13 | Debating Rachel Carson's *Silent Spring*, 1963

Teaching about Silent Spring • *NOS issues* • *scientific concepts* • *simulation profile* • *roles* • *resources* • *teaching notes*

In 1962, Rachel Carson published *Silent Spring,* criticizing the indiscriminate use of synthetic pesticides and advocating respect for the integrity of nature. With its vivid images and dramatic evidence, it helped spark growing concerns about pollution and protecting wildlife into the modern environmental movement. It is frequently cited among the most influential books of the twentieth century. At the time, Carson's book also generated considerable controversy. The public debates about both scientific claims and values epitomize the need for scientific literacy and NOS education (Chapter 1). The case thus offers a prime opportunity for teaching the nature of science.

One teaching strategy is to follow Carson's story in historical context, highlighting the NOS dimensions and posing reflective questions to students, as illustrated in the beriberi case in Chapter 10.[1] Another, fuller and more engaging, option is profiled here: guiding students through a role-play simulation, similar in format to the Galileo trial profiled in Chapter 12. The scenario here is based on President Kennedy's Science Advisory Committee in 1963. The committee was charged to assess Carson's claims and recommend any appropriate policy or legislation. The panel's review provides an occasion to introduce the perspectives of multiple stakeholders and to work towards a consensual solution based on the available evidence. An additional question—should Carson receive a Presidential Medal of Freedom for her public service?—provides an opportunity to reflect on the role of Carson's writing style and methods of promoting the public understanding of science.

The prepared guidance for the activity includes up to 26 roles, ranging from ecologists and economic entomologists to representatives of the chemical pesticide industry and the U.S. Secretary of Agriculture. By design, the roles reflect the spectrum of stakeholder perspectives in 1963. They do not faithfully replicate historically the actual members of the committee. This is a historical *simulation*, an open-ended exercise for exploring the nature of science by posing a particular problem in a particular historical context.

Although based on real historical characters and conceptual positions, the goal is neither to re-enact history nor to "correct" it (see Chapter 4). Still, a large number of original historical documents have been assembled on the Internet (http://pesticides1963.net). They help clarify what was known at the time and how the information was interpreted from various perspectives.

Included in the online resources are reviews of Carson's book, hard-to-find scientific studies, items from the chemical industry magazines, commentaries from *Audubon* magazine, and more. There are also various historical images and documents to set the scene. The ultimate aim is to allow participants to grapple with the problem themselves and experience the uncertainty and contingent dynamics of history-in-the-making (Chapter 2). Such simulations are especially valuable for exploring how many alternative perspectives interact. Students typically learn to appreciate the complexities of the nature of science and the challenges of resolving problems that, in retrospect, may seem quite plain and simple.

The episode surrounding *Silent Spring* became an important historical landmark. Investigations about the adverse effects of pesticides were also launched by journalists and the U.S. Congress, leading to calls for reform. In the years to follow, other environmental concerns entered public debate. Within a decade, the United States had a new Environmental Protection Agency, a nascent Earth Day, and major legislation regulating DDT, endangered species, and air and water pollution. Carson's role in helping modern environmentalism take root has since come to be celebrated (and sometimes romanticized, as in *Time*'s account in its *100 Persons of the Century*) (Chapter 3).

Nature of Science Issues

The case highlights several features of the nature of science, each discussed briefly below:

- scientific credibility
- science and values
- scientific uncertainty
- public understanding of scientific issues
- science and gender

First, how does the public assess scientific credibility? A central feature of this episode is not just the science itself, but the public's understanding of science and its role in public policy. The case highlights the difference between what "is known" scientifically and *who knows it.* How do non-scientists come to have scientific knowledge, and how do they distinguish it from inauthentic science presented as scientific by various political or economic interests? Carson's expertise was certainly widely challenged. Others endorsed her claims. Were pesticides indeed poisoning our food? Were they carcinogenic? Did use of pesticides prompt the evolution of

resistance, ultimately making them ineffective in controlling the insects that ravaged crops or carried disease? Such issues touched the ordinary citizen. Yet not everyone can be an expert. Who, then, can one trust? How does one establish an effective system of credibility? Who makes decisions: the experts or others who may or not be well informed by them?

