Book Reviews

Hopeful Efforts

The Rainmakers. American "Pluviculture" to World War II. CLARK C. SPENCE. University of Nebraska Press, Lincoln, 1980. x, 182 pp. + plates. $15.95.

In this delightful history of rainmaking in America, Clark Spence demonstrates how credulous people can be when they are faced by natural adversity during an era of popular faith in scientific and technological progress. His "pluviculturists," whose customers were mainly farmers, relied usually on one of five basic propositions, claiming that rain could be made by creating an upward movement of warm, moist air; by explosions, in the concussion theory; by releasing chemicals into the atmosphere from the ground, the approach of the "smellmakers"; by adding or removing electricity from the air; or by salting the clouds.

In the first category was James Espy, an important early American meteorologist. Espy concluded correctly that warm air rises, expands, cools, and condenses until rain eventually falls. To expedite the process, he suggested that 40 acres of timber every 20 miles for several hundred miles from south to north be burned weekly during the summer. Other exponents of the theory recommended a number of bizarre ways to create rainmaking air columns. The concussionists derived their theory by associating thunder with rain showers and from a belief that rain accompanied the explosion of gunpowder during battles. Daniel Ruggles's patented system used inexpensive balloons carrying explosives that were detonated in certain clouds determined "in conformity with the Darwinian theory, by selection." Congress, largely through the influence of a single senator, appropriated funds to conduct experiments on the boom-boom principle. They were directed by a patent attorney, Robert Dryenforth, wearing cavalry boots. Dryenforth cannonaded the skies for two years, until an obvious failure earned him the nickname "Dryhenceforth." Weather modifiers of the smellmaking persuasion kept their theories and instruments secret because, one said, his machine was simple enough to be duplicated easily, and if just anybody could make rain (a journalist remarked) "the infidels would spoil all the camp-meetings and the church people ruin the horse races." While Charles Hatfield, the most famous rainmaker of this school, was at work in San Diego, a dam collapsed and flooded the city. A farmer thought Hatfield's operation smelled like "a limberger [sic] cheese factory . . . so bad that it rains in self defense." A promoter of the "electric" theory allied himself to a university chemist, whom he bilked, and a university physicist, whom he discharged as incompetent. The idea was to sprinkle electrically charged sand on the clouds from an airplane. Later rainmakers wanted to seed clouds with a variety of "hydrophilous" substances, until the modern discoveries of Irving Langmuir and Vincent Schaefer began a new chapter in the history of weather modification.

William F. Wright's rainmaking funnels. "Wright . . . explained his rainmaking theories in a book in 1898. A 'vortex spiral vibrational action' split molecules of water into gaseous elements. The firing of mortars, with special funnels attached to induce a spiral current, would produce a chemical reunion of hydrogen and oxygen to form rain. One problem was that firing blew the funnels off; another was that he was unable to obtain funds to continue his experiments, although he claimed showers as a result of a barrage of twenty-four mortars in the summer of 1901." [From *The Rainmakers*. Courtesy of Nebraska State Historical Society]

Spence draws a number of conclusions. The rainmakers were a socially heterogeneous lot who had one thing in common: they were persuasive salesmen. Espy the scientist was called by a contemporary "one of the best lecturers that ever appeared—living or dead." Rainmakers also appreciated the importance of overstatement and the need for timing, which was often based upon government weather forecasts and knowledge of local weather patterns. Many pluviculturists believed in their theories. Widespread gullibility was a reason for their success, but so was helplessness in the face of natural calamity, a commitment to technological solutions, and a willingness to innovate. Modern meteorology proceeded independently of the rainmakers, just as modern medicine owes little if anything to 19th-century medical quackery.

Recurring problems in the history of science policy appear throughout the book. The participation of established institutions and "licensed" scientists in scientifically questionable practices confused the public. Drawing precise, unwavering lines, for policy purposes, between quackery and incomplete science was difficult. Expert advice was ineffective when journalists preferred to report spectacle and miracle and when the public suspected the presence of bureaucratic self-interest. Interagency rivalry was sometimes a hindrance to the ratio-

nal pursuit of science; although the Weather Bureau was critical of the efforts, the Army and a special unit of the Department of Agriculture sponsored rainmakers anyway. Finally, in Spence's words, "Rainmaking . . was not fitted into the legal framework of the country." It still is not.

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Early Environmentalism

Pollution and Reform in American Cities, 1870–1930. MARTIN V. MELOSI, Ed. University of Texas Press, Austin, 1980. xii, 212 pp. $15.

