Watersheds 3

Ten Cases in Environmental Ethics

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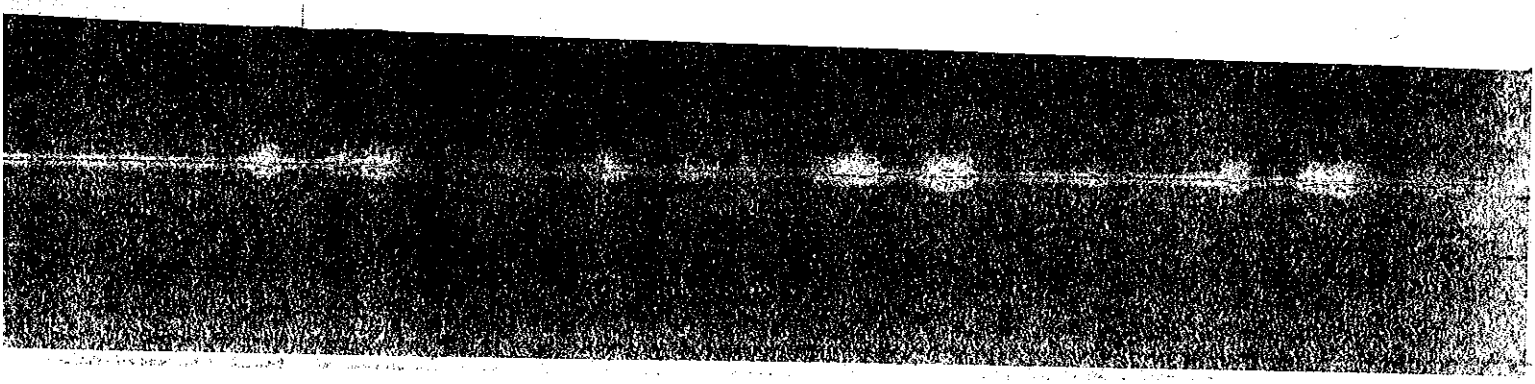

WADSWORTH
THOMSON LEARNING

Publisher: Eve Howard
Philosophy Editor: Peter Adams
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Development Consultant: Jake Warde
Marketing Assistant: Adam Hofmann
Print/Media Buyer: Robert King
Permissions Editor: Bob Kauser

Production Service: Buuji, Inc.
Copy Editor: Alan DeNiro
Cover Designer: Leslie Fitch
Cover Image: Monet, "Creuse Torrent," 1888 (detail) from Eyewire
Compositor: Buuji, Inc.
Text/Cover Printer: Webcom Ltd.

Printed in Canada
1 2 3 4 5 6 7 05 04 03 02

Library of Congress Cataloging-in-Publication Data

Newton, Lisa H., date.
Watersheds 3 : ten cases in environmental ethics / Lisa H. Newton, Catherine K. Dillingham.
p. cm.
Includes bibliographical references and index.
ISBN 0-534-51182-1
1. Environmental ethics. 2. Environmental ethics—Case studies. I. Dillingham, Catherine K. II. Title.

GE42 .N48 2002
179'.1—dc21 2001026518

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CHAPTER 6

The Silence of the Birds

Rachel Carson and the Pesticides

QUESTIONS TO KEEP IN MIND

What evidence convinced Rachel Carson, and others, that pesticides, especially DDT, were harmful to the birds?

What role do insecticides play in American agriculture? Could they be done without? What are the alternatives? What effect would their prohibition have on the way we grow our food?

What role do pesticides in general play in the American economy? What impact on the economy might be expected if they were generally prohibited?

What new ethical concerns are raised by the practice of exporting pesticides that are banned here but not banned abroad?

THE WAKE-UP BOOK

It was 1962. For fifteen years and more, the United States had been the major—indeed, the only—industrial power in the world, developing new products and new technology with magical skill, doubling and tripling the real standard of living for its people, effortlessly dictating to the world a new measure of achievement in productivity and convenience. We created a new class (the new working-become-middle class, employed in the rapidly growing corporations with the first generation

of college degrees, obtained on the GI Bill), as well as a new area of living (never before seen "suburbs"); settled into the new mode of transportation that it required (the automobile, with attendant highways); reformed religion, politics, economics, and the household (with the deep freeze, washing machines, and vacuum cleaners); and showed the world how to live.

