
Henry Ford Reading *Iron Age*
Henry Ford, Industrial Ecologist
or Industrial Conservationist?
Waste Reduction and Recycling at the Rouge

by
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American automakers claim to have finally gotten religion. The religion they are touting is “industrial ecology,” the idea that manufacturers assume responsibility for the environmental consequences of their products by adopting product designs and manufacturing processes to minimize these impacts by prior intent rather than by dealing with unintended consequences at the behest of angry regulators and the public.¹ Like many concepts in the business world, industrial ecology passes for an innovation. Some of industrial ecology’s component ideas and practices have a much longer history, however. Nowhere is the relevant earlier history more evident than in the case of Henry Ford and the Ford Motor Company’s famous Dearborn, Michigan, River Rouge complex during the 1920s and 1930s.

The Rouge was the greatest example of vertical integration in American industrial history—a facility where, as Ford’s publicists bragged, raw materials were turned into finished automobiles driven

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from the final assembly line in just twenty-eight hours. The magnitude and variety of industrial processes conducted at the twelve-hundred-acre site posed tremendous waste-disposal challenges for Ford’s plant engineers. Yet during the 1920s and 1930s, one of the principal goals of industrial ecology—the design of raw material and energy flows to minimize waste in manufacturing—was probably carried further here than at any other industrial site in the world. In fact, the zeal with which Ford’s engineers pursued waste reduction at the Rouge and the scale of their efforts are remarkable even by today’s standards. The Ford commitment to waste reduction at the Rouge raises two questions: whether Henry Ford and his firm should be viewed as early industrial ecologists and whether the practices pursued at the Rouge were important precursors of industrial ecology.

At the heart of industrial ecology is the concept of the product lifecycle: flows of materials and energy from the natural world are transformed into products that are used and ultimately discarded. Flow was central to the thinking of Henry Ford and his plant engineers. But industrial ecologists view this process with two ends in mind. The first is to use both raw materials and energy efficiently. This means maximizing an output from a given amount of material or energy (or minimizing the inputs of either while holding output constant). The second is to minimize the negative environmental impacts from making, using, and

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3 Neither Nevins and Hill nor Biggs have much to say about waste-reduction efforts at the Rouge. See Nevins and Hill, *Ford: Expansion and Challenge*, 283-84; Biggs, *Rational Factory*, 151, for passing references. My contention here is that waste reduction was more important to Ford than these authors suggest and that the Ford waste-reduction efforts merit greater attention from historians today.


disposing of a product. Environmental historians normally classify the first concern as pursuing conservation and the second as reducing pollution. These two motivations and the resulting positive environmental outcomes are central to industrial ecology. Keeping these two different goals in mind is also necessary if one is to understand what Henry Ford and his company were doing at the Rouge in the 1920s and 1930s and why they were doing it.

In practice waste in manufacturing may involve both the superfluous use of materials and harmful environmental impacts when the materials are discarded. In the 1920s when people spoke of "waste reduction" they almost always meant using men, machines, materials, and time more efficiently rather than reducing pollution. When they spoke of "industrial waste" they usually meant the materials discarded by a company, but this phrase did not always imply that environmental harm automatically ensued. However, the pursuit of waste reduction, even when motivated largely by the goal of efficiency or conservation, might well reduce industrial waste and, consequently, environmentally harmful pollution. The question is the extent to which these two goals—conservation and pollution reduction—animated Ford's waste-reduction practices at the Rouge.

Waste reduction and recycling at the Rouge were by-products of the Ford Motor Company's experience with mass production. All factories that transform raw materials into physical products create wastes in the form of some mixture of superfluous gases, liquids, and solids. These need to be moved away from the people and machinery involved in production in order for the factory to function. When production volume increases, the logistics involved in getting out from under the accumulating wastes can be daunting and threaten to disrupt manufacturing operations. Ford crossed this threshold at Highland Park with mass production of the Model T. Waste disposal there was a major headache for the company.6 But when the quantities of waste produced were either large or valuable, Ford also had an opportunity to recover some of the cost of production either by reducing the amount of waste or by recycling the residual materials for reuse or sale. Such opportunities were not lost on the company's plant managers and engineers: "Even a

6 George E. Hagemann, "$15,000,000 Salvaged by Ford Plants," Management and Administration 9 (June 1925): 557. On wastewater problems at Highland Park, see William F. Verner, Oral History, 17, Wm. Verner folder, box 74, acc. 65, Research Center, Henry Ford Museum & Greenfield Village, Dearborn, Michigan (hereafter HFM). Nevins and Hill, Ford: Expansion and Challenge, 201, mentions "the inadequacy of Highland Park" as one of Ford's chief motives for building the Rouge, but the authors do not specifically mention the waste problems at the older plant.
microscopic saving,” as one Ford publication put it, “assumes impressive proportions when multiplied by a million or two.”

Ford’s formal waste-reduction and salvage commitment began at Highland Park in 1916. But the Rouge, built largely between 1917 and 1937, offered the company its most substantial opportunity to design production processes with waste reduction and reuse in mind. At the Rouge, as part of the company’s effort to create the ultimate modern, rational factory, the company’s waste-reduction and salvage activities reached their zenith. “Picking up and reclaiming the scrap left over after production is a public service,” Henry Ford observed, “but planning so that there will be no scrap is a higher public service.” Consequently, the Rouge was planned, built, and modified with waste reduction as a major consideration. “When certain operations produce large amounts of a certain kind of scrap which is re-used in production,” Ford manager L. D. Middleton wrote in the late 1930s, “the same consideration is given to the handling of this scrap as would be given to laying out the various steps in the operations themselves. Consequently, conveyors are used and railroad facilities supplied for handling the major items which have to be forwarded to the other building[s] for re-use.” Middleton ran the Rouge General Salvage Department, whose duties were, in his words, “the advancement of the fundamental principles of waste control throughout the plant; the elimination or reduction of waste wherever possible; and finding proper uses for waste materials within the plant. Its activity deals with ... metals of all kinds, lumber, oils, and greases, building materials, textiles, leather, rubber, tools, glass, paper, equipment, and obsolete materials of all kinds.”

Ford’s waste-reduction and recycling activities at the Rouge can be divided into four categories: by-products, salvage, energy efficiency, and postconsumer recycling, although Ford’s own descriptions of the plant’s waste-reduction activities at the time usually employed only the first two terms. By-products were waste materials that arose as a consequence of

8 Hagemann, “$15,000,000 Salvaged by Ford Plants,” 557.
9 Henry Ford with Samuel Crowther, Today and Tomorrow (Garden City, N.Y.: Doubleday, Page, 1926), 110.
10 L. D. Middleton, “Ford Salvage Practice,” 15 February 1939, 5, 4, box 3, Salvage, acc. 629, HFM.
11 By-products generally involved both further processing and sale outside the company. Salvage involved materials that were reclaimed either for reuse inside the company or for external sale without substantial further processing beyond collection and separation. Similar distinctions and terminology were used by outside waste-reduction
primary production that with further processing (and expense) could be sold at a profit. For example, in making coke from coal for the Rouge blast furnaces Ford also produced coke oven gas, tar, ammonium sulfate, and benzol. By design, the first two items were used as fuels in various operations around the Rouge. Ammonium sulfate, a fertilizer, and benzol, a fuel that could be mixed with gasoline and used in internal-combustion engines, were sold to the public.

Ford also built an extensive wood by-products processing operation at Iron Mountain in Michigan’s Upper Peninsula. In some respects this facility encompassed the company’s most remarkable set of fully integrated waste-reduction activities.\(^{12}\) Ford moved the manufacture of wooden parts for the Model T from Highland Park to Iron Mountain after the company purchased a half million acres of timberland in the Upper Peninsula in the early 1920s. The company wanted to stop paying long-distance freight charges on the 40 percent water weight of green wood and on the scrap wood that was left over after cutting a part from a board. At Iron Mountain Ford tried to use every part of the tree except the shade. After drying the timber and cutting the needed parts, the operation converted the scrap wood into charcoal—the plant later became Kingsford Charcoal—and methyl (i.e., wood) alcohol, as well as numerous other chemical by-products marketed to the public. Any remaining scrap or sawdust was used as fuel in the facility’s power plant, which also provided heat for the drying kilns. The company claimed these arrangements saved one hundred million board feet of lumber a year, which might be true as the firm used a million board feet a day in the early 1920s. But the use of wood in Ford automobiles decreased significantly after the mid-1920s, so the importance of the Iron Mountain facility diminished almost as soon as it became operational.

