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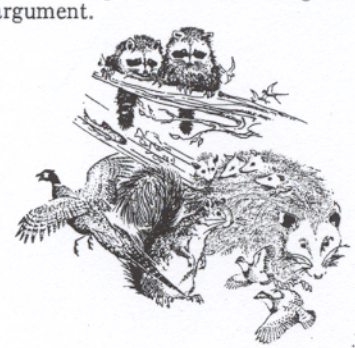
THE CHEMICAL COUNTRYSIDE

A view of Rachel Carson's *Silent Spring*

(Houghton Mifflin, 1962. $5.00)

THE TECHNOLOGICAL society in which Americans live has provided a level of health, ease, and comfort unparalleled in history. We have set the pattern and the goals toward which the rest of the world strives. Loud voices proclaim the value of our achievements and promise an ever-changing, ever-better future. True, there have always been doubters and there have even been those who would reverse our social directions. Yet, on balance, we have come to accept technological innovation as an inherent feature of our culture and to dismiss —sometimes with contempt and ridicule—the arguments of the doubters.

But a second category of doubt has lately appeared; this doubt is neither imagined nor easily dismissed. We have cause to suspect that the products of our technology may be unwisely applied, and in the long run harm us more than help us. Environmental pollution is in my mind today's most serious such problem. This article concerns only one pollutant—pesticides—and is prompted by a current best-seller that challenges their present manner of use. The book is Rachel Carson's *Silent Spring,* a Book-of-the-Month Club selection for October; it is sure to provoke both thought and argument.



Before going on to the book, some orientation is necessary. What are environmental pollutants; why do they concern us all? By pollutant we mean a contaminating substance, one which is usually man-made and which is normally neither wanted nor controllable. Less commonly, pollutants are intentionally applied—usually with single purposes in mind. Both warfare and agriculture give examples of this kind of pollution. There are two major classes of man-made pollutants—radioactive and chemical. The significance of uncontrolled radiation is widely and hotly debated. I shall leave it at that. The arguments about the second kind of environmental contaminant—chemicals—are much the same but are less well known and less resolvable into single issues. Chemical pollutants are of many kinds: effluents from home and industry, such as detergents; refinery gases; acids from pulp manufacture; discharges from automobiles; oil discharges from ships; and pesticides, among others.

Pesticides—now largely synthetic chemicals—are designed to kill or inhibit the plants and animals that interfere with our health, comfort, or production of foods and fibers. Some 200 chemicals are commonly used in agriculture; these are commercially presented in thousands of formulations under as many trade names. These chemicals are categorized according to their intended targets as insecticides, rodenticides, fungicides, and herbicides. Most can be considered "biocides"—they kill living things. The same or similar chemicals are also used in public health, forestry, fish and game management, right-of-way maintenance, property protection, and recreation. The purposes of pesticidal use are clear and widely accepted. But, if these purposes are acceptable, then why should anyone argue against their use?

Here are a few reasons:

1. Most pesticides are non-selective; they kill forms of life other than their targets.
2. Their manner of use, though often increasing the selectivity, is in most cases not precise enough, being restricted neither as to pest species nor area applied.
3. Insufficient attention has been given to other means of crop protection. Most other methods of pest control are culturally or biologically based and result in greater diversity and stability in the biota. Pesticides reduce faunal diversity—natural checks on control—and ensure biotic instability.
4. Many kinds of pesticides—notably the chlorinated hydrocarbon group to which DDT belongs—are chemically incredibly stable; their survival in soil, water, and living tissue is assured.
5. Insidious pathways of biological transfer of toxic chemicals are now well known. These channels of potential harm, include delayed toxicity; secondary poisoning; transfer, storage, and concentration along plant and animal food chains; and, potentially at least, mutagenic and carcinogenic effects. Yet many chemically-oriented persons continue to deny the importance of these biological consequences of pesticide use.

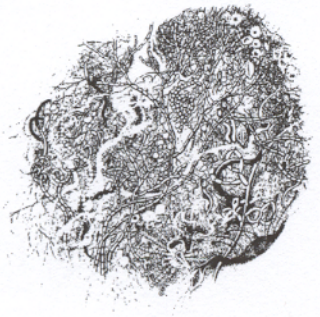
6. Their use is entirely too single-minded in relation to the manifold effects they produce. It is not enough to restrict our concern to their value in crop and personal protection.
7. The technically supported viewpoints of the conservationist, the resource analyst, the biologist, and the sociologist are too frequently overlooked in pest control recommendations and in governmental programming.
8. Equally lacking is overt concern for esthetic and moral values that inevitably figure in the applications of technology to the satisfaction of human needs and desires.

I could categorize other reasons for complaint; and those listed are not of equal weight. No one denies the value of pesticides in safeguarding ourselves and our food supply. All the points listed above have been debated in the limited circles of technologists, regulatory officials, agriculturalists, industrial representatives, and governmental policymakers. However, the era of closed debate has ended. Miss Carson's book has made the debate public property.