Second, how does one integrate values and science? Carson coupled her specific argument about pesticides with a general critique of human attitudes towards controlling nature. Pesticides were thus also cast as damaging wildlife and upsetting a purported balance of nature. Were those views relevant in public discourse? Were we to care (as a society) about the loss of birds, dramatized in a prospective "silent spring"? How does one make a public decision involving both moral perspectives and scientific information? How does one debate values when facts are also involved? How does one debate facts—or the interpretation of facts—when they seem laden with values?

Third, *Silent Spring* introduces the challenge of public policy under scientific uncertainty. Science is not always complete and does not always yield ideal information to resolve public controversy. The evidence for toxicity of food and for the carcinogenicity of pesticides was particularly problematic at this time. What is the appropriate response? Does one use a scientifically guarded posture, even if it might later prove wrong? How does one hedge against possible alternatives? Does one entertain worst-case scenarios and apply a precautionary principle? One can always appeal to the need for further research. But how much will it cost? Who will pay for it? What is to be done in the mean time? In 1962, how was policy to be established without knowing more and having only limited alternative technologies at hand?

Fourth, the case raises striking questions about how the public becomes fully informed on scientific issues relevant to our common welfare. The role of *Silent Spring*'s publication is especially dramatic when framed in historical context. The discovery of the insecticidal properties of DDT—and its role in controlling typhoid and malaria in World War II—earned a Nobel Prize in 1948. For the next decade, the culture continued to bask in the triumph of DDT and the promise of "better living through chemistry." Studies about the adverse effects of DDT had been published almost from the outset but had little effect on public policy. How does the public develop understanding of such issues? Carson's emotional imagery was surely important in raising awareness and shaping public opinion. Were her persuasive tactics appropriate, or possibly even necessary? Did Carson or other scientists have an ethical responsibility to inform the public or, more deeply, to effect political change? How does one balance the ideal of scientific objectivity and political advocacy or activism? The question of whether Carson deserves special recognition highlights questions about this broader context of science in society.

Finally, the episode also raises questions about science and gender. Carson's credibility was challenged in part by portraying her as "a woman" (at a time when the culture largely peripheralized women as voices of authority in science and politics). In addition, one may consider how Carson's views about the control of nature were shaped by values fostered more deeply among women. How important was Carson's gender to her interpretation of science, her perceived role in communicating it to the public, and her writing style?

Many of these general questions about the nature of science enter into the concrete discussions of the President's Committee on Pesticides as it makes its decisions. Other aspects are ripe for explicit reflection and exchange after the simulation is complete.

Scientific Concepts

The case is also an occasion to explore several scientific concepts:

- ecology of agriculture and the role of pest control
- ecology of disease transmission and the role of pest control
- natural selection of resistance to pesticides
- concentration of elements in the food chain
- predator–prey and parasite–host interactions (as a basis for biological control)
- cellular biochemistry and the mechanisms of pesticide action
- "balance of nature" and interactions in complex systems

These are familiar lessons for biology teachers, so no further comment on them seems needed here. One may note, however, that these concepts provide a curricular context for situating the simulation in a standard biology class. Moreover, the case shows how such concepts are not isolated, but are highly integrated in practice. In addition, the case provides a concrete context that typically enhances student learning of such abstract principles.

The use of pesticides also raises important questions about ecosystem stability and/or the unpredictable behavior of complex systems. Carson appealed to the "balance of nature," a concept now widely discredited by ecologists. One may discuss the status of the scientific basis for this concept and, thus, its prospective relevance in a policy context.

Equally important here, perhaps, is probing the limits of science in guiding public policy. Science cannot justify values, even when providing information relevant to forming value judgments. Assessments of risk, for example, may be quantified, but the level of risk that is deemed safe expresses a value. This case illustrates well how science may inform policy decisions, but does not eclipse other considerations.