The production of iron from iron ore, limestone, and coke also yielded blast furnace slag. To eliminate the cost of disposing of 125 tons of blast furnace slag a day, Ford built a cement plant at the Rouge. The company’s engineers designed a process that sprayed the molten slag with cold water to cool and granulate it to the size of coarse salt. They then pumped it as a slurry under hydraulic pressure to a special plant to make portland cement.

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Ford used about a quarter of this cement in its own construction activities and sold the balance on the open market.\(^{13}\)

Salvage—the term that Ford plant engineers and publicists used then for what Americans later called recycling—generally involved waste materials reclaimed from the manufacturing process for reuse inside the company. At the Rouge the most important salvage activities, measured by both weight and value, involved metals.\(^{14}\) After the advent of the closed all-steel body in the mid-1920s, the amount of metal in automobiles increased. Since so many Rouge departments produced scrap metal, the General Salvage Department assumed responsibility for reclaiming it and maintained storage areas for ferrous (iron-based) and nonferrous metals. Steel and iron constituted most of the scrap metal reclaimed at the Rouge. The plant’s salvage system collected and returned more than six hundred tons of steel scrap to the furnaces each day.\(^{15}\) However, many nonferrous metals had a value per unit of weight much greater than iron or steel. As a consequence, the Ford salvage people also collected and reused copper, brass, aluminum, zinc, lead, tin, cadmium, mercury, babbitt, and silver.\(^{16}\)

Even after the introduction of the all-steel body, the automobile industry remained a prodigious consumer of lumber, primarily for packing and shipping. At the Rouge, the company’s goal was to reuse all the wood that came into the plant for shipments going out before resorting to new lumber.\(^{17}\) To accomplish this Ford engineers developed machines to pull nails from the wood automatically, salvaging seventy-five kegs of them a day to remelt.\(^{18}\) This effort to reuse wood, which eventually led to the construction of three separate box (i.e., wooden crate) factories to serve different parts of the Rouge, accomplished a great deal, but some scrap wood and sawdust remained. The Ford people used some of this wood to fire the cupolas that melted iron for the Rouge foundries and sold some to employees as kindling. To utilize the remainder, Ford built a paper mill at the Rouge to make cardboard and

\(^{13}\)The Ford Industries, 57; Harry Hanson, Oral History, 117, folder 1, box 24, acc. 65, HFM; Ford Motor Company—Cement, 1947, box 1, acc. 453, HFM.

\(^{14}\) Middleton, “Ford Salvage Practice,” 5. The well-publicized purchase by Ford from the U.S. government of 199 ships and the dismantling of these ships at the Rouge for scrap metal, as a one-time ad hoc undertaking, will not be discussed in this context.


\(^{16}\) Middleton, “Ford Salvage Practice,” 5.

\(^{17}\) Ibid., 6; Ford, Today and Tomorrow, 121-24.

\(^{18}\) “This is being released . . . ,” press release, n.d. [1930s], box 10, acc. 545, HFM.
corrugated paper for use in its vehicles and for shipping. In addition to wood scrap, the Ford salvage staff collected and sorted fifty thousand pounds of wastepaper each day at the Rouge and Ford’s other Detroit-area facilities. They sent the desirable grades to the Rouge paper mill to be made into cardboard. The company even experimented with using this cardboard to make trunk lids on its automobiles.

As wood and paper recycling at the Rouge played a big role in packing and shipping, it should be noted that the Rouge Salvage Department worked with the company’s suppliers to design containers that not only would protect parts and economize on railroad freight charges, but also could be returned to the vendor for reuse or used by Ford for another purpose. These containers included steel drums, glass jars, reels for cable, wooden boxes, crates, and skids, which were all collected and returned to the vendors by the Rouge Returnable Container Department. Ford employees knocked down cardboard cartons that came into the plant and returned them to suppliers for multiple reuse. When the cartons no longer served their original purpose, the Ford people cut them down for use as packing cardboard. It is doubtful that any large firm in America in the 1920s and 1930s paid as much attention to minimizing waste in shipping and packing materials as Ford did.

If the larger operations at the Rouge showcased Ford’s planning for waste reduction, the smaller salvage activities demonstrated the company’s zeal. The reuse of tools provides the best example. “Drills . . . which are worn to their shortest usable length for a given diameter are reground to smaller diameters so as to permit re-use to a shorter length on some other operation,” the salvage manager L. D. Middleton observed, providing a sense of the extremes to which the company went in pursuit of waste reduction. “After this has been done as often as is practical, the drill may be reworked to an entirely different tool, such as an end milling cutter, used in one of the tool rooms. Finally, when no further use can be found for it as a tool the carbon steel shank is cut off for remelting stock at the foundry and the High Speed Steel cutting end is re-used as melting stock at the Electric Furnace Steel Plant.” Similar examples abound. The salvage staff converted paint cans

21 Hanson, Oral History, 169.
into mop pails. They rethreaded and retapped five thousand discarded nuts and bolts each day and reworked worn machine belting into lifebelts for window washers.24

Power generation and efficient energy use constituted the third major area at the Rouge where waste reduction was important. It is hard to say which activity engaged Henry Ford more, making automobiles or producing electrical power. As a young man Ford had been the chief engineer for Detroit Edison, and the power plants he built at Highland Park and the Rouge were his greatest joys. According to Ford’s publicists, the great eight-stacked Power House Number 1 at the Rouge was the largest electrical generating facility for private use in the world.25 It provided electricity for all Ford operations in Michigan and had the capacity to power a city the size of Boston or San Francisco. Ford had the steam turbines built so they could be fired by coke-oven gas, blast-furnace gas, and pulverized coal—all by-products of the iron- and steel-making operations at the Rouge. Of these fuels, Ford engineers preferred pulverized coal because it could be burned with the least waste of potential energy. In Power House Number 1 Ford operated one of the earliest successful large-scale pulverized coal-burning plants in the world.26

The Ford company’s zeal for waste reduction led it into two areas of postconsumer recycling at the Rouge. The first of these activities had nothing to do with automobiles. In 1929 the company took on garbage disposal for the city of Dearborn in an effort to produce industrial alcohol and fertilizer.27 Ford engineers first used some of the Rouge’s excess fuel to heat the garbage to drive off its water content, captured in the form of steam to power the generators at Power House Number 3. Then they pressed the garbage, which produced an oil that was sold as fat. Finally, they dried the garbage and added it to the coal in the coke ovens as a fuel. Although the anticipated by-products proved disappointing, this operation, which processed forty tons of garbage a


25 Publicity Release, Ford Motor Company, 10 March 1941, box 2, Salvage, acc. 629, HFM. Nevins and Hill, Ford: Expansion and Challenge, 212, accepts the Ford claim that the powerhouse was the largest unit of its kind in the world.

26 Verner, Oral History, 31; George Walker, Oral History, 76-80, Walker folder, box 77-5, acc. 65, HFM.

day, lasted until after World War II. Early on, the company even offered to do the same thing for the city of Detroit.\(^{28}\)

By far the most dramatic postconsumer recycling activity at the Rouge was a disassembly line to take apart junked automobiles. Ford purchased the junks from its Detroit dealers, and the line ran intermittently between February 1930 and the middle of World War II. At the urging of Henry Ford himself, the company initially toyed with the idea of refurbishing worn-out Fords, but eventually settled for taking apart both its own and other manufacturers' vehicles for scrap.\(^{29}\) In doing this Ford did not assume an obligation to repurchase its automobiles at the end of their useful lives in order to reclaim and recycle materials, although some at the time argued that Ford should make this commitment.\(^{30}\) Ford touted the operation as a contribution to highway safety and a way to rid the landscape of abandoned automobiles, but it was really an experiment in the economics of salvage.\(^{31}\) Ford needed large quantities of scrap to make steel at the Rouge. The company hoped that a large-scale disassembly operation would permit labor and operating efficiencies that could not be realized by local junkyards and scrap dealers. It also hoped to eliminate the profits paid to junkmen and scrap dealers as automobile scrap made its way through the usual commercial chain from the used-car lot back to the steel maker.

Ford plant engineers set up the disassembly operation in the Open Hearth Building at the Rouge so that once the vehicles had been stripped of everything that was not steel or iron the hulks could be fed directly into one of the ten open-hearth furnaces as a scrap charge that remelted to form part of a batch of new steel. The open-hearth furnaces used at the time required a charge mix that was 55 percent scrap and 45 percent pig iron.\(^{32}\) The men on the Ford disassembly line first drained the junked cars of gasoline, oil, and grease—which were saved and recycled. The cars then moved along two conveyors—one for Ford vehicles and one for non-Ford makes—where the workers stripped them of tires,

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29 Charles Sorenson, Oral History, 53, box 67, acc. 65, HFM; Frank Hadas, Oral History, 259, folder 12, box 23, acc. 65, HFM.