Leading the way in the technological parade of miracles was the chemicals industry. It had developed the pharmaceuticals (antibiotics, especially penicillin) that saved the GIs during the war, and sent the infant mortality rate plummeting immediately after it. And it developed the insecticides. DDT, focus (villain?) of the story for this chapter, was first synthesized by a German chemistry student in 1874, but it was only in 1939 that a Swiss chemist, Paul Muller, recognized its use as an insect killer. Its worth in World War II cannot be measured: sprayed liberally by the Allies in all theaters, it killed the mosquitos that carried malaria, filiariasis and yellow fever, the lice that carried typhus, and the fleas that carried—for yet another century—the bubonic plague.[1] This is no small accomplishment. Wars have always been races between the generals and the insects, and the generals have rarely won: "Typhus, with its brothers and sisters—plague, cholera, typhoid, dysentery—has decided more campaigns than Caesar, Hannibal, Napoleon, and all the inspector generals in history."[2]

This huge outpouring of technological progress—in construction, in automobiles and the roads to drive them on, in plastics, fuels, pharmaceuticals, and in all products of chemistry—came on the heels of, and because of, the war that we had fought to protect our nation. Possibly for that reason, there was a widespread impression that opposition to progress—read, further development of goods and services for the health, enjoyment, and convenience of the American consuming public—was downright unpatriotic, insufficiently celebratory of the American victory. Victory was a gift from God; the attendant prosperity, the greatest *relative* prosperity the world has ever known, was part of that gift; one does not look gift horses in the mouth, especially Divine gift horses.

Until 1962, that is, when a noted author and naturalist, Rachel Carson by name, published *Silent Spring*. In it she claimed, and to a large degree demonstrated, that the pesticides that we use to kill insects are really killing the birds, and eventually killing us. Of the first importance is the place of this book in the nationwide celebration of victory: this was the first book (Ralph Nader's *Unsafe at Any Speed* did not come out until 1965) that raised doubts about the quality of our triumph, that dared to wonder if concerns for human and environmental safety had possibly been ignored in the march to bigger and better consumption.

That insecticides kill the birds was not news to much of the scientific community. As early as February, 1945, Gove Hambidge, then Coordinator of the Agricultural Research Administration of the

Department of Agriculture, and author of the article cited above that celebrated victory over the insects, worried simultaneously that DDT "may be a little *too effective* for comfort. For it is capable of blotting out insect life so completely throughout large areas that it may upset the whole balance of nature."[3] He noted that it killed the pollinators of the crops, and might well be poisonous to livestock and human beings. His concerns were backed up by observations from the mid-1950s onward, that suggested that pesticides were killing the birds. In 1957, grebes were dying in California's Clear Lake, and biologists blamed DDD, a DDT relative that had been sprayed on local farms.[4] In 1958, Roy Barker of the Illinois Natural History Survey at Urbana documented the decline of local robins, and showed how the spraying of DDT to control Dutch Elm Disease had fed them a diet of poisoned earthworms.[5] By 1960, the scientists generally recognized that there was something wrong, but it was certainly news to us. Where did this come from? Why was the reaction against it so ferocious? How did we respond to it (and to its successors)? For starters, who was Rachel Carson?

RACHEL CARSON, NATURALIST AND PROPHET

Rachel Louise Carson was born on May 27, 1907 in Springdale, Pennsylvania, to a strong-willed mother and a father who farmed his 65-acre parcel and dabbled in real estate, both with very indifferent success. The area was generally industrialized, but Rachel grew up in a rural setting.

Her interest in writing surfaced early—she published her first story at age ten[6]—as did her interest in nature, encouraged by her mother. (Upon her mother's death she wrote of her, ". . . more than anyone else I know, she embodied Albert Schweitzer's 'reverence for life'"[7]). She was particularly fascinated by the sea, despite her inland upbringing. She was a quiet, good student; a bit of a loner, yet known for friendliness and kindness to her fellow students and her elders.