The President's Advisory Committee on Pesticides, 1963

Project Profile

Rachel Carson published *Silent Spring* in 1962, advocating limitations on the use of synthetic pesticides. With its vivid images and dramatic evidence, it sparked emerging environmental concerns into a major public controversy. President Kennedy directed his Science Advisory Committee to investigate the claims and make recommendations. Our challenge is to situate ourselves in late 1963 and respond to Kennedy's charge. Each person will assume a different role and give testimony and initial policy proposals. As a group, everyone will then debate the arguments in *Silent Spring*, the evidence, the individual proposals, and make a final set of recommendations to the president. In addition, the committee will decide whether to recommend Rachel Carson for the new Presidential Medal of Freedom for her public service.

Research, Testimony, and Discussion

Orient your research and writing around the following major issues:

1. **Carson's credibility**—Can the facts in *Silent Spring* be rigorously documented, and are the sources reliable? Is the presentation balanced and complete? How should Carson's emotive rhetoric and style affect our interpretation of her claims?
2. **Benefits of pesticides | Harm to non-target species**—What evidence indicates negative dimensions of pesticide use—to insect pollinators, to other organisms in the habitat, to the food chain? What are the nature and scope of the benefits that pesticides provide? How ought we to maximize benefits while minimizing any risks or harm?
3. **Indiscriminate use**—Should pesticide use be regulated? In what way, to what extent?
4. **Safety**—Is our food safe? Do pesticides cause cancer? Are the health and safety of workers threatened?
5. **Insecticide resistance**—Do insects evolve tolerance to pesticides? If so, what should be our response?
6. **Alternatives**—Are there any alternatives to chemical pesticides? If so, what are their relative costs and effectiveness?
7. **Control of nature, balance of nature**—In what ways does use of pesticides reflect larger issues about human relationships with nature that ought to be addressed?

ROLES

Each person will adopt the role of one historical figure, prepare a statement, and give testimony to the committee. See the webpages (http://pesticides1963.net) for guidance on each person's perspective and relevant sources:

- [optional] Jerome Wiesner, President's Science Advisor and Committee Chair
- P. Rothberg, President of Montrose Chemical Corporation (manufacturers of DDT)
- LaMont Cole, ecologist, Cornell University
- Edwin Diamond, science writer
- Robert L. Rudd, zoologist
- Robert White-Stevens, chemist, Assistant Director of Research and Development, American Cyanamid
- George J. Wallace, zoologist, Michigan State University
- Roland C. Clement, staff biologist, National Audubon Society
- Clarence Cottam, Director, Welder Wildlife Foundation
- Walter H. Larrimer, U.S. Department of Agriculture Insect Control Division; member of the NRC Committee on Pest Control and Wildlife Relations (1960–1963)
- Murray Bookchin, author, libertarian, socialist
- Mitchell R. Zavon, Department of Industrial Medicine, University of Cincinatti, consultant to industry, and member of the NRC Subcommittee on Research Needs for Pest Control and Wildlife Relations
- George Larrick, Commissioner of the Food & Drug Administration
- Ira L. Baldwin, Chair, National Academy of Science–NRC Committee on Pest Control and Wildlife Relations (1960–1963)
- Orville Freeman, Secretary of the U.S. Department of Agriculture

Extension Roles

- Robert Bushman Murphy, ornithologist, American Museum of Natural History
- William A. Brown, Jr., economic entomologist
- Samuel W. Simmons, U.S. Public Health Service
- George Decker, Illinois Natural History Survey and member, NRC Committee
- Roy Barker, Illinois Natural History Survey
- Ira Gabrielson, member of the NRC Committee; chair of Subcommittee on Research Needs
- Tom Gill, forestry, member of the NRC Committee
- Luther Terry, Surgeon General
- Thomas Jukes, chemist, American Cyanamid Company
- William J. Darby, Vanderbilt School of Medicine

Resources

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Historical Sources (available in 1963)

Agricultural Chemicals

- "Pesticide sales increase for eighth straight year" (Aug., 1962)
- "Pesticides and the industry are target of one-sided attack" (Aug., 1962)
- Editorial: "A public relations crisis" (Sept., 1962)
- "For the defense: Pesticide authorities speak out" (Sept., 1962)
- "NACA speakers emphasize industry's role in pesticide safety" (Oct., 1962)
- "Communications create understanding" (Nov., 1962)
- Editorial (Nov., 1962)
- "Rachel Carson influence gains momentum as book appears" (Nov., 1962)
- "Scientists score 'Silent Spring'" (Dec., 1962)
- "Bias, misinformation, half-truths reduce usefulness of 'Silent Spring'" (Feb., 1963)
- "Natural insect control measures are grossly inadequate for today's farming" (March, 1963)

- "The impact of pesticides on public health and recreation" (May, 1963)
- Baldwin, I. L. (1962). Chemicals and pests (book review). *Science, 137,* 1042–1043.

