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War on Two Fronts – and the Scientists Who Shaped an Environmental Movement

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Abstract

This paper examines the influence of scientists on the American environmental movement during the 1960s and 1970s. It focuses on distinct yet connected threads of social and political activism – beginning with the bestselling work of science writer Rachel Carson, who called attention to the indiscriminate domestic use of pesticides and herbicides, and set in motion a movement calling for greater government regulation of the chemical industry. It also outlines the lesser-known efforts of academic scientists who opposed America’s use of chemical defoliants in Vietnam. While these scientists focused on different outcomes in opposing the use of chemical defoliants in America and Vietnam during the 1960s, their efforts are viewed as equally notable in sparking an ecological revolution that limited the future use of potentially toxic chemicals.

Keywords: Rachel Carson, chemical defoliants, Vietnam, ecology, environmental movement

Introduction

Throughout their history, Americans have viewed nature with ambivalence. When seventeenth-century Europeans established permanent settlements in the New World, they set out to subdue a vast wilderness and fulfill their divinely-inspired mission. In the centuries that followed, successive waves of frontiersmen, pioneers, and yeoman farmers brought gun and plow to bear in conquering the frontier. Alexis de Tocqueville said of Americans in the nineteenth century that “they may be said not to perceive the mighty forests that surround them till they fall beneath the hatchet” (1990, p. 74). As historian Roderick Frazier Nash wrote in the preface of his seminal work, *Wilderness and the American Mind*, “for most of their history Americans regarded wilderness as a moral and physical wasteland fit only for conquest and fructification in the name of progress, civilization, and Christianity” (2014, p. xx).

Early in the twentieth century, forester Gifford Pinchot and other conservationists inspired a movement to promote the wise use and preservation of natural resources. By mid-century, however, Americans learned that conservation alone would not protect the natural environment. The tools with which post-war America exerted mastery over nature had become increasingly sophisticated – alarmingly so in the eyes of those who viewed technology as advancing faster than man’s sense of responsibility for its application. Hence, an ecological perspective came into prominence in the 1960s focusing on the interconnectedness of living things, as more Americans “began to see man as a part of a community of life, dependent for his survival on the survival of the ecosystem and on the health of the total environment” (Nash, 2014, p. 254).

This paper examines the influence of scientists on the American environmental movement during the rebellious 1960s and 1970s. It focuses on distinct yet connected threads of social and political activism – beginning with the work of bestselling author Rachel Carson, who called attention to the indiscriminate use of chemical pesticides and herbicides and set in motion “the creation of a grass-roots movement demanding protection of the environment through state and federal regulation” (Carson, 2012, p. x). It also outlines the lesser-known efforts of academic scientists who opposed America’s use of chemical defoliants in Vietnam. While Carson and these scientists sought different outcomes and employed different methods, they were similarly effective in swaying public policy. Accordingly, their efforts are viewed as equally notable in sparking an “ecological revolution” that limited the future use of potentially toxic chemicals.

1. A New Environmental Consciousness

The publication of *Silent Spring* in 1962 was an epochal event in the American environmental movement. Its author was acclaimed science writer and ecologist Rachel Carson, who grew concerned about studies in the mid-1940s that suggested the potential danger to birds, fish, and other animals from DDT, a chemical the government used to control the spread of mosquitoes and other insects. During World War II, DDT had been used to prevent lice infestations, and was later applied as an agricultural insecticide in the post-war period. Carson’s work focused on the relationship between living organisms and their surroundings. Writing at a time when the effects of manmade pollution – including

radioactive fallout from atmospheric atomic testing – were beginning to be understood, “the mission of *Silent Spring* became nothing less than an attempt to create a new environmental consciousness” (Gottlieb, 1994, p. 84).

Before *Silent Spring*, the safety claims of the chemical industry had not been directly challenged; nor had serious concerns been raised about the government’s lax regulation of chemicals whose long-term public health effects were not understood. This was before the establishment of the Environmental Protection Agency in 1970, and the manufacturers of pesticides and herbicides touted their products as miracles of modern agriculture – an answer to the quest for increased crop production. While Carson focused primarily on DDT, she also wrote about chemicals used on countless American forests and lawns – including two chemicals in particular: 2,4-dichlorophenoxyacetic acid and 2,4,5-trichlorophenoxyacetic acid (hereafter referred to as 2,4-D and 2,4,5-T). From the early 1950s to the 1970s, these defoliants were used extensively in the United States for weed and forest control.

