1954, to which she referred here, was one of sixty-seven nuclear tests carried out by the United States in the Marshall Islands between 1946 and 1958, and the most notorious in its effects. The size of the blast (fifteen megatons, equivalent to a thousand times the bomb

dropped on Hiroshima) was more than twice what was expected. Radioactive fallout rained down on inhabited areas of the Marshall Islands and on a Japanese fishing boat, the *Lucky Dragon*, some eighty nautical miles from Bikini (as well as contaminating ocean life over a vast region), creating an international controversy as the United States denied responsibility.[8]

A key figure linking the scientific critique of nuclear fallout and environmental contradictions in general to social movement struggles, and one with whom Carson closely identified, was the biologist and socialist Barry Commoner. In 1956 Commoner discussed with his friend and Marxist activist, Virginia Brodine, the possibility of organizing a campaign to get milk tested for strontium-90, modeled after the earlier pure milk campaign organized by St. Louis women. This led to the formation in April 1958 of the Greater St. Louis Citizens Committee for Nuclear Information (CNI)—after 1963 the Committee for Environmental Information—bringing together scientists (the "technical division" of the CNI) with activists. The CNI soon initiated its famous Baby Tooth Survey to examine babies' teeth for strontium-90. Carson praised Commoner's critique of the system's failure to address problems such as air pollution before a new potentially dangerous technology was introduced. In her 1963 speech on "Our Polluted Environment" she underscored the importance of the CNI's research on the effects of radioactive fallout.[9]

## Carson and Ecosystem Ecology

Another very important influence on Carson's environmental thinking was the rise of ecosystem ecology and new developments in evolutionary theory in her day. Ecology at this time was still a young field. The key concept of "ecosystem" had been introduced only a few decades prior in 1935 by the British ecologist Arthur Tansley. Tansley was a Fabian-style socialist who had studied under the leading Darwinian biologist of his day, E. Ray Lankester. Lankester was an adamant materialist, an early, sharp critic of ecological degradation, and a young friend of Karl Marx—present at Marx's funeral.

In the late 1920s and '30s, when Tansley was writing, the new field of ecology was dominated by teleological conceptions (emphasizing the purposiveness of nature, emanating from final causes) associated with the work of Frederick Clements in the United States and Jan Christian Smuts and his associates in South Africa. (Smuts, who served as South African prime minister, was one of the principal figures in es-

tablishing the preconditions for the apartheid system.) Incensed by the idealistic/racist interpretations of ecology propounded by Smuts and his followers, Tansley developed the concept of "ecosystem" as a materialist alternative to Smuts's teleological "holism." "Though the organisms may claim our primary interest," he wrote, "we cannot separate them from their special environment, with which they form one physical system....These *ecosystems*, as we may call them, are of the most various kinds and sizes. They form one category of the multitudinous physical systems of the universe, which range from the universe as a whole down to the atom." Tansley was deeply concerned with "the destructive human activities of the modern world." "Ecology," he argued, "must be applied to conditions brought about by human activity," and for this purpose the ecosystem concept, which situated all life within the larger material environment and penetrated "beneath the forms of the 'natural' entities," was the essential form of analysis.[10]

Another of the founders of modern ecosystem analysis was the British zoologist Charles Elton, a close associate of Tansley's, whose work was to be fundamental to the development of Carson's ecological critique. Elton was famous for his pioneering 1927 work *Animal Ecology*. However, it was his later book, *The Ecology of Invasions by Animals and Plants* (1958), in which he employed the new ecosystem concept, that was to inspire much of the wider argument of *Silent Spring*. In a powerful ecological condemnation of synthetic pesticides Elton declared that "this astonishing rain of death upon so much of the world's surface" was largely unnecessary and threatened "the very delicately organized interlocking system of populations" in a given ecosystem. There were "other and more permanent methods of safeguarding the world's organic wealth" that emphasized complexity and diversity rather than biological simplification. The unthinking use of "chemical warfare" on living things, he contended, following the U.S. ecologist and environmentalist Aldo Leopold, reflected the failure of a system based on economic values that had no place for the larger values of a biotic community. He stressed that these actions might one day be looked upon as we now do on "the excesses of colonial exploitation." Carson quoted Elton's statement on "the rain of death" in her April 1959 letter to the *New York Times* in which she opened her attack on pesticides; she was to quote it again in *Silent Spring* as the leitmotiv of her chapter "Indiscriminately from the Skies."[11]

Elton's analysis had provided the foundation for the work of Carson's friend and associate, Robert Rudd, a professor of zoology at

the University of California at Davis. Carson first contacted Rudd in April 1958 to get help with her pesticide research, and to obtain some of his publications on the subject. He visited her with his children at her Maine cottage in July and the two struck up a strong friendship, and a close working relationship.