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- "The chemicals around us" [viewpoint] (July 14, 1962), p. 5
- "Nature is for the birds" [viewpoint] (July 28, 1962), p. 5
- "Response to criticism" (Aug. 11, 1962), p. 42
- "Bracing for broadside" (Oct. 6, 1962), p. 23

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Monsanto Magazine. (1962, Oct. 4). The desolate year, *42*(4), 4–9.

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Historical Supplements

"News," 1963. http://pesticides1963.net/news.htm

Time magazine: review of *Silent Spring* and other items in the news (Sept. 28, 1962); letters in response (Oct. 5, 1962)

1963 Billboard Top Pop Hits. Rhino Records no. 27158.

For further details on roles and resources, see

http://pesticides1963.net

The President's Advisory Committee on Pesticides, 1963 Teaching Notes

Format and Day Plans

The historical resources assembled for this project may be used in many ways, of course. For example, one may simply discuss the history of the episode or the various perspectives or use documents related to some particular ethical or scientific issue. However, a simulation emphasizes experience as essential. By adopting a role, one understands a particular perspective in depth, while also coming to appreciate how and why other perspectives may differ. Each participant must be provided time to prepare his or her role, to be able to represent that particular perspective in a creative, open-ended exercise.

Everyone reads chapters 2 and 7 of *Silent Spring*. For each role, there is particular guidance, identifying essential chapters in *Silent Spring* and background articles—especially published reviews of *Silent Spring*. Almost all the characters are mentioned in Frank Graham's *Since Silent Spring*. There is also a list of common resources, including some Internet resources. A background essay—which can also be the basis for an instructor's presentation—introduces the history of DDT, Rachel Carson, and her book. Additional information details news items, popular music, and cartoons. These, too, can be used by an instructor to help set the scene in 1963 (say, at the beginning of class).

Like any case study, activities may expand to include more detail or context. The following is a guide to scheduling, with optional extensions noted.

Introduction (one-half to one class period)

(a) *History of DDT*. (~15 mins.) Possibly use text/visuals from the background essay. This may be expanded with more information about agriculture as monoculture, the problems of disease and crop pests, and pesticides used before 1945.
(b) *Optional*: Set the scene by re-enacting the 1948 Nobel Ceremony. The instructor takes the role of Prof. G. Fischer and presents the Nobel Prize to Paul Müller (possibly played by a teaching assistant or designated student). Use the Nobel presentation speech (online), possibly edited. *Optional*: musical fanfare.
(c) *History of Rachel Carson and* Silent Spring. (~15–20 mins.) Possibly use text/visuals from the background essay.
(d) Alternate to (a),(c): Assign background essay to be read independently by students. The aim is not to provide an exhaustive analytical history or biography, but to present information that an ordinary citizen might know about Carson and pesticides in 1962.
(e) *Task Charge*. (~15 mins.) Present the simulation scenario and the

responsibilities of the committee (see project profile). Assign roles, discuss reading and writing assignments and available resources.

Optional: The instructor may adopt the role of President Kennedy and issue the charge directly to students as the committee. This begins to establish the spirit of the simulation and demonstrates for students how role playing works. Note the brief recording of Kennedy on *CBS Reports*.

Preliminary Discussion (optional; one class period)

For added depth in reading *Silent Spring,* allow students to discuss their personal responses to Carson's book, outside a historical context. This may be based on the whole book or selected chapters. Chapter 2, "The Obligation to Endure," features many of Carson's themes about control of nature. Chapter 7, "And No Birds Sing," is about harm to birdlife, echoing the book's title. Such discussion might be used to identify or highlight the themes that can guide the committee's later discussion. A short reaction essay may be required.