30 "Where Can Good Automobiles Go When They Die?" Literary Digest, 22 February 1930, 59-60.


batteries, headlight lenses and bulbs, spark plugs, floorboards, glass, leather, cloth, upholstery stuffing, radiators, and nonferrous metal parts. The Rouge Salvage Sales Department reconditioned and then sold at a discount from the regular parts list serviceable Model T parts, such as tires, tubes, spark plugs, headlights, steering gears, glass, carburetors, and generators.33

The department sold the better tires as used tires. The worn tires were sheared into sections and sold to rubber recyclers. Ford maintenance men sized and cut the larger sections of glass for use as windowpanes around the Rouge. They sent the broken glass to the Rouge glass plant for remelting. They used the reclaimed leather for aprons, upholstery for hand pads, and floorboards for crate tops.34 They baled and sold the cotton and hair from the upholstery stuffing. Workers carefully separated the nonferrous metals, such as the aluminum in hubcaps, the copper in ignition wire, the brass in oil cups, and the bronze in bushings, by metal type and sold it for scrap. At the end of these lines a twenty-two-ton press crushed the remaining wood, iron, and steel in the body and chassis, as the moving line conveyed it to an open-hearth furnace for remelting. The furnace simply consumed any remaining wood. The entire process took about a half-hour for each junker. Although the scrap from the dismantled autos provided only a small amount of the materials Ford required, the disassembly line attracted a good deal of interest. "It was," Ford production chief Charles Sorenson later recalled, "a very spectacular job."35

This first Rouge disassembly line employed 120 men and dismantled 375 cars in two eight-hour shifts.36 In the second half of 1930 Ford

33 "Auto Salvage Operations," memorandum, 31 October 1930, vol. 3, box 1, acc. 479, HFM. In stripping the junkers of reusable parts and materials, Ford was following the practice of junkmen and the scrap or wrecking cooperatives that many auto dealers set up and ran in the late 1920s to cut the junkmen out of the business. For descriptions of salvage practices at an automobile wrecking yard and a dealer cooperative, see E. C. Barringer, "Scrap Heap Claims Thousands of Automobiles Annually," Iron Trade Review 78 (11 March 1926): 631-34; Robert E. Lee, "A Graveyard for Motorized Junk," National Safety News 19 (May 1929): 15. These ventures did not employ moving conveyor lines for disassembly purposes as Ford did.

34 "Ford Salvages More Than 30,000 Old Cars," press release, n.d. [1930], box 10, acc. 545, HFM.


increased the processing capacity of the disassembly line to four hundred cars in eight hours by employing two hundred men. Although the number of cars dismantled on the disassembly line never remotely approached the number that rolled off the company's assembly lines, it was not trivial either, averaging at peak operation six hundred cars a day.\textsuperscript{37} Ford disassembled nearly sixty-two thousand vehicles in seventeen months between February 1930 and June 1931 before suspending operations for eight months in order to modify the disassembly line to increase its processing capacity. The company apparently had ambitions to expand capacity to five thousand cars a day and to take junkers from dealers around the country, but it never pursued them.\textsuperscript{38} Had Ford reached this volume, the impact would have been significant. Dismantling five thousand cars a day would have meant handling more than a million junkers a year, or something on the order of 30 percent to 50 percent of all the cars then being junked in the United States each year. This figure would have been far more in keeping with the 1.5 million and 1.1 million new Ford passenger cars that the company actually put on the road in 1930 and 1931 respectively.\textsuperscript{39}

Ford opened a revamped disassembly line again in early 1932. Now reduced from two lines to one, it featured a one-thousand-ton hydraulic press capable of reducing a car to a single bale 30 inches long by 74 inches wide by 30 inches high, weighing up to four thousand pounds. A monorail conveyor took the bales to a single four-hundred-ton open-hearth furnace (the largest in the world at the time) that fed the other nine one-hundred-ton open-hearth furnaces. These changes cost Ford $500,000.\textsuperscript{40} The company apparently found the old line too slow because the open-hearth charging machinery had difficulty handling the irregularly shaped crushed vehicles, a problem addressed by the new baler. On the new disassembly line cars spaced about three feet apart moved slowly down the line at a height of about thirty inches from the floor, while groups of workmen stripped them of parts and material. The

\textsuperscript{37} Norwood, "Where Motor Cars Walk the Plank," 68; "Ford Salvages More Than 30,000 Old Cars."

\textsuperscript{38} "Automobile Junking Expands, Becomes a Thriving Industry," \textit{Business Week}, 12 August 1931, 28.

\textsuperscript{39} Ford production figures are from Allan Nevins and Frank Ernest Hill, \textit{Ford Decline and Rebirth, 1933-1962} (New York: Charles Scribner's Sons, 1963), 478.

\textsuperscript{40} "Cars Scrapped in Giant Baling Press," 352; Philip E. Haglund, Oral History, 73-74, acc. 65, HFM; Hanson, Oral History, 144; "Ford to Scrap Automobiles Almost One Every Minute," \textit{Iron Age}, 5 November 1931, 1200. Hanson takes credit for the idea of using the giant baler to crush the cars.
new operation could wreck one thousand cars a day across three eight-hour shifts, but with this new capacity, Ford had trouble finding enough junkers to keep the line running. It proved too costly to ship junkers from around the country to Dearborn, and Ford’s local dealers could not supply enough to keep the disassembly line going. Consequently, the line ran only intermittently from 1932 until 1943 or 1944, at which point the company abandoned it.

A description of the Ford waste-reduction and recycling activities would be incomplete without mention of one last application of the idea. “We salvage everything,” Henry Ford told William L. Stidger in the early 1920s, “even men.” Ford often staffed its salvage operations with physically and mentally challenged people—employees the company bluntly termed “substandard men.” As Henry Ford put it, these men were “salved in the process of salvaging.” Ford’s publicity people nearly always touted the practice of using such men when promoting the company’s salvage activities. Ford, it is clear, viewed this commitment not just as charity or a way to bring greater dignity to the lives of these individuals but as a novel and commendable extension of the idea of waste reduction.

The Ford waste-reduction and recycling activities need to be set in a larger industrial context. Waste reduction and recycling in themselves were not especially remarkable in American industry in the 1920s. In fact, from the First World War through the Great Depression, many people in business and industry actively pursued waste reduction, a movement known as “industrial conservation.” The First World War national emergency and especially the efforts of the Conservation Division of the War Industries Board first sparked interest in industrial conservation.

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41 “Cars Scrapped in Giant Baling Press,” 352; “Ford to Scrap Automobiles Almost One Every Minute,” 1200; E. F. Ross, “Ford Recovers Steel Scrap By Dismantling Old Cars,” Steel, 24 October 1932, 24. There is some ambiguity about capacity in reports on the new disassembly line. Contrast “Cars Scrapped” to “Ford Recovers Steel Scrap,” 27, which suggests that the new disassembly line was capable of crushing only twenty-five cars an hour or about the same four hundred per sixteen-hour day as before.

42 See “Frank Dow Spends Years Saving Metal for Company,” Ford Rouge News, 3 August 1956, 2. Dow, the salvage car supervisor in 1932, indicated that the disassembly line was in operation for “nearly 14 years.”


46 Ford, Today and Tomorrow, 124.

47 On the role of the War Industries Board, see Ray M. Hudson, “The New Conservation—I,” Scientific American 127 (December 1922): 400. See, however, A. W.
Progressive engineers, foremost among them Herbert Hoover, secretary of commerce during the Harding and Coolidge administrations, then championed the idea in the early 1920s. Leaders of the industrial conservation movement focused their attention on far more than just reducing the waste of raw materials. They attacked waste in the use of manpower, machines, materials, and time throughout industry. Arguably, they devoted more attention to the waste of manpower, machines, and time than to the waste of materials. Indeed, proponents of industrial conservation in this larger sense hoped that by achieving greater efficiency American industry would be able to smooth or eliminate business cycles, reduce unemployment, and defuse labor-management conflict, as well as conserve natural resources.