Developed in the late 1940s, 2,4,5-T had proved effective in regulating or suppressing plant growth. When applied to broadleaf plants it accelerated their metabolism dramatically, in effect causing them to grow themselves to death (Wellford, 1972). In the 1950s, 2,4,5-T became the herbicide of choice among farmers and foresters who used it to eliminate weeds and unwanted shrubs, and to “control undesirable plants in pasture lands” (Gough, 1987, p. 137). Public and private sector institutions used it to clear rights-of-way around rail and power lines and along roadsides. Chemicals offered an inexpensive alternative to more labor-intensive methods of clearing brush by hand.

The popular use of defoliants and pest-control chemicals fueled the phenomenal growth of the chemical industry in the post-war era. By the end of the 1950s, “more than 100 million acres in America, including rangelands, croplands, roadsides, utility corridors, parks, golf courses, and private lawns had been treated with herbicides” (Scheffer, 1991, p. 91). Despite isolated reports of fish, bird, and occasional farm worker poisonings, the public knew little of the environmental effects and potential dangers of chemicals in widespread use at the time (Gottlieb, 1987).

Silent Spring charged that “those engaged in spraying operations exercise a ruthless

power,” but it did not call for the elimination of chemicals. “It is not my contention that chemical insecticides must never be used,” Carson wrote (2012, p. 12). “I do contend that we have put poisonous and biologically potent chemicals indiscriminately into the hands of persons largely or wholly ignorant of their potential for harm.” In so doing, “we have allowed these chemicals to be used with little or no advance investigation of their effect on soil, water, wildlife, and man himself” (Carson, 2012, p.13).

2. Vietnam – The Second Front

The use of defoliants and insecticides in America held ironic significance for events unfolding half way around the world, where the U.S. military launched a chemical warfare program in Vietnam in the same year *Silent Spring* was published. Three years before U.S. ground troops were committed to Indochina, American advisors were working with the South Vietnamese government on strategies intended to halt the advance of Communism. American political and military leaders were convinced that social and geographic conditions in Vietnam required unconventional approaches, if enemy infiltration of the south was to be stopped. As a demonstration of his commitment to counterinsurgency in South Vietnam and its border with Laos and Cambodia, President John F. Kennedy authorized the use of chemical defoliants to deprive communist guerrilla forces of jungle cover (Krepinevich, 1986).

From 1962 through 1971, the U.S. Airforce oversaw a chemical defoliation program using a 50:50 mixture of 2,4-D and 2,4,5-T known as Agent Orange. The goal of Operation Ranch Hand was the elimination of jungle grass and trees that Vietcong and North Vietnamese relied on for protective cover. It was also intended to deny them access to food. The defoliation effort expanded dramatically: from just over 5,600 acres of inland hardwood trees and coastal mangrove forests destroyed in 1962 to more than 1.5 million acres destroyed in 1967. “By the end of the decade, Ranch Hand crewmen had sprayed approximately twenty million gallons of Agent Orange and other chemical herbicides over an area of South Vietnam equal in size to the state of Massachusetts” (Zierler, 2011 p. 16).

In 1970 environmentalist Barry Weisberg described the chemical assault on Vietnam in ecological terms similar to the argument Carson had laid out earlier. Americans in Vietnam, he said, were fighting a war “without really understanding that the ecosystem of Southeast

Asia is one organic fabric in which all living beings are tied together in an infinite number of interdependent strands” (1970, p. 17). It was a degree of damage, he maintained, that might never be accurately determined. He estimated that as much as half the Vietnamese countryside had been subjected to a combination of herbicides, explosive ordnance, or napalm. America’s “destruction of Southeast Asia represents a new and unprecedented strategy, aimed not at the destruction of an enemy, his territory, a food crop or a culture but of an entire ecosystem. This is ecocide” (Weisberg, 1970, p. 18).

Weisberg offered a detailed description of social life in Vietnam – a preindustrial society that stood in stark contrast to the technologically advanced superpower whose weapons were trained on it. The Vietnamese countryside was comprised of small rural villages that had changed remarkably little in the centuries prior to arrival of Americans, and the French before them. Village life centered on families whose primary means of sustenance was rice cultivation. Rice was critical to Vietnamese not only for food, but “the entire spiritual relationship between the people and the natural world” (1970, p. 25).