Testimony (one class period, depending on class size)

In this phase, each student gives a presentation to the committee based on his or her role. I have students prepare a written position statement in advance, which also becomes the basis for evaluating their work. The paper is to provide an assessment of Carson's claims from each role's perspective (each focusing on certain issues, as highlighted in the role descriptions). They should include any policy recommendations (new administrative rules or actions, new laws, funding requirements, etc.). I typically preview the statements, so that students have feedback comments before presenting information to class.

I limit presentations to three minutes and require a visual to foster development of presentation skills (no note cards allowed).

Optional: Alternatively, such papers may be posted on a shared website and serve as either required background reading (with no presentations) or a reference.

Optional: Students may be allowed, as members of the committee, to ask questions.

To lead the committee, the instructor may adopt the role of Jerome Wiesner (PSAC chair) or it may be assigned to a student as a role (to foster leadership skills).

Proposals and Discussion (one to two class periods)

If not included as part of the testimony phase, students present concrete proposals or recommendations to include in the report to the president. (More recently, to economize on time, I have delved into this activity without extended testimony.) Discussion may be more formally organized—using

the key issues identified in the project profile and listed below as a structure. For example, discussing Carson's overall credibility is an appropriate opening. Alternatively, one may consider specific proposals in turn. The structure, or agenda, may also be established by the person playing Jerome Wiesner, if that role is assigned.

Students may need to decide whether they will work towards consensus (ideal, for working through all conflicts) or some other form of reaching a group decision. The most challenging topic, if adopted for discussion, is Carson's claims about "control of nature": is environmental action beyond pesticides warranted? If so, what?

Some instructors may want students to work on the language and wording of the proposals and, hence, of a final joint report. If so, segments taken from individual position statements (including justification) may facilitate group writing.

See Discussion Guide below.

Presidential Medal of Freedom (optional; one-half to one class period)

The presidential charge may include considering whether Carson should receive recognition (such as the Medal of Freedom) for her public service. This discussion can highlight more dramatically the role of responsible voices and communication style in public understanding of science. Carson's information all came from published sources, yet her emotive style influenced public opinion. Is her work especially significant or deserving of merit for this reason?

Epilogue (one-half to one class period)

When positions in the simulation are well researched, the participants typically echo the findings of the actual 1963 committee. That is, they likely validate most of Carson's claims, but also reaffirm the role of pesticides in modern agriculture, hardly entertaining a ban on DDT or other pesticides. You may refer to the actual report of the President's Science Advisory Committee from May 1963 (http://pesticides1963.net/library/psac1963.pdf).

Equally important, perhaps, may be the fact that despite such recommendations, little action was taken. The political power of agricultural businesses managed to suppress major action until the late 1960s. See

- MacIntyre, Angus. (1987). Why pesticides received extensive use in America: A political economy of pest management to 1970. *Natural Resources Journal, 27,* 534–577.
- Wang, Zuoyue. (1997). Responding to *Silent Spring*: Scientists, popular science communication and environmental policy in the Kennedy years. *Science Communication, 19,* 141–163.

The lesson about science and politics is part of learning about the nature of science, too. An epilogue may also be an occasion to reflect on several

warnings by scientists and scientific organizations, some in the popular press, in the late 1940s and early 1950s. See

- Russell, Edmund. (1997). Testing insecticides and repellents in World War II. In M. Roe Smith & G. Clancey (Eds.), *Major Problems in the History of American Technology* (pp. 399–409). Boston, MA: Houghton Mifflin.

One may discuss why they did not have a cautionary effect at that time.

A retrospective is also a good occasion for discussing gender. Carson's gender was sometimes portrayed as relevant to her credibility, as exemplified in the review in *Time* magazine or other references to "Miss" Carson. One may also discuss whether Carson's perspective was gendered in a way critical to her effectiveness.

One may also wish to view and comment on many of the political cartoons inspired by Carson's work, some included on the website. Also see Paul Brooks's *House of Life.*

Optional: One may also discuss current controversies over (1) the use of DDT in developing nations for control of malaria and (2) the unregulated use of pesticides for individual residences.