When it came to reducing waste in the use of materials, however, the industrial conservation movement was very much an outgrowth of the conservation movement. Serious efforts to reduce the waste of natural resources in private industry were stimulated by the need for vital materials during World War I and the resulting increase in scrap-metal prices. Because natural-resource conservation was eventually subsumed into the much broader post-World War II environmental movement (and later became a crucial aim of industrial ecology), it is important to distinguish the concerns of industrial conservationists from those of other early-twentieth-century American conservationists. Industrial conservation was an outgrowth of the Roosevelt–Pinchot utilitarian wing of the conservation movement rather than the preservationist wing.

Ross, “Salvage Department of the Westinghouse Lamp Company,” Industrial Management 56 (October 1918): 311, for the suggestion that the Department of the Interior was sounding the alarm about the need for paper recycling in industry in early 1916.

For an excellent discussion of the relationship of waste reduction to Hoover’s larger ideas on conservation, economic prosperity, consumption, and leisure, see Kendrick A. Clements, *Hoover, Conservation, and Consumerism: Engineering the Good Life* (Lawrence: University Press of Kansas, 2000), esp. 44-47, 60-61, 75-76.


For some of these expansive hopes, see Stuart Chase, “Waste and Labor,” Nation 113 (20 July 1921): 67-69.

The classic treatment of the conservation movement is Samuel P. Hays, *Conservation and the Gospel of Efficiency. The Progressive Conservation Movement, 1890-1920* (Pittsburgh: University of Pittsburgh Press, 1959, 1999). Although my analysis deals with a somewhat later period than that treated by Hays, it is entirely consistent with his conclusions.

associated with the efforts of John Muir and the Sierra Club (among many others) to protect wilderness areas. Industrial conservationists, like utilitarian conservationists generally, opposed locking up resources and instead favored using them as efficiently or as sparingly as possible. In this respect, the industrial conservationists shared the infatuation of early-twentieth-century America's technical elites with the larger idea of efficiency.

As with utilitarian conservation, a national technical elite advanced the industrial conservation agenda—in this case engineers who worked with and within industry, especially the disciples of Frederick Winslow Taylor and those who subscribed to his principles of "scientific management." There was no popular or grass-roots pressure for industrial conservation. Although government figures such as Hoover encouraged the movement after World War I, officials neither used nor proposed government regulation as a way to accomplish the movement's goals. Engineers in industry simply pushed industrial conservation because they recognized a significant conservation and efficiency opportunity in the factory. If utilitarian conservationists such as Gifford Pinchot had been preoccupied initially with the future adequacy of raw materials under the control of the federal government—timber in the national forests being a primary example—industrial conservationists recognized that there were even greater opportunities to use efficiently the raw materials owned by private interests. They also recognized that efficient extraction of raw materials was only the beginning. Significant opportunities for saving materials extended right through their transformation into final products in the factory.

Proponents recognized that industrial conservation, as applied to privately owned natural resources, presented an opportunity for private industry to appropriate some of the positive luster of the conservation movement as a service to society's future well-being. In addition, companies could enhance their own bottom lines by making their manufacturing operations more efficient. Of course some engineers saw in the movement an opportunity to enhance their own status as a

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55 These aims are explained in Ray M. Hudson, "Cutting Down the Waste Pile: Costs and Benefits of Industrial Waste Elimination," Management and Administration 9 (May 1925): 413-16.
group within industry, but it should be stressed that real environmental benefits derived from the more efficient use of resources. These benefits included not just resource conservation but pollution reduction as well, and some engineers called attention to the latter benefit at the time.

Where did Ford fit into this picture? Did the company's waste-reduction efforts initiate and inspire the industrial conservation movement? Or were Ford's efforts simply an outgrowth of the larger movement? These questions are difficult to answer with complete assurance. Some answers seem clear, however. Ford did not initiate the movement. Although the company was deeply involved in waste-reduction activities at Highland Park before the industrial conservation movement coalesced as a national concern, the company did not publicize its efforts as such until after others had launched the movement. Engineers such as W. Rockford Conover of General Electric and Harrison E. Howe of the consulting firm Arthur D. Little, who helped launch the industrial conservation movement with articles in engineering and industrial journals such as Industrial Management and Factory, were not associated with Ford. In fact, at no time did Henry Ford or any of his people make a contribution to the industrial

56 See Layton, Revolt, 62-63.
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conservation literature that explicitly acknowledged the existence of the larger movement and Ford's relationship to it.\textsuperscript{59} Nor is there evidence of contact during the early 1920s between Henry Ford and Herbert Hoover, the man who quickly emerged as the foremost national proponent of waste reduction in industry. Ford was already the most famous industrialist in America when in 1920 Hoover, as president of the Federated American Engineering Societies, launched the study that resulted in the publication of \textit{Waste in Industry} the following year. This publication focused national attention on the problem.\textsuperscript{60} Hoover then continued his antiwaste crusade from inside the Commerce Department. Ford and Hoover became friendly later. In fact Ford thought an engineer, such as Hoover, would be an ideal president and endorsed Hoover for the White House in both 1928 and 1932. Ford's 1928 endorsement indicates that he was aware of Hoover's work in the Commerce Department and sympathetic to many of Hoover's ideas. However, Ford apparently chose to draw the line against an earlier formal public association with Hoover, the government, or other industrial firms involved with waste reduction, a stance entirely in keeping with the Ford Motor Company's traditional refusal to join industry associations.\textsuperscript{61}

On the other hand, technical editors and writers who were not employed by Ford often singled out the waste-reduction activities at the

\textsuperscript{59} The only article on waste reduction published by a Ford manager that I have found from this period is Nelson, "Waste-Wood Utilization by the Badger-Stafford Process." It does not mention a larger industrial conservation movement.


Rouge as primary examples of industrial conservation. In fact no other industrial firm during the 1920s was featured as often or as prominently in the technical press for its waste-reduction activities as Ford. John H. Van Deventer, the editor whose journal Industrial Management played a leading role in launching the industrial conservation movement, used a series of thirteen articles on the Rouge that appeared between September 1922 and September 1923 to focus special attention on Ford's waste-reduction efforts. "The thoroughness of waste elimination at River Rouge goes as far beyond the average conception of waste elimination," he wrote in an editorial introducing the series, "as Ford's conception of a complete industrial plant, as exemplified at River Rouge, goes beyond the average conception of the present day industrial plant."62 George E. Hagemann also focused specifically on Ford's waste reduction in two articles he wrote for Management and Administration in 1925. "The reclamation department of the Ford Motor Company," he concluded, "is accomplishing successfully a task of immense proportions, and one profitable from the standpoint of the company, the employees, the consumers, and industry and society as a whole." A number of single articles appeared in other publications as well.63 Ford actively assisted these efforts.64 But these articles all appeared after others had already launched the industrial conservation movement.

Cooperating with editors to produce articles was part of a larger effort that Ford made in the 1920s to publicize the Rouge and its raw-materials and waste-reduction programs. In 1924 the company published The Ford Industries, a glossy 147-page book, extensively illustrated with photographs, devoted in large measure to explaining and touting Ford's raw-materials program. The book highlighted waste-reduction efforts throughout the Ford operations and even included a special section on waste elimination.65 The Ford advertising department sent a copy to every Ford dealer in the United States. It also sent multiple copies to every Ford regional branch with instructions to selectively distribute copies to bankers, city officials,

fleets, owners, and prominent businessmen in each branch’s area. The corporate advertising staff asked branch officials to send the home office lists of newspapers, libraries, and educational institutions in their areas so that additional copies of the book could be sent directly to them, and to follow up with newspaper editors to impress upon them the book’s importance. Ford published several subsequent editions between 1924 and 1931.

In the same year that Ford published the first edition of The Ford Industries it ran a series of at least fourteen two-page institutional advertisements in the Saturday Evening Post to publicize what it was doing in its plants and elsewhere. Dubbed “An Industrial Epic,” the series dealt with a variety of themes such as Ford’s hydroelectric power projects, glass manufacturing, assembly lines, raw materials, forestry practices, engineering lab, and the Rouge power plant. An ad entitled “Saving Millions By Robbing Smoke of Its Waste” discussed waste reduction. It described the by-products that Ford captured while creating coke in its coke ovens. Ironically, the full-page color illustration that accompanied the text showed smoke being released into the atmosphere as red-hot coke was discharged from the coke ovens, emissions that four decades later posed problems for Ford with environmental regulators. The ad’s text stressed the public rationale behind Ford’s waste-reduction efforts. “The economy program of the Rouge Plant which includes many other reclamation and salvage projects is typical of that which has been enforced throughout every step of Ford Production. The annual saving is tremendous—one of the big factors making it possible for the company to give such high quality in its products and sell them at the present low cost.” More revealing, the ad demonstrated quite clearly that pollution reduction in order to minimize harmful environmental impacts was not a primary motivation behind the Ford waste-reduction programs. “No heavy plumes of smoke roll from the tall stacks above the main power plant,” the ad explained, “For smoke is waste, and waste is unpardonable by this company’s standards.” Although burning coal or coke more efficiently and thereby reducing smoke certainly had some positive environmental impact, the company’s engineers sought to cut waste, not to avoid or reduce pollution.