Rudd was a sophisticated left thinker with a deep sense of the ecology, sociology, and political economy of the pesticide issue. When he met Carson he had already started his own book on the subject funded by the Conservation Foundation. In 1959 he wrote two articles for *The Nation*: "The Irresponsible Poisoners" in May, and "Pesticides: The *Real* Peril" in July. "The Irresponsible Poisoners" argued that the use of deadly pesticides such as DDT was based on a misplaced emphasis on production over all other values. "Overproduction has settled on us like a plague....Chemical use to increase production is continually stressed; and few stop to inquire 'Why?'" In "Pesticides: The *Real* Peril" he contended that the key reason that such chemicals were needed and also the leading effect of their use—in a kind of self-reinforcing vicious circle—was the extreme "simplification" imposed on the environment by industrial agriculture. Asked why there was an increasing reliance on such deadly chemicals, "an ecologist would answer....simplification of the ecosystem, [which] is the result of most current production practice in the United States." The only effective way of dealing with the problem was therefore to change the production practice: to "cultivate ecological diversity" and reliance on biological control. "For the good of us all, chemical techniques must give way to ecological emphasis. The cultivation of ecosystem diversity will yield crop safety, sustained productivity, [and] reduction of chemical hazards." The emerging system of global agribusiness needed to be questioned at the outset: "Our export of American agricultural 'know-how' may be doing the 'favored' countries an ultimate disservice."

Carson drew extensively on Rudd's research in two of the chapters of *Silent Spring* ("And No Birds Sang" and "Rivers of Death"). Rudd's *Nation* articles also helped inspire Murray Bookchin's first work on ecology, *Our Synthetic Environment*, published in 1962 (the same year as *Silent Spring*) under the pseudonym Lewis Herber.

Rudd's ecosystem-based critique of the pesticide industry and agribusiness as a whole was so thoroughgoing that he found himself under attack by the vested interests and his own university position was jeopardized. Unlike Carson he was not an independent writer but a university professor at a land grant college dependent on publications

and peer evaluation for promotion. His magnum opus *Pesticides and a Living Landscape* was completed before Carson's *Silent Spring*. But the corporate publisher to which the Conservation Foundation gave the manuscript turned it down as a "polemic." The manuscript was then offered to the University of Wisconsin Press where eighteen reviewers including the entire University entomology department went over it—with the result that it ended up with the record for the largest number of reviewers for that press and the decision on whether to publish it was a protracted one. Consequently, *Pesticides and a Living Landscape* was not published until 1964, the year of Carson's death. The book was reviewed over 200 times, overwhelmingly favorably, but Rudd lost a promotion at the University of California at Davis and his career was threatened. He was dismissed without notice or cause in 1964 from his position at the University's Agricultural Experiment Station.

There is no doubt that *Pesticides and a Living Landscape* was a brilliant work and a devastating critique of existing environmental practice. Rudd explored in depth the larger systematic issues related to the transformation of ecosystems associated with the application of pesticides that Carson, whose main object was to bring the deadly nature of pesticides themselves before the public, was unable fully to address. According to Rudd, "the general problem" could be succinctly stated:

> Crop systems are necessarily ecologically simplified for economical production of marketable foods and fibers. The frequent consequence is an unbalanced ecosystem in which a few species of organisms increase beyond thresholds of numbers that we can tolerate. By definition these species then become pests....Production and [pest] protection are parts of the same cloth. They cannot be biologically separated....We can no longer afford to dismiss piecemeal the "separate" problems that arise from uncontrolled chemicals in living environments. There are no separate problems.

With respect to the risks to human beings from pesticides Rudd pointed out that "it would be embarrassing for our 'experts' to learn that significant effects do occur in the long term. One hundred and eighty million human guinea pigs [in the United States] would have paid a high price for their trust."

