Studies in History and Philosophy of Biological and Biomedical Sciences 53 (2015) 118–121

Contents lists available at ScienceDirect

Studies in History and Philosophy of Biological and Biomedical Sciences

journal homepage: www.elsevier.com/locate/shpsc

Essay review

# Toxicity abounds: New histories on pesticides, environmentalism, and *Silent Spring*

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**Banned: A History of Pesticides and the Science of Toxicology, Frederick Rowe Davis. Yale University Press, New Haven, CT (2014). xi + 264 pp., cloth, Price: $40.00, ISBN: 9780300205176**

**Rachel Carson and Her Sisters: Extraordinary Women Who Have Shaped America's Environment, Robert K. Musil. Rutgers University Press, New Brunswick, NJ (2014). xiii + 328 pp., cloth, Price: $26.95, ISBN: 978-0-8135-6242-1**

**Our Once and Future Planet: Restoring the World in the Climate Change Century, Paddy Woodworth. University of Chicago Press, Chicago, IL (2013). xi + 536 pp., cloth, Price: $35.00, ISBN: 9780226907390**

Rachel Carson's *Silent Spring* powerfully shaped the politics and policies of postwar American environmentalism. In 1962, Carson's book, which began as a *New Yorker* serial, offered an accessible study of the insecticide DDT—its dangers, overuses, and problematic ideologies that accompanied aerial and surface applications. Carson underscored that DDT presented acute and chronic ecological hazards for urban and rural communities alike: "It is not my contention," Carson insisted, that "chemical insecticides must never be used. I do contend that we have put poisonous and biologically potent chemicals indiscriminately into the hands of persons largely or wholly ignorant of their potentials for harm. We have subjected enormous numbers of people to contact with these poisons, without their consent and often without their knowledge (Carson, 1962, pp. 12)."

With precision in evidence to match the boldness of its claims, *Silent Spring* energized America's Ecological Age, sparking an era of environmental policymaking that would guide as much as challenge throughout the 1960s and 1970s. Pesticides' dual power to protect and poison made them potent hazards with long-term consequences compared to their rapid and what Carson believed to be haphazard applications. "Future generations," she warned, "are unlikely to condone our lack of prudent concern for the integrity of the natural world that supports all life… It is the public that is being asked to assume the risks that the insect controllers calculate (Davis, 2014, pp. 13)."

Environmentalism's ascent, challenges by American chemical companies, the patchwork of governmental oversight offers a compelling history—so persuasive, in fact, that most scholars center their studies on the politics and policies of DDT and the Environmental Protection Agency's banning in 1972. Yet the legacy of *Silent Spring*, DDT, environmentalism, and the evolution of governmental regulatory power only begins to highlight the dynamic and controversial global legacy of toxic chemicals.

As all three authors surveyed in this review show, Carson's book moved well beyond springing a movement. By rethinking scientific, agricultural, socio-technological, and rural/urban relationships, *Silent Spring* redefined the role of local knowledge and professional expertise in scientific communities. Carson argued for an ecological view that united naturalists with ornithologists and conservationists with environmental health scientists. Pesticides' ability to poison and the degree to which they harmed humans, animals, and landscapes—their toxicity—came to represent both the measure of safety and level of risk in modern America. An increase in rural and urban applications of insecticides and herbicides meant healthy fields or protected homes came at a price. Poisons placed Americans at risk as much as they offered shortcuts in farming or sterilized city apartments. While agricultural chemicals protected crops, they also simplified ecosystems. Fields continue to be more toxic, steams increasingly poisoned, and wildlife communities continue to decline.

Although banning DDT took important legislative steps toward curbing industrial agriculture chemicals and indiscriminate insecticide applications, it also endorsed more toxic alternatives. From practitioners to policymakers, "reading the label" offered safer political alternatives but did not reduce the ecological risks. *Silent Spring*'s endorsement of environmental science, policymaking, and

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http://dx.doi.org/10.1016/j.shpsc.2015.07.009
1369-8486/

precise application shifted the public's views about vulnerability, risk and regulation. But did debates about risk exist before Rachel Carson's book? How did the nature of expertise change or determine Americans' views of toxicity, health, and safety?

As toxicity continues to increase on a global scale, so does the need for new studies by environmental historians, history of science scholars, and sustainability advocates. Many historians such as Thomas Dunlap (*DDT: Scientists, Citizens, and Public Policy Scientists*), Edmund Russell (*War and Nature: Fighting Humans and Insects with Chemicals from World War I to Silent Spring*), and David Kinkela (*DDT and the American Century: Global Health, Environmental Politics, and the Pesticide that Changed the World*) have explored the ecological, political, and socio-economic contours of *dichlorodiphenyltrichloroethane*, or "DDT," in American laboratories, as militarized weapons, agricultural shields, and socio-political lightning rods. But *Silent Spring* did more than that. As Kinkela explains, it also sparked a debate about "knowledge production and professional authority that pitted the 'soft' science of ecology against the 'hard' science of chemistry (Kinkela, 2011, pp. 118–119)."

Debates over risk, health, and practitioner knowledge versus scientific expertise also extended into cities. Insecticides protected apartments from bedbugs, cockroaches, and rats, but, just as easily poisoned their operators. As Dawn Biehler (*Pests in the Cities: Flies, Bedbugs, Cockroaches, and Rats*) has shown that these lines between urban environments and toxicity regimes are quite blurred. Other historians such as Nancy Langston (*Toxic Bodies: Hormone Disruptors and the Legacy of DES*) and John Wargo (*Green Intelligence: Creating Environments That Protect Human Health*) have continued adjusting the lens to look at pesticides, toxicity, and environments in the context of bodies, landscapes, and communities.