For Vietnamese farmers, rice was a key to cooperation within their own communities and with neighboring villages as well. The primary physical manifestation of this connection between villages was a complex hydraulic irrigation system, borrowed from the Chinese, permitting water from higher rice paddies to flow to lower regions in the Mekong Delta. Weisberg maintained that American bombing had destroyed the irrigation system throughout much of the southern part of the country, with resulting crop failures contributing to the breakdown of family and community systems. Thousands were uprooted from their ancestral homelands and forced to the city to survive. The bombs and chemicals, he said, severely damaged the environment and the culture by severing villages from their “physical and spiritual foundation” (1970, pp. 24-25).

Weisberg cited evidence from Vietnamese sources indicating extensive damage to the soil where herbicides had been sprayed. By depriving the forest floors of decomposing vegetation, chemicals had rendered fertile soil as hard as rock, adversely affecting agricultural productivity in the rice-rich Mekong Delta (1970, p. 20). To illustrate the damage, he explained that in 1964 Vietnam exported more than 48,000 million metric tons of rice. A year later the damage from defoliation and bombing necessitated the importation of five

times that amount of rice for food (1970, p. 24).

3. Academic Scientists Respond to Chemical Warfare

According to historian David Zierler (2011), the word “ecocide” was coined by plant biologist Arthur Galston, chair of the Department of Botany at Yale University, and a leading critic of herbicidal warfare. At an academic conference in 1970 examining alleged war crimes committed by the United States in Vietnam, Galston took part in a panel discussion titled “Technology and American Power,” and offered the following assessment:

After the end of World War II, and as a result of the Nuremburg trials, we justly condemned the willful destruction of an entire people and its culture, calling this crime against humanity *genocide*. It seems to me that the willful and permanent destruction of environment in which people can live in a manner of their own choosing ought similarly to be considered as a crime against humanity, to be designated by the term *ecocide*. I believe that the most highly-developed nations have already committed autoecocide over large parts of their own countries. At the present time, the United States stands alone as possibly having committed ecocide against another country, Vietnam, through its use of defoliants and herbicides (2011, p. 19).

Galston was part of a growing group of academic scientists who criticized the military’s use of herbicidal chemicals in Vietnam in the 1960s. But while he and other scientists opposed chemical warfare on ecological and moral grounds, they did not see themselves as part of the broader environmental or antiwar movement; rather, they coalesced in opposition to the tactic of herbicidal warfare, with the goal of prohibiting use of increasingly sophisticated chemical weapons in future wars. They patterned their case on the work of other scientists who had succeeded in forcing an end to the atmospheric testing of nuclear weapons, despite government assurances that radioactive contamination from such testing posed no health risks to humans. Similarly, the scientists who denounced the use of chemical warfare in Vietnam were challenged by officials who cited the widespread domestic use of 2,4-D and 2,4,5-T as evidence of the chemicals’ harmlessness to humans. By 1970, however, the environmental case built by Galston and his colleagues was strengthened by an understanding of the scale of environmental destruction in Vietnam and “the possibility that

the United States had exposed millions of people – including its own soldiers – to potentially cancer-causing chemicals” (Zierler, 2011, p. 16).

Despite the publication of *Silent Spring*, which had focused on the domestic use of chemicals by government agencies and agribusiness, herbicidal warfare was not a mainstream issue when American combat forces were sent to Vietnam in 1964. Nevertheless, as Zierler notes, “Operation Ranch Hand manifested virtually all the warnings laid out by *Silent Spring*. By the end of the decade, it reached a scope that Carson could not have imagined, and it did so in a land far removed from rural America” (2011, p. 94). While many in the scientific community did not oppose the American use of chemical defoliants in Vietnam, including those who supported related weapons research, that began to change as early as October 1964, when an editorial in the *Bulletin of the American Scientists* denounced America’s “first use” of chemical weapons.

The following year, the American Association for the Advancement of Science (AAAS), began focusing on herbicidal warfare in Vietnam. The organization was uniquely positioned to take up the issue, given its long history of commenting on policy issues. Following the use of atomic bombs in Japan in 1945, for example, it sought to check the “conscious exploitation of science for military advantage” by promoting the impact of science on “human welfare” (Zierler, 2011, p. 97). At its annual meeting in 1965, the AAAS adopted a resolution indicating that scientists bore a special responsibility for opposing the war: “Like all scholarship, the sciences cannot fully flourish, and may be badly damaged, in a society which gives an increasing share of its resources to military purposes” (Zierler, p. 99).