During her college years at the Pennsylvania College for Women, conflict between the Biology and English departments drove her to change her major to Biology from English, to the intense consternation of the English Department (which had supported her with scholarship funds, in recognition of her ability as a writer). She completed her educational career with a combination of work, financial aid, and loans, earning first her A.B. (summa cum laude) at Pennsylvania College, and then an M.A. in marine zoology at Johns Hopkins, made possible in part by a summer fellowship at Woods Hole, Massachusetts. Her interest in writing never waned, however; she once commented that "Eventually it dawned on me that by becoming a biologist I had given myself something to write about."[8]

After her father and sister died, Rachel took on the responsibility for her mother and her sister's two daughters; she abandoned academe to take a position at the Bureau of Fisheries (later to become the Fish and Wildlife Service), in the employ of which she remained from 1935 to 1952.[9] By then, she was gaining recognition as a fine science writer by both scientists and the literati; and it was during this time that her literary career took off. She believed that there was "no separate literature of science. The aim of science is to discover and illuminate truth. And that, I take it, is the aim of literature."[10] Her first book, *Under the Sea-Wind,* was published in 1941, followed by the immensely popular *The Sea Around Us* in 1951, and *The Edge of the Sea* in 1955.[11] These works and others brought her numerous awards, and literary as well as scientific praise.[12] While her writing was noted for scientific clarity combined with poetic expression, her sense of humor, noted by friends and in her letters, was not reflected in her published works. She evidently felt that if she, as a woman, was to be taken seriously as a writer of science, humor should not interfere. When some readers could not believe that a woman wrote *The Sea Around Us,* she commented, prophetically, given the forthcoming reaction to *Silent Spring,* "Among male readers, there was a reluctance to acknowledge that a woman could have dealt with a scientific subject."[13]

By 1952, she was able to buy a cottage on the Maine coast near her beloved ocean, and devote full time to her writing. It was here that her friendship with Dorothy and Stanley Freeman was formed, which enriched her remaining years;[14] it was along the Maine Coast where parts of *Silent Spring* would be written. She was preoccupied with the need to care for her adopted son, the child of her deceased niece; as well as her mother, who died in 1958, over some of this period.[15] But by that year she had decided that pesticide poisoning would be her next focus.

She had been aware of DDT and its potential for ecological disruption since 1944, and had joined other scientists in unpopular warnings that it might not be the panacea, sought since biblical times, that would finally win the war against the insects. These warnings fell on deaf ears. After all, as above, DDT had saved American GIs lives from a typhus epidemic in Italy during World War II; it had been sorely needed and roundly praised by the sick, undernourished, and flea-infested Dutch after liberation in 1944. DDT stopped the spread of infection, permitting the Allied armies to operate, and saved the first crops after the war, establishing adequate nutrition in Europe.[16] But numerous communications detailing the pesticide's effect on birds and other species, as well as continuing rising concerns among her colleagues, led her to the decision that this issue would be the next she addressed.[17]

"The time had come," she reflected later, "when it must be written. We have already gone very far in the abuse of this planet . . . the ideas had to be crystallized, the facts had to be brought together in one place . . .

knowing the facts as I did, I could not rest until I had brought them to public attention."[18]

This book would be a departure from her earlier paeans to the sea, ". . . no longer the delights of . . . Maine rocks at low tide . . . the exploration of coral reefs. . . ."[19] This book would be a declaration of war. Rachel Carson was fully aware that the book would be controversial and that the response from the chemical industry and a number of policy makers would be intense. To make the response more manageable, she tried to keep the work under wraps until publication. She had been warned that upon its publication she would be subjected to ridicule. Typically, therefore, she proceeded with meticulous, time consuming research, which included correspondence with experts worldwide. Her interest in exploring the links between pesticides and cancer was perhaps more than academic; she had been diagnosed with breast cancer in 1957, and was in poor health for much of the writing of *Silent Spring*.[20]

THE REACTION TO THE BOOK

Robert Downs, reflecting on Rachel Carson's work in the year of the first Earth Day, commented that "*Silent Spring* was comparable in its impact on public consciousness, and demand for instant action, to Tom Paine's *Common Sense,* Harriet Beecher Stowe's *Uncle Tom's Cabin,* and Upton Sinclair's *The Jungle.*"[21] Prior to publication of the hardcover edition, the public had had a chance to learn its major themes. In June, 1962, *The New Yorker* started a three issue condensation of *Silent Spring,* and responses poured in. Excerpts were read into *The Congressional Record,* and President Kennedy was questioned about pesticides at a news conference. The official publication occurred on September 27, 1962, to excellent reviews: Loren Eiseley, a well-known naturalist from the University of Pennsylvania called it ". . . a devastating, heavily documented, relentless attack upon human carelessness, greed, and irresponsibility;" Supreme Court Justice William O. Douglas called it "the most important chronicle of this century for the human race."