The "first American environmental crisis," the unifying theme of this book of essays, was produced by the same 19th-century technological changes that accelerated the transition from a rural, agrarian society to an urban, industrial one. It was an often misunderstood by-product of applied science that occurred at a time when scientific knowledge was undergoing dramatic change. Once the relationships were better understood scientifically, society demanded that the deterioration in the "quality of life" be reversed. Increased pollution was unacceptable, but so were decreased industrial production and urbanization, both of which were viewed as contributing to a rising standard of living.

Martin Melosi has assembled an interesting collection of historical essays that do indeed "fill a void in the study of the American city." The essays are written at a level accessible to general readers, and the material presented should be considered by anyone concerned with or about pollution.

The book begins with an essay by the editor in which he relates pollution to such factors as the use of coal, the factory system, and growing concentrations of industry and people. He then discusses the response of the Progressive Era to the growing pollution problem. At first, reform was aimed at obvious, specific health hazards. Over time, reformers, both individuals and groups, gained a wider perspective. In general, abatement was sought through public policy actions; on occasion reformers set about to change industrial operations, nuisance laws, and municipal services. The primitive state of local government complicated matters. The idea of requisite municipal services as a complete package was not well developed, and, in any event, its implementation was beyond the financial capabilities of most late 19th-century cities. Nonetheless, reform sometimes did come from within a city's public works and health departments.

Melosi's introduction is followed by a section composed of five narrative histories of specific urban pollution problems and the response to them. Stuart Galishoff's study of water supply emphasizes the experience of three cities: Atlanta, Chicago, and Newark. He identifies businessmen and public health officials as the leaders of the movement for improved urban water supplies. Joel Tarr, James McCurley, and Terry Yosie in their study of sewage disposal discuss how improvements in urban water supply systems and the shift to the water-carriage system for waste water removal entailed a considerable increase in urban sewer investment. After a brief discussion of the health effects of the water carrier technology, the authors turn to the development of water quality policy in the years 1900–1930. They examine the positions of public health officials at both the state and federal level and the positions of the leading sanitary engineers. Dale Grinder's study of smoke pollution emphasizes political and legal elements. He identifies women's groups, engineers, and civic groups as the most active supporters of smoke abatement. Melosi's second essay is a history of efforts pertaining to solid wastes. He identifies a set of supporters similar to those involved in the antismoke campaigns. In particular, he focuses on the career of George Waring, a sanitary engineer, whose appointment as street cleaning commissioner of New York City in 1895 "was the major turning point in the development of modern refuse management." The fifth essay is Raymond Smilor's study of noise pollution. His discussion of reform first centers on the work of Julia Barnett Rice, president of the Society for the Suppression of Unnecessary Noise in New York City. He then notes that by 1920 reformers were likely to be drawn less from civic groups and more from the scientific and technological communities. Here he concentrates on the New York City Noise Abatement Commission, appointed in 1929.

In each essay reform is viewed primarily from the perspective of the reformers. This focus may overstate the case for reform, and Melosi notes, "The environmental reformers perhaps faulted in the direction of exaggerating a potential threat, but that was certainly preferable to a lack of caution." The reformers' emphasis was on the problem, not necessarily the solution. In many cases, the alternatives to the status quo were not articulated clearly by the reformers, and consequently they are left implicit in these essays.

All the essays speak to the multidisciplinary nature of pollution problems, but the notes that accompany each essay and the concluding bibliography contain few references to the present-day natural and social science literature on pollution, a literature that emphasizes the need to consider alternatives. One result of the reliance on historical materials is that these narratives raise issues they do not address. The following quotation from the 1932 New York City study on city noise, cited by Smilor, is representative: "If man came first in the mind of man, noise abatement would be effective in a week. But the machine comes first and it is simpler for the machine to make noise." Environmental improvement, Smilor notes, "would require sacrifices and a dramatic shift in priorities." But what are the sacrifices? What priorities are affected and in what ways? Compromise is necessary; there are trade-offs to be considered, in this case between the social costs of pollution and the social benefits of urbanization and industrialization. Most of the essays discuss some of the factors that would have to be taken into account in addressing such issues, but readers must draw their own conclusions.

The final section of two essays examines two groups that played a significant role in the reform movement: municipal engineers and women. Stanley Schultz and Clay McShane focus on the professional response to the public's demand for environmental improvement. This came from municipal engineers who demonstrated that solutions to these problems lay in physical and technological innovations. That some of these solutions were at best temporary is often attributable to the overwhelming growth rates experienced in many turn-of-the-century cities. The authors discuss how the initial success of sewage campaigns lent weight to the engineers' solutions. Continued monitoring of these solutions contributed to the professionalization of urban government; the first generation of city managers were drawn from the ranks of municipal engineers. Suellen Hoy highlights the role of particular women and women's groups in shaping and articulating the public demand for improvement. Hoy's essay is an important piece of women's history, and the efforts she describes were an integral part of environmental history, as several of the earlier essays in the book