Optional Supplements

Various elements may help set the scene in 1963 (for example, as a prelude or opening to class):

- *1963 Billboard Top Pop Hits* (Rhino Records)
- Tom Lehrer's satirical song, "Pollution." See online video (http://www.youtube.com/watch?v=nz_-KNNl-no or http://www.youtube.com/watch?v=XCojBngA--s).
- News headlines

Discussion Guide

As noted elsewhere, discussion may be led by the instructor or by a student in the role of Committee Chair Jerome Wiesner.

The aim is for participants to not merely express their views, but to develop a joint recommendation. Reasoning is central. Thus, one major role of the discussion leader is to ensure that comments clearly articulate the reasons for a particular claim, based on evidence, ethical principles, or other shared values. A helpful standard for facilitators is the tone of a journalistic interviewer, interested in bringing information to light and seeking clarity and elaboration.

Another role of the discussion leader is to ensure that all stakeholder voices are addressed in developing the final decision(s). See Figure 13.1 as a general guide for where to expect, and possibly draw out, particular positions. Students often exhibit a tendency to "correct" history to reflect modern interpretations. The discussion leader can help amplify the contemporary disagreement in 1963. Similarly, the leader can help clarify

Table 13.1. Rachel Carson's supporters and critics, by topic.

	Carson Supporter	Carson Critic
credibility • documentation of sources • reliability of facts • bias/balance of presentation • rhetoric/tone/style	Cole (science) Brown Cottam Bookchin	Diamond Stevens Larrimer? Baldwin (bias) [Jukes, Darby]
harm (non-target species) • insect pollinators • shared habitat • food chain (*fish, birds) • other	Cole Clement Cottam [Wallace, Barker, Rudd]	Stevens Larrimer Baldwin?
benefits (target species!) • crops: food/fiber/ forest • disease control • nuisance/comfort		Rothberg Cole? Diamond Stevens Larrimer Zavon Baldwin Freeman? [Decker, Gill, Jukes, Darby, Simmons]
safety • food (carcinogens?) • worker safety	Cole? Bookchin (Baldwin)	Rothberg? Stevens Zavon Baldwin (workers) [Bean]
insecticide resistance	Brown Cottam Cole?	White-Stevens (alternatives)
indiscriminate use • excess/runoff	Cole Cottam (aerial) Freeman [Gill]	Rothberg [Decker, Gill]
alternatives: • biological (+) • earlier organics (-) • pesticide persistence • research	*Freeman (biol.) [Gill]	Baldwin (wary) [Decker]
balance of nature	Clement	White-Stevens
control of nature	Clement	~Bookchin Cole White-Stevens [Decker]

items of disagreement and actively engage those with contrary perspectives in fruitful exchange.

The leader may wish to clarify, possibly through group discussion, the standards for agreement—consensus, simple majority, two-thirds majority, or other.

The other major challenge for leading discussion in this simulation is helping to deepen the level of discussion, especially where participants may be underprepared. For example, policy proposals may be vague—advocating a position, not concrete actions or remedies that embody that position. Participants may need to be encouraged and supported in developing specifics.

Also, students tend to appeal to easy solutions, such as "we need more research"—thereby avoiding the real issues of managing any current problem. Decisions must often be made under circumstances of scientific uncertainty or incomplete knowledge. Again, one may need to offer further guidance:

- Who pays for the research? How much? (This raises ethical questions about who benefits and who bears risks and costs. It may also help expose the historical problem of incentives.)
- Are biological controls truly practical? (Their specificity and cost, in contrast to cheap, broadbased pesticides, may be easily overlooked.)
- How long will the development of alternatives take? What do we do in the mean time?
- Assuming that participants document errors in the past (such as exceeding recommended dosages, or human error in safe application), why did such errors occur? What problems (and prospective regulations) should be considered at this deeper level? For example, are the problems with the system of agriculture/forestry or insect-pest control? (Here, Carson's arguments about control of nature become relevant. Bookchin may present a case for the economic system and the regulation of industry, echoing some of Carson's statements about big business.)

The accompanying table (Figure 13.1) lists the various issues and maps them to the particular roles.

The Extension Activity, on whether Carson should receive the Medal of Freedom, allows deeper discussion of Carson's rhetoric and persuasive methods, the relationship of her scientific claims to her emotional imagery, the relevance of arguments about the control of nature, and her scientifically unfounded claims about the "balance of nature."