But even before official publication of the book, in July, the *New York Times* headlined a controversy: "Silent Spring is now Noisy Summer; Pesticides Industry Up in Arms Over a New Book. Rachel Carson Stirs Conflict—Producers Are Crying Foul." The article went on to describe the distress in the industry: "Some agricultural and chemical concerns have set their scientists to analyzing Miss Carson's work line by line. Other companies are preparing briefs defending their products. Meetings are being held in Washington and New York. Statements are being drafted and counterattacks planned. . . ."[22]

Reactions came from far and wide. The Toledo, Ohio, Library ordered gallons of ladybugs as a biological control for aphids. Friends wrote that

Silent Spring was the prime topic of conversation in their communities. By way of contrast (and typically!), the Bethlehem (Pennsylvania) *Globe-Times* surveyed local county farm offices and found that "No one in either . . . office who was talked to today had read the book, but all disapproved of it heartily."[23]

Even some in the scientific community reacted cautiously. Typical of Carson's thorough research was her consultation with experts in each field about which she wrote, asking them to review appropriate chapters. Not all of them were prepared for war. A. W. A. Brown, a zoologist from the University of Western Ontario, had been consulted, and had in fact made some helpful comments prepublication. Once the book became controversial, he complained publicly that his suggestions had not been taken and that, by using his name, Carson "had put him in a bad light with his colleagues."[24] Carson searched her notes, discovered that all she had used of his was already published, pointed out icily that he had surely been free to complain when he reviewed her manuscript before it was in print, and requested that he represent the facts accurately in future. She expressed regret that he was unhappy with the result, but did not back down one inch.[25]

Typically, critics patronized Carson as a sentimental woman lacking in scientific objectivity. *Time* magazine reported that "Many scientists sympathize with Miss Carson's love of wildlife, and even with her mystical attachment to the balance of nature. But they fear that her emotional and inaccurate outburst in *Silent Spring* may do harm by alarming the nontechnical public, while doing no good for the things that she loves."[26]

But it was the chemical companies and other agricultural interests that launched the most vigorous attacks. The Velsicol Chemical Corporation, sole manufacturers of the pesticides chlordane and heptachlor about which Carson was highly critical, responded rapidly and fiercely. Having been alerted by the *New Yorker* articles, they wrote Carson's publishers, urging them not to publish a book so full of "inaccurate and disparaging" statements that was designed to sabotage Western capitalism. A portion of what has become a notorious letter reads:

> ". . . members of the chemical industry in this country and in western Europe must deal with sinister influences, whose attacks on the chemical industry have a dual purpose: (1) to create the false impression that all business is grasping and immoral and (2) to reduce the use of agricultural chemicals in this country and in the countries of western Europe, so that our supply of food will be reduced to east-curtain parity. Many innocent groups are financed and led into attacks on the chemical industry by these sinister parties."[27]

Other comments from those threatened by the book were less formal, but equally revealing. Some dismissed Carson as an unimportant member

of some fringe group. The director of the New Jersey Department of Agriculture spoke for many: "In any large scale pest control program we are immediately confronted with the objection of a vociferous, misinformed, group of nature-balancing, organic-gardening, bird-loving, unreasonable citizenry that has not been convinced of the important place of agricultural chemicals in our economy."[28] Others leveled personal attacks such as that from a member of the Federal Pest Control Review Board, quoted as saying, "I thought she was a spinster. What's she so worried about genetics for?"[29]

Many of the Chemical and Agricultural interests treated the publication of *Silent Spring* as a public relations problem. The Nutrition Foundation put together a "fact kit" that contained defenses of pesticides, negative reviews of the book, and a letter written by the Foundation president claiming that the Carson's supporters and advocates included "food faddists, health quacks, special interest groups, [that are] promoting her book as if it were scientifically irreproachable and written by a scientist."[30] These "kits" were distributed among universities, agricultural organizations, public health officials, women's organizations, state, county and local officials, and libraries.[31] Another approach used the National Audubon Society's annual Christmas Bird Census to point out that, contrary to Carson's warning, birds are abundant. (The Audubon Society tends to discount the accuracy of this annual event.)[32] As Paul Brooks, her editor, said in his book about her work, *The House of Life*, "Perhaps not since the classic controversy over Charles Darwin's *The Origin of the Species* just over a century earlier had a single book been more bitterly attacked by those who felt their interests threatened."[33]