For Carson, the ecosystem concept emerged as the basis of a radical challenge to the notion of the human domination of nature. The modern discovery of "the fact that man, like all other living creatures, is part of the vast ecosystems of the earth, subject to the forces of the environment," she argued, was on a par with (and ultimately inseparable from)

Darwin's theory of evolution. The obvious corollary of such an evolutionary-ecological view is that "man is affected by the same environmental influences that control the lives of all the many thousands of other species to which he is related by evolutionary ties."[12]

Crucial in forming Carson's ecological critique were the new developments in evolutionary theory and in the theory of life's origin. A materialist explanation of the origin of life had been introduced in 1924 when the Soviet biochemist A. I. Oparin developed the hypothesis that life had arisen prior to the presence of oxygen in the atmosphere (allowing the sun's rays to operate more effectively to promote life on earth) from a body of water gradually enriched in organic molecules, later referred to as the "Oparin ocean" or "primordial soup." Somehow life emerged when these molecules clustered together and then self-organized into a chemical system capable of self-replication. Similar ideas were developed separately in 1929 by the British biologist and Marxist J. B. S. Haldane, who was one of the major figures in the development of the neo-Darwinian synthesis linking Darwin's evolutionary theory to the new field of genetics. This general approach to the origins of life was pushed forward experimentally in the early 1950s by the Chicago chemist Harold Urey and his student Stanley Miller, who succeeded in producing amino acids, the building blocks of proteins, by passing a spark through water under such primitive earth conditions replicated in a laboratory. Carson was clearly affected by this new influential scientific theory of the origin of life and the unified evolutionary-ecological perspective it generated. Her book *The Sea Around Us* commenced with the sea as the setting "for the creation of life from non-life."

One of the fundamental conceptions of this theory of the origin of life, going back to Oparin and Haldane (and derived from V. I. Vernadsky's conception of the biosphere), was that life had itself altered the atmosphere by generating oxygen and the ozone layer, making such spontaneous creation of new life from non-life no longer possible. Carson in her talk on "The Pollution of Our Environment" placed enormous importance on this point and its significance for an ecological critique, arguing that,

> From all of this we may generalize that, since the beginning of biological time, there has been the closest possible interdependence between the physical environment and the life it sustains. The conditions on the young earth produced life; life then at once modified the conditions of the earth, so that this single extraordinary act of spontaneous generation

> could not be repeated. In one form or another, action and interaction between life and its surroundings has been going on ever since.
>
> The historic fact has, I think, more than academic significance. Once we accept it we see why we cannot with impunity make repeated assaults upon the environment as we do now. The serious student of earth history knows that neither life nor the physical world that supports it exists in little isolated compartments. On the contrary, he recognizes that extraordinary unity between organisms and the environment. For this reason he knows that harmful substances released into the environment return in time to create problems for mankind....The branch of science that deals with these interrelations is Ecology....We cannot think of the living organism alone; nor can we think of the physical environment as a separate entity. The two exist together, each acting on the other to form an ecological complex or an ecosystem.[13]

Such complex, evolving ecosystems were highly dynamic entities. Consequently, the changes they were undergoing were frequently unforeseen until it was too late.

Throughout her work Carson stressed the evolutionary character and interconnectedness of the natural world. It was this that gave her naturalistic writings their breathtaking quality. In an insightful analysis of Carson's sea trilogy—*Under the Sea Wind* (1941), *The Sea Around Us* (1951), and *The Edge of the Sea* (1955)—together with *Silent Spring*, Mary McCay has traced this quality in Carson's writing to her fundamental concept, introduced early on in her work, of "material immortality." As Carson wrote in 1937 in her article "Undersea," the various forms of life are "redissolved into their component substance," as a result of "the inexorable laws of the sea." Consequently, "individual elements are lost to view, only to reappear again and again in different incarnations in a kind of material immortality." As a scientist, Carson approached the natural world from a materialist standpoint, rejecting all non-naturalistic explanations. Once when her mother said to her that God had created the world, she replied, "Yes and General Motors created my Oldsmobile. But how is the question." The evolution of a complex web of life was everything.[14]

## Ecology as a Radical Force

Carson's intense study of ecosystem ecology in the context of her work on *Silent Spring* heightened this materialist understanding and turned it into a radical force. At the time of her death she had a book contract to undertake a philosophical examination of ecology and she was

collecting material for a scientific study of evolution. The two subjects were obviously connected in her mind and were undoubtedly to form the basis of a thoroughgoing critique of the present human relation to the earth.[15]