Company publications, articles in technical journals based on access to the Rouge, and advertising that all described in detail Ford’s production processes reflected the company’s immense pride in its manufacturing prowess, a pride that was at the very heart of its corporate identity. Ironically,

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66 “Distribution of ‘The Ford Industries,’” cover memo, 2 January 1925, box 51, acc. 78, HFM.
68 “Saving Millions By Robbing Smoke of Its Waste,” advertising proof sheet, box 151, acc. 19, HFM.
this focus on production served to create and bolster a mystique that also obscured what the company was doing in the area of waste reduction. Company publications and technical articles are the best source for detailed descriptions of the firm’s various waste-reduction programs, but they are problematic if used alone to explain the motives behind the programs. Other evidence suggests a more complex reality.

The Rouge was largely conceived and built while interest in industrial conservation was at its height, yet the material on the Rouge and waste reduction prepared by Ford’s publicists almost completely ignored this fact. Although the Henry Ford legend that his publicists helped to create made much of his insistence on doing things his own way, neither he nor his company reflexively reinvented the wheel or insisted on doing things de novo. Quite the contrary. Much of what Ford did—using by-product instead of the older beehive coke ovens and recycling scrap metal, for example—was standard or becoming standard practice in comparable industries such as steel. Plant engineering records make it plain that Ford normally sent its engineers to visit other manufacturers to ascertain “best practice” before setting up similar processes itself. Many specific waste-reduction practices had been implemented by other companies and publicized in the trade and industrial press before Ford adopted them at the Rouge. “The present salvage department is receiving from all over the works scrap material of every conceivable kind, old and inactive machinery, steel and wooden partitions, pipe, old belting, copper wire, oil barrels and other containers, in fact, everything with a scrap value,” reported A. W. Ross concerning the waste-reduction

69 Hardheaded, clear-sighted engineers were by no means immune to the mystique. Indeed, some contributed to it. The best example is Faurote, “Henry Ford Still on the Job,” 197. For a debunking assessment from an engineer, see Halbert P. Gillette, “Ford’s Business Philosophy,” Engineering and Contracting 68 (March 1928): 137-40.

70 Both David A. Hounshell, From the American System to Mass Production, 1800-1932: The Development of Manufacturing Technology in the United States (Baltimore: Johns Hopkins University Press, 1984), and Biggs, The Rational Factory, 161, prove this point beyond all doubt.

71 For examples of articles that mention waste-reduction practices later pursued by Ford, see Conover, “Salvaging and Utilizing Wastes and Scrap,” 450-51, on cutting oils and the reuse of tools; Howe, “Instructive Examples of Utilizing Industrial Wastes,” 225-26, 228, on slag to cement, the use of wood wastes, and fats from garbage; Howe, “Common Wastes of Industrial Materials,” 303-4, on the use of pulverized coal, the value of coke by-products, and the use of blast furnace gas; Kandolt, “Eliminating Waste and Nuisance,” 428-32, on blast furnace gas, coke oven by-products, and wood distillation; Harold D. Whinney, “Save and Have,” Industrial Management 62 (October 1921): 217, 219, on recycling nuts and bolts, reusing wood and boxes as containers, and recycling plant wastepaper.
program at Westinghouse in 1918. This description might have served for the Rouge a decade later.\textsuperscript{72} Indeed, some companies and plants—General Electric’s Schenectady, New York, plant being the best publicized example—rivaled the Rouge in their zeal for waste reduction.\textsuperscript{73} Nor was Ford alone among automakers in pursuing waste-reduction opportunities during the 1920s. In fact as early as June 1920 William Crawford Hirsch wrote in \textit{Automotive Industries}, “Nearly all of the automotive plants have special departments charged with the salvage and disposal of scrap.”\textsuperscript{74} For the most part, scrap-metal salvage remained the primary focus of the other automakers’ waste-reduction efforts, although by the latter part of the decade firms such as Cadillac, Buick, Dodge, Hudson, and Studebaker were also recycling glass, leather, upholstery stuffing, wood, wastepaper, and cutting oil.\textsuperscript{75}

Nonetheless, the Ford approach to waste reduction can be distinguished from these other efforts in three respects. First, the scale of the Ford efforts dwarfed the activities of other firms. No other industrial company in America during the 1920s pursued waste reduction on so many fronts involving the quantity of materials that Ford processed. Second, during this period Ford often refused to settle for “best practice” when it considered that practice to be needlessly wasteful.\textsuperscript{76} Indeed, the company’s engineers prided themselves considerably on their ability to do “best practice” one better.\textsuperscript{77} For example, while General Motors, Chrysler, and eventually the National Automobile Chamber of Commerce (forerunner of the Automobile Manufacturers Association) devised incentive schemes in the late 1920s and early 1930s to encourage dealers to scrap old automobiles, Ford went the additional step of

\textsuperscript{72} Ross, “Salvage Department of the Westinghouse Lamp Company,” 311.


\textsuperscript{74} William Crawford Hirsch, “Profiting from the Scrap Heap in the Automotive Factory,” \textit{Automotive Industries}, 3 June 1920, 1270.


\textsuperscript{76} Nevins and Hill, \textit{Ford: Expansion and Challenge}, 203, 283, 290. The authors describe Ford’s unwillingness to settle for “best practice,” although not with specific reference to waste reduction.

\textsuperscript{77} Riecks, Oral History, 58.
creating a disassembly line.\textsuperscript{78} Other examples where Ford took waste-reduction technology beyond then current best practice included use of the Badger–Stafford wood-distillation process at Iron Mountain, the wet-process for manufacturing cement from slag, the use of hardwood scrap to produce pulp to make cardboard, and the successful large-scale use of pulverized coal in Power House No. 1 at the Rouge.\textsuperscript{79}

Most important, Ford differed in its motives from other companies pursuing industrial conservation activities. A close look at the company’s waste-reduction programs suggests that the reasons behind them were fundamentally idiosyncratic. Industrial conservationists argued that the efficient use of materials contributed to a firm’s bottom line.\textsuperscript{80} But as Harrison E. Howe pointed out in 1919, “frequently . . . the real problem in waste utilization is more economic than technical. Many wastes do not occur in sufficient quantity at any one spot to make their use possible, or the cost of collection and storage defeats the project.”\textsuperscript{81} The engineers who advocated industrial conservation certainly did not expect companies to pursue waste-reduction opportunities to the point where they added to rather than reduced the cost of their operations. This economic constraint, critics such as Stuart Chase charged, meant that the industrial assault on waste was often limited.\textsuperscript{82} Ford embraced cost reduction as a general expectation in its public waste-reduction rhetoric.

\textsuperscript{78} The most important incentive plan was the Highway Safety Plan of the National Automobile Chamber of Commerce (NACC), which was implemented in 1930. See “Application of the National Automobile Chamber of Commerce for Consideration of . . . the Highway Safety Plan” (New York: NACC, 10 January 1931), in “Scrapage” vertical file, National Automotive History Collection, Detroit Public Library, Detroit, Michigan. “Scrap Dealers Consider Nation-Wide Disposal of Worn Out Automobiles,” \textit{Iron Age}, 6 November 1930, 1316-17, indicates that General Motors concluded that scrapping was best left to the dealers.


\textsuperscript{80} See, for example, Hudson, “Cutting Down the Waste Pile,” 414. There were exceptions to this generalization, especially when the war still dominated discussions of waste reduction. See Conover, “Salvaging Miscellaneous Wastes,” 16.

\textsuperscript{81} Howe, “Possibilities in Saving and Utilizing Industrial Wastes,” 93.

but in actual practice the company did not rigorously apply it as a test of whether an activity was worth either pursuing or continuing.