In 1966 a group of plant physiologists, led by Arthur Galston, sent a letter to the White House urging President Lyndon B. Johnson’s reconsideration of the herbicide program he had inherited from Kennedy. The message questioned the “ecological safety” of defoliation and expressed concern that “biologists who knew the most about herbicide science were kept in the dark about the program” (Zierler, p. 102). The scientists made clear that they were not offering political or military advice; rather, they sought to explain the “ecological interconnectedness” of widespread chemical spraying in Vietnam:

We would assert in the first place that even the most specific herbicides known do not

affect only a single type of plant. Thus a chemical designed to defoliate trees might also be expected to have some side effects on other plants, including food crops. Secondly, the persistence of some of these chemicals in soil is such that productive agriculture may be prevented for years into the future, possibly even after peace has been restored. Thirdly, the toxicology of some herbicides is such that one cannot assert that there are no deleterious effects on human and domestic animal populations. It is safe to say that that massive use of chemical herbicides can upset the ecology of an entire region, and in the absence of more definitive information, such an upset would be catastrophic (Zierler, pp. 102-103).

Continued pressure from AAAS scientists prompted an assertion from a Department of Defense (DOD) spokesperson that “qualified scientists” in and out of government service had determined that herbicide use in Vietnam would not have adverse consequences. The DOD commissioned the Midwest Research Institute in Kansas City, Missouri, to assess the ecological impact of herbicide use by conducting a literature review of some 1,500 scientific papers. The report, completed near the end of 1967, did not involve field testing in the war zone and “could not provide conclusive answers about the long-term effects of chronic exposure to herbicides on the ecological system or on the population” (Institute of Medicine, 1994, pp. 29-30). Predictably, the report did little to assuage the concerns of AAAS members.

Two on-site surveys to assess the herbicidal damage in Vietnam were undertaken by scientists in the last years of the 1960s. The first was conducted by a tropical ecologist with the U.S. Agricultural Research Service who toured the countryside for a month in 1968. Fred Tschirley noted the “total denuding and near-total killing of trees seen in the mangrove areas,” which were particularly “important economically and ecologically as breeding grounds for fish and as habitats for birds and other animals” (Gough, 1987, pp. 55-56). But where Tschirley found “little evidence” of long-term ecological damage from defoliants, the second field study conducted found the effects to be “very severe.” That study was led by E.W. Pfeiffer of the University of Montana who, like Galston, had been openly critical of Operation Ranch Hand. Given his opposition to the use of chemical weapons, Pfeiffer’s report was politically charged and subject to criticism by scientists who “questioned the validity of his findings based on merely two weeks of field work, and suggested that an academic scientist had no business protesting wartime tactics, especially in wartime” (Zierler, 2011, p. 121).

There was no substantial change in policies governing the use of chemical herbicides in the U.S. and Vietnam until 1969, when the results of a Bionetics Research Laboratories study of 2,4,5-T indicated a correlation between the chemical and stillbirths and malformations in laboratory mice. The report proved especially damning when it was revealed that U.S. government and chemical industry officials had been aware since 1966 that the Bionetics report suggested the potential health dangers of Agent Orange to humans, and prevented the information from being disseminated (Zierler, 2011, p. 123). After these findings were made public, the Department of Agriculture moved to restrict the domestic use of 2,4,5-T around residential homes in the U.S.

In the 1972 book, *Sowing the Wind*, consumer advocate Harrison Wellford alleged that the U.S. government had suppressed the Bionetics report because it delegitimized a tactic that political and military leaders believed was important to the war effort. It also jeopardized a source of revenue on which chemical companies relied. Because the findings had alarming implications for millions of people exposed to 2,4,5-T in the U.S. and Vietnam, Wellford maintained that “the government clamped a policy of strict secrecy on the report” and concealed it from the public and greater scientific community for three years (1972, p. 197). Further, he cited evidence of American and South Vietnamese government efforts to cover up the effects of herbicide spraying on the civilian population in Vietnam. In 1969 several Saigon newspapers published articles and photographs of deformed children, said to have been born to mothers who lived in areas sprayed by American planes. The newspapers were promptly shut down and officials in Saigon refused to answer reporters’ questions (1972, p. 195).