This put her in direct conflict with the powers that be. For the dominant economic interests, as her editor and biographer Paul Brooks observed, "the really scary thing" was that Carson "was questioning the whole attitude of industrial society toward the natural world. This was heresy and this had to be suppressed." Carson herself was well aware that her radical ecological perspective was placing her at odds with a system geared to expansion of private production at all costs. In the process of writing *Silent Spring* she studied John Kenneth Galbraith's *Affluent Society*, which had raised the question of private wealth and public squalor, i.e., the external diseconomies of the market system, whereby social and environmental costs were imposed on society and nature.[16]

In responding to the attacks on *Silent Spring*, Carson complained of the "enormous stream of propaganda" blocking rational science and ecological values. She railed against the tax subsidies given for corporate lobbyists, and attacked the large private grants to universities through which corporations tried to purchase a "scientific front" for their operations. Behind all of this lay the question she continually raised: "What happens…when the public interest is pitted against large commercial interests?"

Carson had no doubt that there was an irreconcilable conflict between economic and environmental interests within contemporary society. Thus she complained of the promotion of extreme "intensivism" in production in the search for greater profits, particularly as it related to the maltreatment of animals. The economic system, she emphasized in line with Rudd, was geared toward "overproduction" at the expense of the environment. In our society, dominated by material acquisition, life was destroyed because business was "blinded by the dollar sign." Indeed, "the modern world," she declared, "worships the gods of speed and quantity, and of the quick and easy profit, and out of this idolatry monstrous evils have arisen." She added that "the struggle against the massed might of industry is too big for one or two individuals…to handle"—a view that clearly called for the formation of an environmental movement to counter the power of industry.[17]

What appeared to anger the chemical industry more than anything else about Rachel Carson's book was that she chose to begin *Silent Spring* with a literary device: "A Fable for Tomorrow"; the tale of "a

town...where all life seemed in harmony with its surroundings," and which unthinkingly, almost unbeknownst to itself, introduced chemicals of destruction into its midst. For Carson "a grim specter" was haunting modern industrial, acquisitive society, threatening to silence the spring. Her fable was clearly "for tomorrow" in two senses: it represented both an unprecedented threat to all life, and the possibility of overcoming it. The worst society could do would be to stand still in the face of such a threat. Giving evidence of her broad progressivism, she wrote elsewhere: "the changes and the evolution of new ways of life are natural and on the whole desirable."[18]

Today many of the same problems that Carson pointed out persist, often in more potent forms. This has to be the case for a system that by its very nature must grow (at a rate exceeding population growth) in order to stay out of severe crises, and in which producing more and more profit is the motive force propelling the economy. An example of how economic priorities override ecological approaches can be seen in the case of strawberry growers in California, who can't make as much money if they rotate crops and take land out of strawberries. Thus, they "need" to use a biocide, methyl bromide (which also acts to deplete the protective atmospheric ozone layer at fifty times the level of CFCs), in order to kill soil-borne pests that would be well taken care of by a more ecological approach to growing strawberries. To give an idea of how significant the problem of pesticide use continues to be, in 2006 some 64 percent of the fresh produce and 59 percent of the processed fruits and vegetables tested by the U.S. Department of Agriculture contained detectable levels of pesticide residues.[19]

Likewise, producers of agricultural animals using factory farms in which animals are crowded together under inhumane conditions "must," we are told, routinely use antibiotics (a form of pesticide, of course) to try to keep the animals growing reasonably fast. This leads not only to antibiotic residue in meat but also to the development of antibiotic-resistant microbes. Raising animals in a less dense and more humane system, only using antibiotics when animals actually get sick, leads to higher production costs and hence is rejected by market principles—what Carson called "the gods of profits and production." Although there is a developing public interest in organically raised agricultural products and "humanely" raised animals these are still niche markets.