Ford’s engineers demonstrated that most of the waste-reduction and recycling activities that they undertook at the Rouge were practical in the sense that waste could be reduced in many ways and uses found for many materials. But there were technical difficulties. And these difficulties sometimes frustrated efforts to save money. On the automobile disassembly line, for example, the greatest problem was simply that the cars had not been designed to be taken apart, and therefore the task required a great deal of labor. Ford’s own production machinery was adapted to disassemble those parts of Ford automobiles that it had once put together, but this application provided a minor benefit. It proved especially difficult to separate small quantities of nonferrous metals from the iron and steel. This had to be done, however, because even small amounts of such metals would ruin a batch of molten steel made from scrap. Yet there is no evidence that Ford engineers in the 1930s ever discussed making their own cars easier to disassemble—an approach that late-twentieth-century industrial ecologists would call design for recycling (DFR).

Given that Ford senior managers of the 1920s and 1930s were ambivalent and on occasion actively hostile toward keeping rigorous managerial accounting records, it is not possible to reach a definitive conclusion about the profitability of Ford’s waste-reduction activities. In 1925 George E. Hagemann reported that the company saved $15 million in 1924 from waste-reduction activities, of which $4 million came from the sale of salvaged scrap metal. Spreading the total savings across the two million cars and trucks produced that year, Ford thus reduced the selling price of a fully equipped Model T by an average of $7.50, or about 2 percent. In his book Today and Tomorrow, published the following year, Henry Ford himself claimed $20 million in savings each year from salvage. During the 1930s, the company claimed that general salvage activities at the Rouge generated a more modest $4 million to $5 million in profit each year.

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84 Hanson, Oral History, 147.
85 On the lack of records, see Nevins and Hill, Ford: Expansion and Challenge, 296.
86 Hagemann, “$15,000,000 Salvaged by Ford Plants,” 557; Ford, Today and Tomorrow, 91. I have found no corroboration for Ford’s claim. “Converting Waste Into Millions”; press release, “Salvage Takes Its Place at the Table: Part I,” typescript, n.d. [1930s], box 10, acc. 545, HFM. The figure does not include profits from by-product sales. The vagueness of
Not all the Rouge waste-reduction and salvage activities were profitable, however. Despite the company’s claims that the automobile disassembly line was a success, it was not profitable. In fact, as early as March 1922 the company experimented with disassembling a junked automobile only to discover what junkyards around the country had already found: the value of the scrap often did not cover the cost of the junker and the labor to take it apart.87 For reasons already discussed, the managers responsible for the disassembly line at the Rouge failed to find either the methods or sufficient volume to overcome this difficulty. “We did not come out ahead on the operation,” Charles Sorenson conceded. Plant engineer Frank Hadas was more candid; the company “spent a million bucks there knowing that it wouldn’t work.”88 If Ford’s waste-reduction activities as a whole did generate savings, these were net savings achieved in spite of some projects such as the automobile disassembly line that were clearly unprofitable.

This willingness to deviate from standard business practice and pursue some unprofitable waste-reduction programs raises the important matter of Henry Ford’s personal involvement. What was the basis of his interest? What were his motives? The answers to these questions reveal a larger pattern in Henry Ford’s personal projects and interests during the 1920s and 1930s and ultimately lead back to industrial ecology. As The Ford Industries put it in 1924, “In the Ford Motor Company waste is regarded as almost criminal.”89 The sentiment was Henry Ford’s, and it was a point of pride that the company widely publicized: Henry Ford abhorred waste; he wanted to see how many things could be salvaged; and, if salvage was practical, he wanted to find out whether it could be done profitably with the savings passed on to consumers.

This public pose, while true at one level, actually masked a more complex reality that the problems with the disassembly line only begin to reveal. Interviews conducted with former Ford and Rouge managers by Owen Bombard for the Ford Motor Company Archives in the early and

the figures for the 1930s and the fact that they did not vary in publicity releases over the decade also argue for skepticism.


89 The Ford Industries, 99.
mid-1950s are full of stories about Henry Ford's waste-cutting zeal.\textsuperscript{90} Rouge plant engineer George R. Thompson related one of the best. Thoroughly imbued with the Ford salvage ethos, Thompson searched for something to do with the coke breeze (i.e., residual dust) accumulating around the Rouge coke ovens before he hit on what he thought was the perfect solution—using the breeze as railroad track ballast around the plant instead of buying cinders. The reaction to his idea was not quite what he expected. As he recalled:

Mr. Ford came along one morning and said, “Let's take a walk up the track here a piece.” We walked up the track and he pointed down to this black sandy-looking thing and he said, “What's that?”

“Oh, Mr. Ford,” I said, “that's coke breeze. There is no use for it. There is no place to use it. We are saving 75 cents a cubic yard that we paid for cinders.”

He said, “Young man, that coke breeze represents energy. If you people down here at the plant aren't smart enough to know how to get the energy out of that breeze, I hope it buries all of you. Why don't you burn it in the furnace?”

I said, “I have inquired about that, but they say it is so light that the draft takes it right up the stack.”

He said, “You tell them that I said not to throw that away and to find some use for it.”

They did fool around with it. They tried burning it with tar, briquetting it, and several other things. If I remember right, they did find a way of burning it. Mr. Ford was quite right about it. It was useful stuff, we just didn't know how to use it.\textsuperscript{91}

Thompson raised a key issue, whether Ford was more concerned with saving money or simply preventing waste. Alert to this very question, Bombard posed it directly in several of the interviews. The recollections of Henry Ford's associates consistently indicate that he pushed waste-reduction programs even when he knew they were not profitable. “I don't think the economical point always interested Mr.

\textsuperscript{90} See those of A. M. Wibel, Ernest G. Liebold, Frank Hadas, Philip E. Haglund, Charles E. Sorenson, Harry Hanson, John L. McCloud, Frank C. Riecks, George R. Thompson, and John W. Thompson, all acc. 65, HFM.

\textsuperscript{91} George R. Thompson, Oral History, 31.
Ford,” his personal secretary Ernest G. Liebold recalled.92 “Mr. Ford would insist on the by-products being salvaged because he didn’t want to throw them away.” The firm’s purchasing manager Albert M. Wibel added, “He didn’t want to throw it down the drain. These were usually not economical operations. We would never throw anything away regardless of whether it was economical or not. We would work out some way, and rather than set up the example of throwing something away, we would let the good ones take care of the bad ones and hope that an average would be set up.”93

In fact, the managers involved in waste reduction often seemed reluctant or embarrassed when they recalled these activities. Some thought that the company’s waste-reduction zeal was excessive and communicated this reservation to Henry both directly and indirectly. Several managers quietly ignored Ford’s directives. Frank Hadas went further and tried to talk Ford out of setting up the automobile disassembly line on the grounds that it would not pay.94 It would be inaccurate to characterize this reluctance as open opposition, but the clear reservations expressed make plain that Henry Ford’s managers and plant engineers balked when waste-reduction activities were unprofitable, and they were not happy about pursuing them beyond this point. But Ford insisted that they give them a try, and in some cases keep trying. “Mr. Ford’s whole philosophy,” John W. Thompson recalled, “was that you had to do a thing to learn it, but, you couldn’t actually learn to make anything without actually making it.”95 This approach characterized Ford’s waste-reduction efforts. Ford’s managers thus provide evidence that one of the most important industrialists of the twentieth century, the man whose obsession with lowering the cost of automobile production helped put America on wheels, sometimes chose to pursue waste reduction even though he knew that it added cost to his operation.

Was Henry Ford simply indulging a personal obsession, or was he struggling to accomplish something more with his waste-reduction programs? Ford had a strong affinity for nature. He loved the outdoors

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92 Ernest G. Liebold, Oral History, 610.
93 A. M. Wibel, Oral History, 323.
95 John W. Thompson, Oral History, 71.
and bird-watching in particular.96 He probably knew a good deal more about the natural world than did most people of his time and certainly more than most people today. His friendship and camping trips with the naturalist John Burroughs are well known. But there is no evidence that these interests motivated Ford’s waste-reduction activities. Ford himself did not entirely lack what late-twentieth-century Americans considered environmental sensitivity. “It is not right . . . ,” he told readers in *Today and Tomorrow*, “to put a layer of dust [from smokestack pollution] over the surrounding country and spoil its trees and plants.” Nor was the company oblivious to the environmental benefits of its waste-reduction and recycling activities. The automobile disassembly line, for example, was touted as a means to “free the landscape of unsightly junk piles.”97 And Ford’s waste-reduction activities produced tangible environmental benefits. “If you could see any smoke come out of the smoke stacks then there was something wrong,” John W. Thompson recalled with some exaggeration. “You had to call somebody and you either captured that coal or coke, whatever it was that was coming out of there or the fires burned so you didn’t get it. For a long time you couldn’t see anything on those stacks. Mr. Ford wanted to save everything he could.”98 But as Thompson’s observation and the institutional advertisement “Saving Millions By Robbing Smoke of Its Waste” suggest, Ford’s chief motivation in waste reduction was not reducing pollution. In fact, any such beneficial environmental impact was simply an incidental by-product of his waste-reduction activities. Since minimizing environmental pollution by conscious intent is a central goal of industrial ecology, Henry Ford by this standard was not an early industrial ecologist.