Frederick Rowe Davis' new history on pesticides and the science of toxicology in *Banned*; Robert Musil's new look at the connections between gender, science, and ecological views of pesticides and ornithological societies in *Rachel Carson and Her Sisters*; and Paddy Woodworth's journalistic survey of contemporary extrapolations of Aldo Leopold's "intelligent tinkering" in restoration ecology in *Our Once and Future Planet* emphasize just how interwoven risk, benefit, expertise, technology, policy, and landscapes are throughout the world. Each author, in his own way, argues that in order to study the environmental hazards, scientific advancements, and public health policies of pesticides throughout the twentieth century, the scholarly boundaries of science, health, technology, and environment must be blurred.

If some of the most novel, if not controversial tools of the twentieth century are pesticides, then one of most crucial scientific disciplines is toxicology. The Pure Food and Drug Act of 1906 acknowledged the risks of synthetic chemicals to American homes and fields. Its passage, largely the result of early experiments with poisons, showed farmers, homemakers, and policymakers the power of pesticides to protect as well as make them vulnerable. Arsenic, Lead Arsenate, and Paris Green carried both an environmental and cultural potency that encouraged Americans' broad acceptance for the use of DDT after the Second World War. The principles of industrialism that defined the late nineteenth century—efficiency in labor, technological advance, and monoculture production—continued to make and remake American society in the first three decades of the twentieth century. Risk and benefit squarely resided in profits rather than safety. Even as agricultural chemists and entomologists pursued these goals, they were also aware of dangers to public health. As Davis argues in *Banned*, the relationship between the history of pesticides and the science of toxicology is a "tightly bound helix of risk and benefit [that] defies simple solution (Davis, 2014, pp. xiv).

Long before Rachel Carson sat before congress to speak on DDT's dangers, earlier than the founding of the Chicago Tox Lab, and before toxicology was an independent science, scientists and regulators debated the risks and rewards of pesticides. As Davis succinctly shows, rethinking *Silent Spring* means tracing the pharmacological origins of toxicology as well as its scientific and political evolution. Carson's scientific evaluations of risk had a much longer historical continuity with agricultural and laboratory experimentation. The key concepts of toxicology—the relationship of dosage to risk, the formulation of LD50 for a toxicity standard, and strategies of precaution all emerged in this longer exchange between lab, field, and city.

Toxicology emerged in the early 1900s as public health defined the progressive era. In its early chapters, *Banned* explores how the use of Elixir Sulfanilamide to eradicate streptococcus in American cities and the growing, heavy use of farm chemicals in the countryside led to early warnings about toxicity. Scientists such as E. M. K Geiling and Paul R. Cannon at the Chicago Tox Lab or Chester I. Bliss and Edwin P. Laug from the Food and Drug Administration (FDA) "laid the foundation for future toxicological investigations by designing toxicological tests to determine if: (1) the relationships of toxic and lethal doses to consumption frequency; (2) the clinical and pathological comparisons between animal health and human health (3) discover toxic agents in the elixir (Davis, 2014, pp. 23)."

The Tox Lab's efforts to explore and expand the science of toxicology before the Second World War served as a key proving ground for insecticides such as DDT. In addition, their experiments developed concepts such as the precautionary principle and contributed to the rise of environmental toxicology as part of public health policymaking. Other labs such as the Bureau of Entomology and Plant Quarantine in Orlando, Florida or New York's Rockefeller Lab joined Chicago's toxicity experiments. Director Edward F. Knipling, for example, conducted many early efficacy and toxicity trails on DDT for U.S. Armed Forces in the lead-up to World War II. Rockefeller scientists tested potent insecticides on a variety of subjects "including medical students in New York, conscientious objectors in New Hampshire, and an unwitting civilian population in Mexico (Davis, 2014, pp. 41)." Knipling and others believed that experiments with chlorinated hydrocarbons insecticides, especially DDT, meant not only "controlling lice and typhus but of eventually eradication typhus from the earth (Davis, 2014, pp. 42)."

In subsequent chapters, Davis explores how the Chicago Tox Lab was the forefront of toxicological research—conceptualizing risk, anticipating vulnerability and calculating toxicity—all offered hard data for the acute and chronic dangers. Geiling and his colleagues designed studies that some praised as proof of effectiveness while others saw premonitions of ecological crisis. As toxicology emerged as a distinct discipline, new scrutiny, testing practices, and independent analysis around DDT informed how scientists would interact with a new series of pesticides—organophosphates or "OPs"—that quickly replaced chlorinated hydrocarbons such as DDT. Many of these toxics such as Parathion, Malathion, or Tetraethyl Pyrophosphate (TEPP) offered immediate action, varied in persistence, and were not chronic in their toxicity. Toxicologists throughout the late 1940s and 1950s such as Arnold Lehman (FDA) or Kenneth DuBois (Chicago Tox Lab) confirmed these new chemicals' acute toxicity was quite lethal, but did not reside in the surrounding environment like chlorinated hydrocarbons. OPs, however, included their own dangers. Dermal absorption in humans or soil and plant absorption in the landscape rendered extreme insecticidal rates. Toxicology offered standards for risk assessment, exposure, and public health by designing toxicity hierarchies, constructing dose-mortality curves, and investigating the phenomenon of joint toxicity.