The U.S. government has been particularly sympathetic to the desires of business to maintain as free a hand as possible in continuing

to introduce new chemicals into the environment. It has therefore opposed mandating the removal of potential hazards. As pointed out in a recent *New York Times* article: "The United States has held on to its original 30-year-old chemical regulatory systems, which make it difficult for agencies to ban chemicals or require industry testing. While the government has worked with the industry on a voluntary basis to study as many as 2,000 chemicals and phase out certain ones, it has required the study of only 200 chemicals and restricted the use of only 5 since 1976."[20]

Beyond these persistent problems associated with the introduction of synthetic chemicals into our environment, there remains the wider set of ecological perils that Carson addressed. It was this larger ecological critique that challenged the whole nature of the modern production system that represented her most enduring contribution. Far from being the quiet, demure, establishment figure that we often hear of today, Carson in reality represented a defiant, radical voice. As a scientist and a writer she went beyond the bounds of what is allowed in "polite circles" and thus alerted and energized the public. When attacked by industry, she stood her ground, and went to the root of the issue. She urged us, and particularly those responsible for raising and educating children, to reject "the sterile preoccupation with things that are artificial, the alienation from the sources of our strength."[21]

Carson spent most of her adult life discovering and lovingly describing the "sea around us." But as her ecological critique developed, perceiving the destructiveness of the social encounter with the environment, she sought not merely to explain the world, but to change it.

## Notes

1. Rachel Carson, *Lost Woods* (Boston: Beacon Press, 1998), 210, *Silent Spring* (Boston: Houghton Mifflin, 1994), 13; Mark Hamilton Lytle, *The Gentle Subversive* (New York: Oxford University Press, 2007).
2. Lytle, *The Gentle Subversive*, 184; Carson, *Silent Spring*, 277–97; Appendix IV, "Recommendations of the President's Scientific Advisory Committee on the Use of Pesticides," in Robert L. Rudd, *Pesticides and the Living Landscape* (Madison: University of Wisconsin Press, 1964), 297.
3. Data on pesticide active ingredients referred to here refers simply to "conventional pesticides" (herbicides and insecticides) and excludes wood perservatives (fungicides) and other ingredients on the EPA's expanded list. Carson, *Silent Spring*, 8; Shirley A. Briggs, "Thirty-Five Years with Silent Spring," *Organization & Environment*, 10:1 (March 1997), 73–84; Al Gore, "Introduction," in Carson, *Silent Spring*, xv–xxvi; Carson, *Lost Woods*, 218, 244; Dan Fagin and Marianne Lavelle, *Toxic Deception* (Monroe, Maine: Common Courage Press, 1999); Theo Colborn, et. al., *Our Stolen*

*Future* (New York; Dutton, 1996); "Sperm in the News," *Rachel's Environment and Health Weekly*, January 18, 1996; Audubon, "Reduce All Pesticides But Eliminate Those Used on the Lawn," http://www.audubon.org/bird/at_home/ReducePesticideUse.html.