Nevertheless, by the end of 1962, *Silent Spring* had had a tremendous impact on the ordinary public. There had been 40 bills introduced to various state legislatures to regulate pesticides, and on the public side, "CBS Reports" scheduled "The Silent Spring of Rachel Carson" for April 3, 1963. (Some of the sponsors of that program, predictably, opted out, including Standard Brands and Ralston Purina.) By May 15, 1963, President John F. Kennedy's Science Advisory Committee echoed the criticism Carson had initiated against chemical pesticides. In a report on that date, it strongly agreed with her evaluation of the danger inherent in the insect eradication program—the danger posed by pesticides that are persistent, and the apparent lack of concern in dealing with the application of synthetic chemical pesticides. This report was headlined in *The Christian Science Monitor* as "Rachel Carson Stands Vindicated."[34]

By the summer of 1963, she knew she was dying, but nevertheless, before her last trip to Maine, she detoured to testify before a Congressional committee at which she urged regulation, research, education, and registration for pesticides.

The chemical offense was not yet stilled. A consultant to Shell Chemical Company testified that "Miss Carson is talking about health

effects that will take years to answer. In the meantime we'd have to cut off food for people around the world. These peddlers of fear are going to feast on the famine of the world—literally." During a recess, one of the agricultural "experts" commented, "You're never going to satisfy organic farmers or emotional women in garden clubs."[35]

Rachel Carson died on April 14, 1964. Her funeral in the National Cathedral in Washington, D.C. was attended by many dignitaries, among whom was Senator Ribicoff (CT), before whose committee she had testified, and who eulogized her as "this gentle lady who aroused people everywhere to be concerned with one of the most significant problems of mid-twentieth century life—man's contamination of his environment."[36]

THE TROUBLE WITH DDT

Rachel Carson, now dead for more than thirty-five years, is a national institution—almost a national icon. But let us backtrack. *Why* is she so justly celebrated on this issue? How do pesticides work, that makes them at once so apparently valuable and so apparently deadly to the birds?

The trouble with DDT is that it kills things, and that it persists in the environment. That's what's good about it, and that's what's bad about it. Insecticides are designed to kill the insects that enjoy the same types of food that we do, and that try to get to it before we do. If they were not toxic, they could not do their job. And they stay around. They do not dissolve and disappear in the next rainstorm; otherwise their effectiveness would be very limited. But that is also the root of their harmfulness.

DDT is an organochlorine, a synthetic insecticide of the chlorinate hydrocarbon group. These substances are "persistent"; that is, they do not break down in the environment. Instead, they accumulate through the food chain (from plant to worm to bird, for instance). Soluble in fat or oil rather than water, they concentrate in the fatty tissues of the animals at the top of the food chain. And they are deadly. In ways that are not completely known, these organochlorines destroy living cells, affecting the nervous system in particular, and end the life of the organism that ingests them.[37]

They are distinguishable by the range of their toxicity, their solubility, their persistence, and the breadth of their killing spectrum. If one wanted to kill every insect in sight (and many other creatures along the way), one would use a broad spectrum, highly toxic, fat-soluble, and very persistent insecticide, such as DDT. Historically, that has been the approach taken, and its drawbacks soon became apparent. The broad spectrum insecticides resulted in the death of nontarget insects, including the insect pest predators that lived on the target insects and the pollinators essential to the growth of flowering crops. A fat-soluble pesticide is not soluble in water, and therefore impossible to flush out of an organic system;

it cannot be cleared from animal bodies by the kidneys and washed out in the urine. The persistence meant that the poison did not begin to break down into other chemicals for years, but accumulated and concentrated in the food chains. That is, each organism higher in the food chain will have a higher concentration of a poison than their prey. For in order to survive, consumers must, eventually, eat more than their own weight in the plants or animals they eat. So, to use the rule of thumb, 0.1 part per million (ppm) concentration of an insecticide in algae becomes 1.0 ppm in zooplankton that eat algae, 10 ppm in minnows that eat zooplankton, 100 ppm in small fish that eat minnows, and 1000 ppm in large predator fish.