Under increased pressure following the release of the Bionetics report, the Department of Defense allowed a group of AAAS scientists to conduct the most comprehensive field research undertaken to that time. In early 1970 members of the AAAS established the Herbicide Assessment Commission (HAC) “to assess the effects of large-scale use of herbicides on the environment and population of Vietnam” (Institute of Medicine, 1994, p. 30). The HAC research plan called for the collection of soil and animal samples and interviews with Vietnamese village leaders to determine when and where the local population had come into contact with Ranch Hand spraying operations. The scientists understood that their research “would only begin the monumental task of a full ecological and epidemiological

study of herbicidal warfare” in Vietnam, a task complicated by the Pentagon’s “steadfast refusal” to reveal such basic details as a list of areas sprayed and the concentrations of chemicals used (Zierler, 2011, pp. 130-131).

Given the absence of reliable data, the HAC mission ended “inconclusively” on the question of human health effects, but the “scientists did confirm that, whatever the actual health effects of Agent Orange, the U.S. military had failed to isolate spray missions from civilian-occupied areas.” The Commission’s report also confirmed “massive and potentially irreversible damage sustained by the ecology of South Vietnam” (Zierler, p. 132). The resulting media attention thrust the controversy into the spotlight, and in 1970 the Department of Defense suspended use of Agent Orange in Vietnam. The following year Operation Rand Hand was cancelled (Gough, 1986, p. 5).

4. Agent Orange and Dioxin Controversies

With the withdrawal of American combat soldiers from Vietnam in 1973, the American public’s concern with herbicidal spraying subsided. But the controversy reemerged when war veterans started showing up at Veterans Administration hospitals with symptoms ranging from rashes and headaches to more serious health conditions, including various forms of cancer (Cecil, 1986, p. 166).

In 1978 two television events raised public awareness of Agent Orange and the dangers of chemical exposure. The first was a documentary called *Agent Orange, the Deadly Fog*, produced by a CBS affiliate in Chicago. The documentary was born out of the experiences of a benefits counselor at the VA hospital in that city who, beginning in 1977, had spoken to a growing number of veterans who believed their cancers and related illnesses were caused by exposure to chemical defoliants in Vietnam. The counselor began gathering information on family health histories from veterans who came to the hospital for treatment. Fearing the high cost of treatment for health conditions that could not be directly linked to herbicide exposure in Vietnam, the Veterans Administration denied responsibility.

The second event occurred when a helicopter crew chief, who had flown numerous missions in Vietnam, appeared on a popular television morning interview show and

announced: “I died in Vietnam, but I didn’t even know it.” Paul Reutershan told the audience that he “flew almost daily through clouds of herbicides being discharged from C-123 cargo planes, and how he observed the dark swaths cut in the jungle by the spraying.” He said he was told by commanders that Agent Orange was “relatively nontoxic to humans and animals.” When he returned to America, Reutershan was diagnosed with cancer, and died in December 1978 at age 28 (Institute of Medicine, 1994, p. 33).

A full accounting of resulting product liability litigation is beyond the scope of this paper. To summarize, a class-action lawsuit was eventually brought against five American chemical manufacturers for failing to inform the government of the potential toxicity of chemicals, and in 1985 an out-of-court settlement was reached establishing a \$180 million fund for veterans (Institute of Medicine, pp. 34-35). The settlement did not acknowledge industry liability, and no direct relationship was established between exposure to Agent Orange and adverse health effects. Indeed, Dow Chemical executives had rejected the Bionetics findings, and claimed that “dioxin, a toxic by-product created during production of 2,4,5-T, was likely responsible for the mutations – not the herbicide itself” (Zierler, 2011, p. 123). Nevertheless, in 1983 the company announced that it would stop making the chemical, due to negative publicity surrounding its use (Gough, 1987, p. 237).

The company’s decision was also related to several environmental “incidents” in the U.S. which led the Environmental Protection Agency to ban the domestic use of 2,4,5-T in 1979. One was the contamination of Times Beach, Missouri, by dioxin in the early seventies. The other was public outcry over the spraying of forests around Alsea, Oregon in the mid-seventies, stemming from concerns over the effects of such spraying on pregnant women (Institute of Medicine, 1994, p. 39). These events are summarized here briefly to juxtapose the chemical war in Vietnam, which had just ended, with the environmental “war” that continued to be waged on the domestic front.