Rachel Carson's talents as a writer do not require my endorsement. Her best-known book, *The Sea Around Us,* has been a continuing best-seller and now appears in translation in 30 languages. She has other books and

articles to her credit; all reflect the skill, accuracy, and perception of "The Sea." *Silent Spring* is a credit to its writer. But while conceding her literary abilities, her critics challenge her technical competence in the subjects she covers. Are they correct? I should say, "Yes, in part, if what is expected is an ultimate knowledge of every aspect of the problem." However, no reviewer, including her critics, has that knowledge today. Among specialists there is far too much equivalence given to all facts and far too little venture into matters of judgment and conceptual thought. Miss Carson is a trained biologist and has worked professionally for many years in the U. S. Fish and Wildlife Service. Her interest in pesticidal chemicals dates from World War II, when she figured in early testing of DDT prior to its public release. In my opinion, she is eminently qualified to present the facts, synthesis, and argument she has in *Silent Spring*. I leave it to her critics to do as well.

The book is an argument. "The obligation to endure," as Chapter 2 is entitled, rests upon the recognition that human beings are part of, not apart from, the world of living things.



The 17 chapters of the book all concern known or potential effects of pesticides and alternatives to their use. Chapter 1 is an allegory—a description of a fictional American city where, with good intentions but limited purposes, men unknowingly pursue chemical control to the point that wild voices are stilled (hence, "Silent Spring") and the citizenry itself is threatened. With the exception of the last, the remaining chapters describe pesticidal effects in soil and water, in living organisms—including human beings—and in ecosystems. The last chapter convincingly summarizes biological and physical methods of pest control that can now be substituted for chemical means. It is a plea to recognize our inescapable dependence on natural processes and to use these processes wisely.

Take the simplest case of the effects of pesticides—*direct toxicity*. Millions of acres have been covered with DDT, aldrin, dieldrin and heptachlor. Over a period of years beginning in 1954 many thousands of acres in Illinois have been treated with dieldrin or aldrin at high dosage rates in attempts to eradicate the Japanese beetle. The beetle remains and in fact is extending its range. But virtual annihilation was the fate of robins and a host of other bird species and of squirrels, muskrats, rabbits, and farm cats. There were other toxic effects too—on livestock, for example.

Now consider a more complicated case—*storage and transfer along a food chain*. Two examples will suffice. The fungal disease responsible for loss of elm trees in the Eastern and North-Central states is carried by a beetle. For over a decade treatment aimed at reducing beetle numbers has consisted of drenching entire trees in DDT solutions. The loss of elm trees has not stopped, only slowed. But the persistent toxicity of DDT surviving in the leaf-litter, picked up and stored by earthworms, and ultimately eaten by robins, has led to their near extinction in some areas. Professor George Wallace of Michigan State University four years ago estimated robin loss in the seven North-Central states at 100,000,000. Moreover, heavy mortality now has been recorded among about 90 species of birds. Nesting populations of birds in some sprayed towns have declined as much as 90 per cent. The same kind of food-chain phenomenon has occurred in the West at Clear Lake, California. Here, efforts to control a gnat with DDD led to nearly total contamination of fish flesh, and the loss of most nesting western grebes on the lake. The biological story in this instance borders on the unbelievable and should be read in detail in *Silent Spring* for full understanding.

The chemicals too must be looked at. Many persist not only in animal tissues but also in soil and water. They may thus accumulate in successive applications. Moreover, some chemicals convert into more toxic substances in nature. Aldrin, for example, changes in large part to the more toxic dieldrin, and heptachlor quickly forms a more toxic epoxide. Changes of these kinds may have profound effects on living things, but in fact the relationship is rarely studied.

Biological effects range well beyond obvious toxicity. Ecosystems are intricate webs of relationships, each element in delicate tune with others. Animals adapt to their environments. The use of chemical insecticides illustrates this principle. Some 150 pest- and disease-carrying arthropod species have now become resistant to the common insecticides. In an insecticide-contaminated environment, selection for the most resistant types proceeds until most of the population is no longer controllable with the insecticide. DDT, for example, is now virtually useless against house flies, mosquitoes, and body lice. Or, if one important segment of an ecosystem is removed, remaining segments may surge in numbers and become pests themselves. The spider mite, little affected by DDT, is now a common pest, whereas before DDT it was scarcely recognized as one. Other species, too, exhibit these resurgences in numbers or "flare-backs" as the entomologists call them.

What then of the human case? This is, after all, the species in which we are most interested. Hazard is clear and harm demonstrable when we consider spray operators, workers in treated fields, children who pick up pesticide containers, and, in other countries, families whose dwellings have been sprayed in efforts to control disease vectors. But is hazard obvious and harm evident when we consider the small amounts of pesticide residues present in most foods? Most human beings in the United States contain DDT residues in their tissues, and the amount has increased in a decade. Miss Carson presents a lucid account of the oxidation mechanisms of the body and links known toxic pathways of pesticides to them. She then ties the interactions to potential mutagenic and carcinogenic effects. I believe her evidence is weakest here, even though it concerns the animal species about which we know most. The evidence is incomplete and conflicting. I hope she is not correct. Whatever her correctness, we can assuredly do very well without toxic residues in foods and should take every step to prevent their occurrence.

Silent Spring is not simply another fine literary work of the sort we expect from Rachel Carson. It is, as well, biological warning, social commentary, and moral reminder. Insistently she calls upon technological man to pause and take stock.

Drawings from *Silent Spring* by Lois and Louis Darling.