Rachel Carson recognized this problem: "One of the most sinister features of DDT and related chemicals is the way they are passed . . . through all the links of the food chains . . . hay containing residues of 7 to 8 parts per million may be fed to cows. The DDT will turn up in the milk in the amount of about 3 parts per million, but in the butter made from this milk the concentration may run to 65 parts per million."[38]

Meanwhile, the undiscriminating toxicity of DDT threatened with extinction numerous unintended species, especially the birds of prey (the raptors) that ate the owls (that had eaten the snakes that had eaten the mice that had eaten the acres of insecticide treated plants). *Silent Spring*, written in 1962, contains myriad descriptions of senseless unintended poisonings. The next thought of course is: what is the effect on humans, who are high on the food chain? The effect is terrible. That is why the eating of fish caught in contaminated waterways is banned, and why some poisons exist in human milk in higher concentrations than allowed in cow's milk.

All this devastation, and the effectiveness of the insecticides is really very limited. There are more than one million insect species. That's *species*—not individuals; and only those that are known to us now. If we talk *individuals,* there are about four billion insects found per square mile. Carson put it this way: ". . . 70 to 80 per cent of the earth's creatures are insects. The vast majority of these insects are held in check by natural forces. . . . If this were not so, it is doubtful that any conceivable volume of chemicals . . . could possibly keep down their population."[39] Given these numbers, it is reasonable to expect that among an insecticide target species, there would be a number that were genetically immune to the poison (just as some humans are immune to poison ivy). Now, if the insecticide is an effective one, it will kill all those that are not immune. Left behind are those unaffected by the poison, who reproduce like crazy, passing the trait along to a population that is presented with a feast, such as a corn field, with *no competition* from either their own species or predator species (also dead from the insecticide). We now have an insecticide resistant strain of an insect species. The next step for the farmer is usually to try a different, generally more expensive, insecticide, and the

process starts all over again. This is often referred to as "the pesticide treadmill."

Carson documented a large number of observations of insecticide resistance worldwide, and mused that "Darwin himself could scarcely have found a better example of the operation of natural selection than is provided by the way the mechanism of resistance operates." She explained that ". . . it is the 'tough' insects that survive chemical attack. Spraying kills off the weaklings. The survivors are . . . the parents of the new generation, which, by simple inheritance, possesses all the qualities of 'toughness' inherent in its forebears. Inevitably, it follows that intensive spraying with powerful chemicals only make worse the problem it is designed to solve. After a few generations . . . there results a population consisting entirely of tough, resistant strains."[40]

In 1938 there were seven insect species that exhibited pesticide resistance. In 1984 there were 447. Today about the same percentage of our crops—fifteen percent—are lost to insects and weeds as were before the development of synthetic pesticides.

Rachel Carson's comment made in 1962 is as relevant today as it was then: "To have risked so much in our efforts to mold nature to our satisfaction and yet to have failed in achieving our goal would indeed be the final irony. Yet this, it seems, is our situation."[41]

NATIONAL RESPONSE: REGULATION

As soon as the book came out, as above, there were cries for regulation of the use of pesticides in general and DDT in particular. DDT was generally banned for all use and sale in the United States in the federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). That was the first comprehensive approach to the problem. The Act has been amended a number of times, most recently in 1988. It provides that all pesticides used in the United States must be approved by the Environmental Protection Agency (EPA). The pesticide manufacturer submits data to EPA regarding their product, and the EPA then, using that data, determines an acceptable daily intake of the poison as a residue on food. EPA's approval does not constitute an approbation for the chemical, merely a judgment that if used as directed, its benefits are greater than its risks. No pesticide can be advertised as safe.

Enforcement of the Act has always been a problem. The EPA does not have the manpower or resources to evaluate the 450 active ingredients and 1,820 "inert" ingredients used in pesticides today. Although EPA can ban a chemical any time, it must compensate the manufacturer for stored supplies and the like, which would bankrupt EPA if no other way can be found to sell the pesticides legally. The upshot is that many chemicals on the market have not been fully and reliably tested by an objective organization.[42]

THE UPDATE ON PESTICIDES

Unbelievably, the pesticide problems and controversies continue. DDT is showing up in albatrosses at Midway Island in the middle of the Pacific Ocean. A World Resources Institute report indicates that many pesticides seem to affect the immune system. The Institute reviewed a large number of studies on pesticides and immunity, including laboratory animal tests, tests on animals in the wild such as Baltic seals, and Soviet studies on changes in human immunity. In the Soviet Studies, the scientists reported high levels of infections in areas containing pesticide residues beyond "accepted standards." In addition, a Canadian study of Inuit children, whose mother's milk contained high levels of organochlorides, found that their immune response was so low that they couldn't be vaccinated, given their lack of antibodies.[43]