The contamination of Times Beach is illustrative of ecological interconnectedness: how seemingly isolated actions involving chemicals have been found to create chain reactions with deadly effects. In the early 1970s, the manufacturing processes of the Northeast Pharmaceutical and Chemical Corporation of Verona, Missouri, generated considerable amounts of by-products, including dioxin-tainted water and waste oil. In the process of

disposal these chemical wastes were passed to recipients who were unaware of the toxic nature of what they were dealing with. Thus, it happened that in May 1971 a horse ranch north of St. Louis contracted to have an arena sprayed with waste oil (to keep dust to a minimum), unaware that the product used had come from Northeast Pharmaceutical. Within days of the spraying, scores of horses died and ranch hands became sick. The Centers for Disease Control eventually traced the problem to its source, but not before the same thing happened at other ranches in Missouri (Allen, 2004).

The extent of the problem came to the public's attention in the wake of the Times Beach disaster. There, over a four-year period in the mid-seventies, the small town sprayed 23 miles of dirt road with waste oil, effectively poisoning a wide swath of countryside. Eventually, the town was declared uninhabitable, the federal government purchased the property, and it was abandoned.

Events in Alsea, Oregon, proved equally difficult to trace and document. Still, what happened there was convincing enough to pressure the government to first curtail and eventually ban the use of 2,4,5-T in America. Until 1979 the herbicide was used routinely by timber companies and the U.S. Forest Service for forest management. But in 1977 a teacher named Bonnie Hill, who had recently suffered a miscarriage, saw a film suggesting that dioxin had been known to cause "spontaneous abortions" in monkeys (Gough, 1986, p. 139). Hill identified and interviewed eight other Alsea women who had miscarriages in the seventies, and established an unsettling connection between the homes of the women and the times and locations of nearby forest spraying by authorities (Institute of Medicine, 1994, p. 42).

EPA studies were unable to conclusively link the spraying of 2,4,5-T with the nine women in Alsea and, in the absence of tangible evidence, local government authorities and chemical companies criticized the agency for relying on incomplete data. Still, the Alsea incident focused citizens and the federal government on the potential dangers of 2,4,5-T use in inhabited areas. The herbicide's days in the U.S. were numbered.

5. Philosophical Underpinnings of Environmental Activism

As outlined in this paper, public understanding of the ecological dangers of chemical pesticides and herbicides in the 1960s stemmed from the collective actions of scientific activists who opposed the use of chemical weapons in Vietnam. The “ecological revolution” that took shape in that decade was also rooted in Rachel Carson’s “philosophical challenge to the *anthropocentrism* of Western culture.” As George Sessions noted, the broader message of *Silent Spring*, and the scientific, social and political movements it hastened, was the “move from anthropocentrism to ecocentrism” through environmental activism (1995, p. iv).

The 1960s were a decade of sweeping rebellion, and the threads of social movements tied to civil rights, feminist, and anti-war activism were tied to the environmental movement in complex ways. As Victor Scheffer observed in *The Shaping of Environmentalism in America*:

The sixties and early seventies were shocking times. Future historians may find it hard to envision the anger released as elements in our society fought to win freedom of opportunity and constitutional rights for themselves and others. They struggled to change outmoded attitudes and institutions. They set themselves against received authority. They demanded that scientists and technologists rise from their workbenches to accept social responsibility. The ferment of the times would later be called the liberations movements. The environmental movement, while peripheral to those others, attracted many of the same activists: the thoughtful kinds who in every generation have seen no distinction between injustice to men and injustice to the earth. What the environmentalists and liberationists shared in common was a fierce devotion to moral principles (1991, p. 16).

An important intellectual influence on social activism was philosopher Herbert Marcuse, German-born celebrant of the Frankfurt School of critical theory, and “one of the gurus of the environmental movement” (Scheffer, 1991, p. 18). Marcuse struck a chord among anti-war activists who saw America’s actions in Vietnam as the work of an industrial society bent on domination and destruction. In *One-Dimensional Man* he cautioned, “If we attempt to relate the causes of the danger to the way in which society is organized and organizes its members, we are immediately confronted with the fact that advanced industrial society

becomes richer, bigger, and better as it perpetuates the danger. The defense structure makes life easier for a greater number of people and extends man's mastery over nature" (1964, p. ix).

Marcuse believed it was the tendency of industrialized societies to use technology as a means of domination, an idea that fueled students' rejection of America's involvement in Vietnam. The most vexing aspect of advanced industrial civilization, he argued was "its productivity and efficiency, its capacity to increase and spread comforts, to turn waste into need, and destruction into construction" (1964, p. 9). He saw social change as an essential contribution of the environmental movement, and encouraged young people to transform institutions responsible for the ecological pollution of the planet (Scheffer, 1991, p. 18).