On the other hand, both Henry Ford and his firm understood and sympathized with the arguments of utilitarian conservationists. The company was a prodigious consumer of natural resources and, through the mid-1920s, particularly that special focus of conservationists’ concern, timber. Although it received no criticism on this score, the company recognized the conservation implications of this fact.

98 John W. Thompson, Oral History, 79. These efforts, while effective to a degree, were not very successful by post-WWII environmental standards. See Hanson, Oral History, 118, for an acknowledgement of a less successful effort to control air pollution at the Rouge Production Foundry.
Consequently, company publicists touted Ford's early salvage operations with lumber as "the Ford Motor Company's contribution to national forestry conservation." Moreover, the same press release claimed that the company's salvage department and, by implication, all the company's waste-reduction programs were "conducted purely as a conservation agency." The trade press praised such efforts—especially the wood-processing operations at Iron Mountain—as contributions to the conservation movement.99

Henry Ford, like nearly all utilitarian and industrial conservationists, explicitly rejected resource preservation as an alternative to conservation. Indeed, he viewed preservation as the worst form of waste. "Conserving our natural resources by withdrawing them from use is not a service to the community," he argued, since "our natural resources are ample for all our present needs."100 On the crucial matter of future needs, he remained silent. Although his statements indicated a belief that the natural world was there to be used, his actions at the Rouge and elsewhere suggested a belief that it was to be used as sparingly as possible. And his actions and statements with respect to the use of timber clearly indicated a concern about future supplies. The firm's sensitivity to the conservation ethic provides an important clue to understanding what motivated Henry Ford's waste-reduction efforts. In common with utilitarian and industrial conservationists, Ford cared chiefly about efficiency. But instead of subordinating efficient resource use to profit maximization and pursuing the former as a means to achieve the latter, which was the aim of most business firms and certainly the expectation among most industrial conservationists, he reversed these priorities. Ford sought to maximize the physical efficiency with which materials and energy were actually used, confident that satisfactory (although perhaps not optimal) profits would ensue.

Ford's ability to pursue waste reduction past the point of profitability depended on his control of the company and its continuing profitability. The point is an important one. After he bought out the other shareholders in 1919, Ford no longer had to justify his decisions to anyone.101 Few corporate managers—given their fiduciary responsibility to increase shareholder wealth—are ever in a position to pursue waste


100 Ford, Today and Tomorrow, 90.

reduction (or any other activity) for very long unless they can make a plausible argument that what they are doing contributes to the bottom line. Ford could not always provide this justification when discussing waste-reduction activities with his own managers, but then he did not have to provide it—a prerogative he exercised with some regularity in this context.

Ford’s views about the purpose of business enterprise might explain his special concern with waste reduction. He insisted that a business existed not to make profits but to provide a service to the public.\textsuperscript{102} Profits were necessary, of course, but if a company provided a needed service, profits, Ford believed, would follow in due course. In \textit{Today and Tomorrow} he asked readers: “Where does the money to make wheels go ’round come from?” His answer followed: “From the consumer, of course . . . success in manufacture is based solely upon an ability to serve that consumer to his liking. He may be served by quality or he may be served by price. He is best served by the highest quality at the lowest price and any man who can give to the consumer the highest quality at the lowest price is bound to be a world leader in business.”\textsuperscript{103} During the 1920s, other businessmen defined business as a public service. Nor was Ford alone in defining service as providing a quality product at the lowest possible price. But he certainly differed from major industrialists in his practice of lowering the price of his product first in order to force his organization to find ways to cut costs and remain profitable.\textsuperscript{104} Ford argued that waste reduction was the single most important way that his company cut costs and continued to sell its cars at a profit.\textsuperscript{105} Hagemann’s conclusion in his 1925 articles that waste reduction enabled the company to shave only about 2 percent off the selling price of its cars and internal evidence of the unprofitability of many waste-reduction efforts suggest that this claim was simply hyperbole.

The pursuit of unprofitable waste-reduction activities certainly made the daunting task of cost cutting more difficult. Indeed, by requiring his managers to continue these money-losing programs, while at the same time forcing them to achieve cost reductions in order to remain profitable in the wake of arbitrarily dictated price reductions, Henry Ford

\textsuperscript{102} Ford, \textit{Today and Tomorrow}, 229-41. See also Faurote, “Henry Ford Still on the Job,” 201.

\textsuperscript{103} Henry Ford, “My Rule for Making Steady Profits,” 2-5, reprinted from \textit{System}, March 1922, box 2, acc. 465, HFM.

\textsuperscript{104} Nevins and Hill, \textit{Ford: Expansion and Challenge}, 265. The authors make this point but do not mention waste reduction.

\textsuperscript{105} Ford, “My Rule for Making Steady Profits,” 5.
Waste Reduction and Recycling at the Rouge

Waste seems to have been particularly perverse. But these two contradictory ends might be reconciled by adopting a long-term perspective and thinking of the unprofitable waste-reduction activities as a form of investment in research and development (R & D). In fact the large cash reserves that the company carried during the 1920s made it possible for Ford to indulge in a great deal of research and experimentation in this and other areas.\textsuperscript{106} In the long run such activities might have led to technological or managerial innovations that would have reduced costs. The company’s waste-reduction publicity, which always stressed that the consumer would benefit through reduced costs, can be read in this manner. Not surprisingly, however, company publicists never mentioned the losses that waste-reduction projects sometimes incurred, nor did they attempt to justify such losses in terms of long-term benefits. Someday waste-reduction R & D may be recognized as an important form of business investment, but Henry Ford and his company did not use this rationale to explain their efforts at the Rouge.\textsuperscript{107}

Perhaps the most discerning critic of Henry Ford’s philosophy and his waste-reduction activities in the 1920s was the man whom historians now most closely link with that decade’s crusade against waste, Stuart Chase. Chase is best known for \textit{The Tragedy of Waste} (1925), a sweeping inventory of waste in the American economy written not out of concern for the opportunity cost to industry but from the perspective of social welfare. Chase argued that the American economy could provide everyone with the necessities and amenities that the U.S. Department of Labor specified in its minimum budget of health and decency by taking the following steps: reducing laborers’ idle time, using natural resources wisely, employing the best available production and managerial techniques, and, most important, directing resources away from products and services that did not provide socially worthwhile benefits. Like the engineers who launched the industrial conservation movement, Chase saw in the American experience during World War I proof that the federal government could direct the American economy in a fashion that prioritized production and distribution by social need, reduced waste, and increased the real income of American families, the majority of whom were not yet earning enough to afford the Labor Department’s minimum budget. Chase published his book too late to influence the men designing

\textsuperscript{106} Faurote, “Henry Ford Still on the Job,” 198.

\textsuperscript{107} C. B. Auel of Westinghouse articulated very nearly this perspective on waste reduction in “Lower Costs by Waste Elimination,” \textit{American Machinist} 65 (7 October 1926): 597.
the Rouge. Conversely, Ford’s efforts to publicize its waste-reduction activities did not hit their stride until 1924, too late to influence Chase. Still, Chase could not ignore the leading industrialist in America. He lauded Ford’s use of by-product coke ovens at the Rouge. He was even more taken with Ford’s nascent village-industries project and Ford’s associated claims—almost certainly never realized in fact—that decentralized production was less wasteful than production at large plants such as the Rouge. Although Chase concluded his book by holding Henry Ford up as the preeminent example of the engineer-businessman, he gave Ford a fairly superficial treatment.108

Chase did not really engage Ford and his ideas on waste reduction until July 1926, when he responded to Ford’s recently published book *Today and Tomorrow* with an essay in the *Nation* entitled “Henry Ford’s Utopia.” Chase was mightily impressed with many of the waste-reduction activities that Ford and ghost-writer Samuel Crowther described in the book, lauding the firm for “realizing—and acting thereon—that waste-elimination means prevention, not recovery—preplanning, not salvaging the breakage.”109 Although Chase dismissed much of the book’s philosophizing as “pretty terrible,” he praised Ford’s argument that profits should not belong to a firm or its shareholders but should be held in trust for the consumer to be reinvested in waste reduction and other manufacturing improvements with the ultimate aim of reducing the product’s price. He judged Henry Ford’s motives in this regard favorably, arguing that Ford’s paeans to business service were sincere because they were backed by real efforts. Chase of course took Ford’s claims about waste reduction at face value, unaware that the firm was having difficulty finding significant savings by this means.