Where are these Canadian, Arctic, and Pacific residues coming from? Pesticides in use in the United States, and presumably other industrialized countries, are pretty well accounted for, but the United States (and again, other countries) exports tons of pesticides to less-developed countries, especially in Africa and South America. Protecting the safety of workers and populations where these substances are in use is subject to difficulties familiar to the nongovernmental organizations that monitor international health. Often, those who use the imported substances cannot read the labels, are unused to sterilization and safe spraying practices, and cannot take remote dangers into account. Agencies of their governments that are supposed to monitor imported chemicals are understaffed, inefficient, often corrupt. The pesticides in use are often banned or restricted for use at home, so antidotes and special precautions are never developed. Between 1992 and 1994, the U.S. exported 4,950 tons of unapproved pesticides, 11,000 tons of "severely restricted" pesticides, and 100,000 tons of pesticides with some U.S. restrictions. In 1992 alone, the United States exported 1,950 tons of pesticides that are either banned, suspended, or discontinued at home. The farmer tends to believe that if the product comes from the United States, it's safe—the label, if there is one and it's understandable, doesn't tell him it's banned in the United States.

It is estimated that the U.S. exports 250,000 tons of *recorded* pesticides per year, but the export data is scarce and not reliable, and that from the EPA spotty, given that the EPA doesn't track unregistered pesticides-and the staff is overwhelmed anyway, due to budget restrictions. Many are volatile and sprayed indiscriminately, causing numerous poisonings locally, and resulting in airborne chemicals that are deposited all over the world. Atmospheric scientists are just now beginning to think of monitoring pesticide "emissions" as they do other air pollutants. Dr. John Giesy, a toxicologist from Michigan State University who was a member of the team studying Midway Island, opined that ". . . our

research demonstrates that global controls on the distribution of persistant, bioaccumulative, toxic compounds need to be considered. The problem can't be approached on a country-by-country basis."[44]

Consider that insecticides are only the most visible of the pesticides, a billion-dollar industry. This in turn is dwarfed by all the other petrochemical operations—plastics, synthetic fibers, and thousands of other chemicals. There are 100,000 synthetic chemicals being used worldwide, with about 1,000 new ones being put on the market each year, "most of them without adequate testing."[45] There is a movement afoot to eliminate all synthetic chlorinated hydrocarbons (including the pesticides like DDT that have that chemical make-up) in some U. S. quarters. Recently, all chlorinated hydrocarbons, such as PCBs, dioxins, and pesticides, have come under attack on account of these effects. In a study done by the World Wildlife Fund, it was found that of 42 chemicals that affect the reproductive system, 55% contained chlorine. A senior economist with Environment Canada posits that "no other class of industrial—or natural—chemicals is known that exhibits so many detrimental properties at the same time."[46] Greenpeace, the environmental activist association that started the attack, has adopted the position that "no further organochlorine pollution should be permitted,"[47] entailing the complete cessation of the use of chlorine in manufacturing. The chemicals industry is pursuing substitutes for chlorine, but tend to view the proposed chlorine ban as "an extremist position," and generally ridiculous. "[W]e're not well served by blanket solutions to complicated problems."[48]

ALTERNATIVES TO PESTICIDES

What can we do? Alternatives to chemical warfare against the insects are under study, some of them on the horizon. For starters, not all pesticides have to be chlorinated hydrocarbons; a number are organophosphates, which do not persist in the ground as long as the organochlorines. Some have less dangerous chemical formulas, such as carbamates. Some very interesting research is being done in the area of IPM—Integrated Pest Management—using carefully measured minimal doses of pesticide, along with biological and mechanical controls on insect pests. The cultivation of insect predators is already under way; perhaps we should look into the capacity of plants to defend themselves, quite without our help. "Besieged by armies of voracious creatures but unable to run away, plants over the eons have evolved cunning defenses that include deadly poisons, oozings of toxic glue and hidden drugs that give leaf-eaters serious indigestion. . . . Many plants . . . wait until a predator actually starts munching before they unleash their most noxious washes of chemicals."[49] The obvious suggestion is to learn how they do that, and figure out how to teach, or modify, our agricultural staples to do the same. Then

we would not have to use chemical pesticides at all. That would be good for the farmers, good for the land, and a fitting tribute to the foresight and to the memory of Rachel Carson.