Another intellectual who focused on environmental challenges in post-war America was ecologist Murray Bookchin, who also wrote under the name Lewis Herber. His book, *Our Synthetic Environment*, also published in 1962, was not as widely read as *Silent Spring*, but it too questioned the use of technology by industrial societies. Bookchin's conception of "synthetic environment" involved the "restructuring of agriculture, the annual introduction of hundreds of new chemicals into the market, the ominous rise of nuclear energy and nuclear military weaponry, and the rapid escalation of pollution and waste disposal" (Gottlieb, 1993, p. 87). These developments amounted to what he termed "human biological warfare."

Bookchin viewed industrial society as no longer defined by constraints of economic scarcity, as in classical economic theory. Instead, he characterized modern society in terms of "conditions of post-scarcity," which found logical application in America's approach to agricultural production as well as war. Both farmers and soldiers used technology to sow their respective payloads. In *Post-Scarcity Anarchism*, he wrote:

The real symbol of modern agriculture is not the sickle (or, for that matter, the tractor), but the airplane. The modern food cultivator is represented not by the peasant, the yeoman, or even the agronomist-men who could be expected to have an intimate relationship with the unique qualities of the land on which they grow crops – but the pilot or chemist, for whom soil is a mere resource, an inorganic raw material (1971, pp. 88-89).

The modern industrial visions of Marcuse and Bookchin were given further credence in Theodore Roszak's treatise on the 1960s, *The Making of a Counter Culture*. Roszak described a social system that had given rise to leadership at the Defense Department of Robert S. McNamara, the quintessential organization man from the Ford Motor Company. McNamara's "technocratic society" was one in which bullets and bounty coexisted naturally. Modern industrial society, wrote Roszak, has "given us a proficiency of technical means that now oscillates absurdly between the production of frivolous abundance and the production of genocidal munitions" (1969, p. 13).

While Marcuse and Bookchin were deeply skeptical of a culture subject to the coercive whims of an industrial elite, the "technocratic children" of Roszak's imagination held in their hands the capacity for transformative activism. Thus, 1960s liberationists were America's hope for a better future through generationally motivated change: "the alienated young are giving shape to something that looks like the saving vision our endangered civilization requires," he wrote (1969, p. 7).

It was not the future, but a desire for a return to the peaceful simplicity of America's agrarian past that found expression in one of the most symbolic environmental protests of that tumultuous decade. In 1969 a group of protesters took over a plot of land slated for development into a parking lot at the University of California, Berkeley, and transformed it into a community garden. According to sixties chronicler Todd Gitlin, thousands of people participated in the beautification of the "People's Park" over a period of several weeks, including students, professors, neighbors and parents (1987, p. 355). They planted trees and put up tables and benches. "The creation of People's Park," Gottlieb wrote, "became noteworthy as an act of defiance against a dominant institution and for its pursuit of the idea of environmental transformation" (1993, p. 102).

While the People's Park symbolized "the establishment of a liberated environmental zone," it held subtle differences in meaning for protesters. Gitlin suggests that for some it represented an expression of Native American affinity for the land, both culturally and politically. Some saw it as a spiritual refuge from industrial development, while others saw it as a fitting response to white occupation of Indian lands centuries before. University instructors used it as a setting for teach-ins focusing on environmental issues, while others,

including poet Gary Snyder, used the park to argue the belief that “trees were like other exploited minorities, such as blacks, Vietnamese, and hippies” (Gottlieb, p. 102).

But like the waning enthusiasm for radical activism, the park did not last. California Governor Ronald Reagan called in the National Guard, ordered the gardens bulldozed, and had a fence erected around it. On-campus rallies organized by the Berkeley student government led ultimately to the death of one demonstrator from buckshot wounds (Gitlin, 1987, p. 357). It seemed an appropriately violent ending to a violent decade. Comparisons between the war in Vietnam and the repossession of the People’s Park were inevitable. To state authorities, students were reminiscent of Communist “insurgents” occupying disputed jungle territory. If protestors had briefly recreated a piece of bucolic rural village life, it would soon be paved over in the name of progress.