Despite his carefully circumscribed admiration for Ford, Chase concluded that Ford and his company were problematic models of industrial waste reduction. He recognized that the Ford efforts were crucially dependent on the idiosyncratic views of one man and that this particular man had the luxury of holding such views because of his firm’s unprecedented success. He questioned whether the commitment to waste reduction would survive Henry Ford and whether the company provided a useful model for other firms. Chase also recognized that with respect to waste reduction, Ford drew the line at the boundaries of his own firm.


He was unwilling to take what Chase viewed as the necessary next step—subordinating his company to economy-wide direction and cooperation in order to reduce waste that resulted from many forms of competition among firms in the same industry. Chase noted Ford's aversion to "experts." "Our author [Ford]," he wrote, "hates experts and outside efficiency men of all kinds. He apparently works on trial and error within his own organization."110 Chase accurately sensed Ford's distance from the industrial conservation movement, the hit-or-miss quality of the company's waste-reduction efforts, and the fundamental reason why many of these efforts fell short of "best practice." Ford was simply too idiosyncratic and too wedded to conventional notions of business independence to exemplify the changes that Chase sought in American business.

The extent to which waste reduction was pursued at the Rouge and elsewhere at Ford Motor Company during the 1920s, the degree to which these activities were publicized, the lengths to which unprofitable activities were pursued without an explicit R & D rationale, and the resulting lack of wholehearted support from the company's plant engineers, all suggest that Henry Ford's personal obsession is the single best explanation for Ford's waste-reduction and recycling programs. His interest and the passion with which he pursued it were the manifestation of a deep-seated need. Ford himself suggested as much when he told people that he got his related obsession with cleanliness from his "Dutch" [i.e., German] mother.111

The Ford Motor Company's commitment to waste reduction did not survive Henry Ford's retirement and the postwar reorganization of the firm. Viewing the waste-reduction programs as an idiosyncrasy of a misguided autocrat rather than as a progressive aspect of business management, Henry Ford II and his new team of professional managers terminated many waste-reduction and recycling projects after World War II in their larger effort to redeem the firm from financial and managerial chaos.112 Some activities survived simply because they were built into the

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111 Interview with Henry Ford by George Sylvester Viereck, *New York American*, 5 August 1928, box 1, acc. 511, HFM. "My Dutch mother is in my workshops. She is in my workshops to this extent—it is impossible for me to tolerate disorder or uncleanness anywhere."
112 McCloud, Oral History, 311; "Grandson Scraps Ford's Projects," *New York Times*, 23 March 1947, section III, 8, box 21, acc. 940, HFM, does not specifically mention salvage activities but strongly intimates that these had gone the way of "virtually all the pet projects of the founder."
production design of the Rouge, but many practices that failed the cost-benefit tests of the famous "whiz kids" and their managerial accounting systems were discontinued. Higher postwar labor costs also tipped the balance against a number of programs. By early 1947 the new management had reduced salvage costs by 50 percent. However, a residual culture of recycling and waste reduction persisted at the Rouge well into the 1960s.

In the closing years of the twentieth century, Ford Motor Company publicists pointed to Henry Ford and waste reduction at the Rouge in the 1920s and 1930s as evidence of the firm's longstanding commitment to the environment. These claims were misleading. First, waste reduction at the Rouge was not motivated primarily by environmental concerns. Any favorable environmental impact was simply an incidental outcome of the firm's paramount pursuit of waste reduction. By this test alone Henry Ford and his company were not proto-industrial ecologists. If anything, he was a 1920s industrial conservationist. But the lengths to which Henry Ford pursued waste reduction call into question whether he shared the industrial conservationists' primary concern for cost reduction and profit maximization.

The company's implicit suggestion that there had been an unbroken corporate commitment to waste reduction was also misleading. In fact, there was a period between 1945 and the 1980s—a lengthy hiatus—during which Ford's managers deemphasized, if not actually repudiated, the commitment to waste reduction, as the company narrowed its postwar focus to making cars and money. My own research on post-World War II pollution problems at the Rouge revealed not a single instance in Ford's press releases or exchanges with environmental regulatory bodies after 1945 in which the company pointed to its surviving waste-reduction activities as a positive countervailing effort, a sure sign that the company's executives, lawyers, plant engineers, and public-relations staff did not yet conceive of them in environmental terms. Not until the development of the field of industrial ecology in the late 1980s and the early 1990s did the company discern a connection between waste reduction and the environment that could be used in its

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113 On these cost-control practices, see interview with Robert S. McNamara, 8 January 1960, box 15, acc. 940, HFM. For their application to salvage activities, see Automotive Industries, 1 January 1947, 30-31, box 23, acc. 940, HFM.

114 See Rouge News, 1946-1964, passim, HFM.

public-relations efforts. Upon close examination, the Ford Motor Company's historic commitment was not to the environment but to indulging a personal idiosyncrasy of its founder-owner, an undertaking that for a quarter century happened to produce benefits in the form of resource conservation and, to a lesser extent, pollution reduction.

If the primary motivation behind waste reduction and recycling at the Rouge was not environmental concern, should we leave it at that? Interviewing Henry Ford in 1923, Allan L. Benson observed: "His mind is no longer concerned with the manufacture of automobiles. It is concerned with the infinitely greater problem of organizing the industrial world." Benson is correct. By the 1920s Henry Ford no longer narrowly focused his interest on the manufacture of automobiles. When we consider the projects that occupied his attention in the 1920s and 1930s—his creation of the Rouge and the acquisition of the raw material sources and transportation facilities to feed it, his obsession with waste reduction and recycling, his interest in power generation at the Rouge, Muscle Shoals, Alabama, and elsewhere, his village industries in the Michigan countryside, and his famous experiments with soybeans and other agricultural products—it is clear that Ford was grappling with a broader set of problems. The temptation for historians using marketplace success as their sole measure of the man and the firm is to treat these interests as foolish diversions, further reasons why Ford's company lost its commanding market position to General Motors. Industrial ecology suggests a different basis for evaluation.

Ford's interests formed a pattern: they all involved a search for more efficient uses or flows of materials and energy—a central preoccupation of industrial ecology and an interest that Henry Ford certainly shared. Moreover, many of Ford's projects also betrayed a concern with the social implications of large-scale industrial production. Making an affordable quality car for the masses, squeezing as much use as possible out of materials and energy, and finding ways to reconcile the virtues of rural life with industrial opportunities—all indicated a genuine commitment to addressing important problems. "In his unsystematic, unorthodox way," historian Howard P. Segal wrote of the Ford village-industries

117 On the significance of Ford's village-industries project, see Segal, "Little Plants in the Country," 181-223. Segal reached much the same positive conclusion about Ford and his projects as the one advanced here.
118 On the importance of the concept of flow to Ford's operations, see Nevins and Hill, Ford's Expansion and Challenge, 202-3; Biggs, The Rational Factory, 145. The importance of flow appears in numerous contemporary accounts about the firm and its operations.
experiments, "Ford understood a good deal more about the direction of modern technology and society than did most of his seemingly more sophisticated contemporaries. He sought a limitation on the ever-greater size, scale, and impersonality of technological development and a concern for other aspects of the 'good life.'"\textsuperscript{119} If Ford's waste-reduction concerns and other interests were not motivated by environmental sensitivity, they do suggest an emerging sense of corporate responsibility not unlike that advocated by later proponents of industrial ecology. Ford usually pointed to his product as justification in itself for the contribution his company made to the greater good of society. But his projects in the 1920s and 1930s suggest that he was not content to leave it at that. On the contrary, he invested a great deal of time, energy, and money in programs that dealt with the consequences of mass production. There is no evidence that Ford was motivated to do this by guilt or that he was taking responsibility in a formal, public sense for these larger consequences. Yet his actions demonstrate that he was quietly taking some responsibility nonetheless—without any real prodding from outsiders and with little enthusiasm from his own people. The question of whether Henry Ford was an early industrial ecologist is an exercise in anachronism, but a useful one. Regardless of his idiosyncratic motives, Ford grappled with issues that foreshadowed the subsequent development of industrial ecology. His efforts in this direction deserve far more attention and respect.

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\textsuperscript{119} Segal, "Little Plants in the Country," 213.