CONCLUSION

It seems fitting to let Rachel Carson have the last say. She finished *Silent Spring* with the following castigation:

> "The 'control of nature' is a phrase conceived in arrogance, born of the Neanderthal age of biology and philosophy, when it was supposed that nature exists for the convenience of man. The concepts and practices of applied entomology . . . date from that Stone Age of science. It is our alarming misfortune that so primitive a science has armed itself with the most modern and terrible weapons, and that in turning them against the insects it has also turned them against the earth."[50]

QUESTIONS FOR REFLECTION

Where should we place responsibility, or accountability, for the deleterious effects of pesticides? On the chemical companies? On the farmers? Why not on the consumers and their demands for perfect appearance in their fruits and vegetables?

What is the difference between the way we ascribe blameworthiness to individuals and to corporations? Can you blame a whole country for taking a wrong turn? Can American consumerism and reliance on technological fixes be regarded as morally blameworthy?

What course should the chemical companies follow to ensure that their products are safe? What would follow from the Responsible Care initiative described in Chapter 5?

Can pesticides be made completely safe for use around humans and on products consumed by humans? If not, why not? If so, how?

Notes

1. Gove Hambidge, "The New Insect-Killers," *Harper's Magazine* (February 1945): p. 264.
2. Ibid., citing Hans Zinsser.
3. Ibid., p. 265.
4. Frank Graham, Jr., *Since Silent Spring* (Boston: Houghton Mifflin, 1970): p. 16.
5. Ibid.

6. Phillip Sterling, *Sea and Earth, The Life of Rachel Carson* (New York: Thomas Y. Crowell, 1970): p. 2.
7. Carol B. Gartner. *Rachel Carson* (New York: Frederick Ungar Publishing, 1983): p. 7.
8. Frank Graham, Jr., *Since Silent Spring,* p. 5.
9. Mary A. McKay, *Rachel Carson* (New York: Twayne Publishers, 1993): p. 13.
10. Ibid., p. 2.
11. Carol B. Gartner, *Rachel Carson*; see Chronology.
12. Ibid.
13. Ibid., p. 17.
14. Mary A. McKay, *Rachel Carson,* p. 19; Martha Freeman (ed.), *Always, Rachel The Letters of Rachel Carson and Dorothy Freeman* (Boston: Beacon Press, 1995).
15. Carol B. Gartner, *Rachel Carson,* p. 21.
16. Mary McKay, *Rachel Carson,* p. 63.
17. Ibid., p. 63ff.
18. Paul Brooks, *The House of Life: Rachel Carson at Work* (Boston: Houghton Mifflin, 1972): p. 228.
19. Ibid.
20. Mary A. McKay, *Rachel Carson,* pp. 69, 80; Carol B. Gartner, *Rachel Carson,* p. 21ff.
21. Robert B. Downs, *Upsetting the Balance of Nature,* London: Macmillan, 1970); quoted in Mary McKay, *Rachel Carson.*
22. Phillip Sterling, *Sea and Earth, The Life of Rachel Carson,* p. 172.
23. Frank Graham, Jr., *Since Silent Spring,* p. 48.
24. Ibid.
25. Ibid., p. 60.
26. Paul Brooks, *The House of Life: Rachel Carson at Work*, p. 293.
27. Frank Graham, Jr., *Since Silent Spring,* p. 49; Marty Jezer, *Rachel Carson* (New York: Chelsea House, 1988): p. 95.
28. Frank Graham, Jr., *Since Silent Spring,* p. 56.
29. Ibid., p. 50.
30. Ibid., p. 60.
31. Ibid., p. 59.
32. Ibid., p. 60.
33. Paul Brooks, *The House of Life: Rachel Carson at Work*, p. 293.
34. Ibid., pp. 72–79.
35. Ibid., p. 86–88.
36. Frank Graham, Jr., *Since Silent Spring,* p. 89.
37. Ibid., p. 15 (note).
38. Rachel Carson, *Silent Spring* (Greeenwich, CT: Fawcett Publications, 1962).
39. Ibid., p. 220.
40. Ibid., p. 240.
41. Ibid., p. 217.
42. G. Tyler Miller, Jr., *Living in the Environment,* 9th Ed., (Belmont, CA: Wadsworth Publishing, 1996): p. 598.
43. Janet Raloff, "Pesticides May Challenge Human Immunity," *Science News* Vol. 149 (9 March 1996): p. 149.