6. Earth Day Co-opted

As the 1960s ended another environmental milestone was observed prior to the withdrawal of American troops from Vietnam. Earth Day was a national day of ecological recognition set for April 22, 1970 – one week after the Defense Department announced the suspension of herbicide spraying in Vietnam. According to Gottlieb, organizers hoped to make it as non-confrontational as possible to keep from alienating the middle class. For proponents of environmental radicalism, this suggested “a shift in focus from a critique of the urban/industrial order and its polluters to individual lifestyle issues.” For New Left and counterculture advocates who favored a more activist approach to social awareness, efforts of Earth Day promoters to obtain “the blessing of the press, government, and even industry seemed a betrayal of the search for alternatives” (1993, p. 107).

More troubling from the standpoint of radical and even moderate environmentalists was an attempt by President Richard Nixon’s administration to coopt the environmental issue by advancing a “technology-centered” approach to pollution control. In his 1970 State of the Union Address three months before Earth Day, Nixon told Americans that it was time to “‘make our peace with nature’ through ‘reparations for the damage we have done to our air, to our land and to our water.’” Environmentalists were struck by the disingenuousness of an administration that could profess such concern for nature while championing pro-

development causes like the Alaska oil pipeline (Gottlieb, pp. 108-109).

As media focused on the approach of Earth Day, even corporate America jumped on the bandwagon. Perhaps fearing that they might soon be targeted for regulation, companies in the paper, chemical, and utility industries trumpeted their individual efforts to protect the environment through newer and cleaner technologies. Ironically, some of the same companies responsible for the manufacture of chemical sprays mailed financial contributions to Earth Day organizers (Gottlieb, p. 110).

The events of Earth Day were as varied as the motivations of individual and group participants. In Oregon and Illinois, for example, university students protested, disrupted speeches, and reacted with hostility toward government and industry representatives in attendance. Nixon's Secretary of the Interior was shouted from the stage at the University of Alaska, where he attempted to describe the administration's support of the oil pipeline. But there were quieter, more orderly observations of the occasion throughout the country as well. Some demonstrations served as peaceful reminders that the radical activism of the sixties had passed. Earth Day was seen as a "transitional event" that suggested a shifting national mood (Gottlieb, p. 111).

Conclusion

The 1970s offered hope for a more enlightened approach to environmental issues. The establishment of the Environmental Protection Agency and passage of the Clean Air Act – both in 1970 – suggested a more proactive role by the federal government in safeguarding public health. That same year, the U.S. Department of Agriculture suspended use of 2,4,5-T "around homes, recreation areas, lakes, and ponds, and canceled registration for the domestic use of 2,4,5-T, except for pastures and ranchlands." In 1979 the EPA prohibited its use in the United States altogether (Institute of Medicine, 1994, p. 39).

Amid such signs of progress, attempts to establish a direct link between America's use of chemical defoliants and any long-term environmental damage and effects on human health in Vietnam, were unsuccessful. In 2005 a case brought by Vietnamese nationals seeking damages from American chemical manufacturers for alleged health and ecological

damages stemming from Operation Ranch Hand was rejected by an American court. The U.S. Supreme Court later denied plaintiffs' request for an appeal (Zierler, 2011, p. 13).

This paper has focused on the scientists who opposed the massive application of chemical herbicides in America and in Vietnam in the 1960s and 1970s. As thought leaders and activists in the broader environmental movement, Rachel Carson and the academic scientists focused on separate parts of the same problem, and their methods differed significantly. Carson challenged and changed the public's understanding of the indiscriminate and potentially harmful spraying of herbicides and pesticides by government agencies and agribusiness. More than a half century after its publication, *Silent Spring* is still regarded as one of the influential books of the twentieth century, and a classic of the environmental movement.

The scientists who hastened the end of herbicidal warfare in Vietnam were no less influential in forcing a sweeping change in policy. Drawing on the influence of professional organizations, including the American Association for the Advancement of Science, they opposed the policy of herbicidal warfare in 1964 and eventually won the right to survey its impact in Vietnam in 1970. In the years that followed, they successfully lobbied Congress to limit the use of chemical weapons and eventually influenced President Gerald Ford's decision to renounce America's first use of herbicides in future wars.

Rachel Carson died of terminal cancer in 1964, at the age of fifty-six, and did not live to see the unfolding of America's "herbicide controversy" in Vietnam. Had she lived she would likely have joined other scientists in condemning the policy of chemical warfare. Though she and her colleagues were not direct participants in the virulent campus protests of the 1960s, they stirred the consciousness of a generation and left a legacy of environmental progress in the face of what Roderick Nash called "the self-destructive tendencies of an excessive civilization" (2011, p. xxi).

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