4. Carson quoted in Paul Brooks, *The House of Life* (Boston: Houghton Mifflin, 1989), 301–02; Carson, *Silent Spring*, 211, Carson, *Lost Woods*, 106–09.
5. Carson, *Silent Spring*, 36–37. On the mutagenic effects of organochlorines, including some pesticides, see Joe Thornton, *Pandora's Poison* (Cambridge, Massachusetts: MIT Press, 2000), 84–85.
6. Loren R. Graham, *Science and Philosophy in the Soviet Union* (New York: Alfred A. Knopf, 1972), 451–53; H. J. Muller, "Lenin's Doctrines in Relation to Genetics" (1934) in Graham, *Science and Philosophy*, 463; Elof Axel Carlson, *Genes, Radiation, and Society* (Ithaca: Cornell University Press, 1981). Muller was a controversial figure in another respect, because of his lifelong advocacy of "progressive eugenics." His overall humanistic commitments, however, were evident. In 1963 he received the "humanist of the year award" from the American Humanist Association.
7. H. J. Muller, "Silent Spring" (review), *New York Herald Tribune*, September 23, 1962.
8. Barry Commoner, *Science and Survival* (New York: Viking, 1966); Joel B. Hagen, *An Entangled Bank* (New Brunswick, NJ: Rutgers University Press, 1992), 100–07, 115–18; Richard Rhodes, *Dark Sun* (New York: Simon and Schuster, 1995), 541–42; Tokue Shibata, "The H-Bomb Terror in Japan," *Monthly Review* 4, no. 2 (June 1954): 72–76; Eugene P. Odum, *Fundamentals of Ecology* (Philadelphia: Saunders, 1959), 467; Carson, *Lost Woods*, 108–09, 237–38; "U.S. Nuclear Testing Program in the Marshall Islands," http://www.nuclearclaimstribunal.com; Helen Caldicott, *Nuclear Power is Not the Answer* (New York: New Press, 2006), 64, 73.
9. Virginia Brodine, *Green Shoots and Red Roots* (New York: International Publishers, 2007), 3–10; Carson, *Lost Woods*, 232, 240. Briggs was editor of the CNI/CEI's publication *Nuclear Information* (later *Science and Citizen*) from 1962 to 1969.
10. A. G. Tansley, "The Use and Abuse of Vegetational Concepts and Terms," *Ecology* 16, no. 3 (July 1935): 299, 303–04. In developing his ecosystem concept Tansley was influenced by the dialectical systems analysis presented by the British Marxist mathematician Hyman Levy in *The Universe of Science* (New York: The Century Co., 1933).
11. Charles Elton, *The Ecology of Invasions by Animals and Plants* (London: Methuen and Co., 1958), 137–42; Carson, *Lost Woods*, 190; *Silent Spring*, 155.
12. Robert L. Rudd, "The Irresponsible Poisoners," *The Nation* (May 30, 1959), 496–97, "Pesticides: The *Real* Peril," *The Nation* (November 28, 1959), 399–401, *Pesticides and the Living Landscape*, 154–55, 284–91; Frank Graham Jr., *Since Silent Spring* (Boston: Houghton Mifflin, 1970), 167–69; Linda Lear, *Rachel Carson* (New York: Henry Holt, 1997), 331–32; Murray Bookchin (under the pseudonym of Lewis Herber), *Our Synthetic Environment* (New York: Knopf, 1962), 55–61; Carson, *Lost Woods*,, 244–45.
13. Robert M. Hazen, *Genesis* (Washington D.C.: John Henry Press, 2005), 85–90; J. D. Bernal, *The Origin of Life* (New York: World Publishing Co., 1967); Rachel Carson, *The Sea Around Us* (New York: Oxford University Press, 1989), 7; Carson, *Lost Woods,* 230–31.
14. Mary McCay, *Rachel Carson* (New York: Twayne Publishers, 1993), 23–24, 42–43, 109.
15. Carson, *Lost Woods,* xi.
16. Brooks quoted in Shirley A. Briggs, "Rachel Carson," in Gino J. Marco, et. al., ed., *Silent Spring Revisited* (Washington, D.C.: American Chemical Society, 1987), 6; Lear, *Rachel Carson*, 334.

17. Carson, *Lost Woods*, 162, 194–95, 218, 220–21, Carson, *Silent Spring*, 9; Carson quote in Lytle, 178–79.
18. Carson, *Silent Spring*, 1–3; *Lost Woods*, 89.
19. U.S. Department of Agriculture, *Pesticide Data Program, Annual Summary, Calendar Year 2006* (December 2007), x, http://www.ams.usda.gov.
20. "Meythyl Bromide Still Finds its Way into U.S. Fields," *San Francisco Chronicle*, November 24, 2007; "Everyday Items, Complex Chemistry," *New York Times*, December 22, 2007.
21. Rachel Carson, *The Sense of Wonder* (New York: Harper and Row, 1965), 43.

*Silent Spring*'s connotations...reach afar beyond insect and bird life; far beyond the health, reproductive capacity, and life of individual human beings, and certainly far beyond the pocket nerve of the chemical industry....Viewed in its broadest aspects, and considered in the light of its probable consequences, the theme of *Silent Spring* has a quality of universality that was merely hinted at in parallel books on war, slavery, and insanitary conditions of meat processing [such as *War and Peace, Uncle Tom's Cabin*, and *The Jungle*]. It is a book that should bring a reasoning modern man face to face with the overwhelming disaster toward which he is moving with the speed of a super-jet....

Modern man, using the immense potential of the Power Age, has won his war against animals, enslaved (domesticated) them, and used them for food, power, or for sport. He is winning his war against vegetation by ploughing up the grasslands, butchering the forests, paving the earth, and spraying poisons on trespassing plant life (weeds). Man is engaged in a savage chemical war against those insects and other forms of life which threaten his health or interfere with his projects or enterprises. He is carrying on a cold-hot war against those who differ with his ideals and theories or who question his practices. In a word, present-generation western civilization is repeating the cycle followed by previous civilizations: beginning with emphasis on production and consumption, continuing through the 19th century era of accumulating surpluses and extravagant waste, and early in the present century passing into the third phase of the cycle, suicidal destructivity....

The alternative? Learning to live and let live; or, better still, to live and help live.

—Scott Nearing, "Lament for Poisoned Songbirds/Coexistence or Extermination," *Monthly Review*, November 1962.